Editorial: water efficiency and management

The challenge of global water availability is increasingly prevalent due to unpredictable rainfall patterns, increasing population, particularly in urban areas, surface water contamination, etc. As a result, water resource management and efficient water use is at the forefront of socio-political life in many regions of the world. Resolving these challenges requires social, economic, political, technological and environmental responses. Similarly, it requires joined-up thinking to propose and implement optimised solutions appropriate in the different geographical regions. It also becomes important to engender public engagement and participation to ensure water efficiency measures have lasting effects.

This special issue on water efficiency studies in the *Journal of Water Supply: Research and Technology–AQUA* highlights the multi-dimensional factors that affect and influence water efficiency at the micro and macro scale; factors that often transcend subject realms and require multi-disciplinary solutions. The edition broadly covers: water supply and water demand, together with their social ramifications; reducing environmental impact and carbon emissions associated with water use; technological innovation particularly for surface water management; and water recycling and reuse.

Pullinger *et al.*'s (2013) paper on 'New directions in understanding household water demand' presents a practice-based or activity-based approach to demand forecasting and the design of water efficiency interventions. They introduce a paradigm shift from the current socio-demographic indicators such as litres per person per day, to an approach which utilises the knowledge and understanding of routine and habitual activities of household members. Their argument is supported with studies conducted in Southern England on external water use, i.e. the watering of gardens. Their results found little relationship between water use and socio-demographic characteristics of comparable households. Further explorations also found that households with similar per capita consumption use water in widely varied ways, thereby necessitating a different approach to water efficiency intervention design. The authors conclude with examples of how this new understanding could help in demand forecasting and in designing more effective approaches to water efficiency interventions.

To further support the premise of a customised approach to water efficiency interventions particularly for households, Balnave & Adeyeye's (2013) 'Comparative study for attitudes and preferences for water efficiency in homes' conducted surveys in urban and rural communities in Sussex, England. Findings indicated complex interactions between physical infrastructure, technology, socio-economic factors, cultural attitudes and to some extent even religious belief systems in terms of the use of water in buildings and the uptake of water efficiency measures in the home. In a broader context, this knowledge of water users' behaviours can be fed into water supply strategies and also directed towards policy considerations and ultimately regulatory structures.

Water users have been shown to exhibit complex behaviours, but they are one stratum of the water supply chain. Wang *et al.*'s (2013) paper 'Stakeholder involvement in drinking water supply system: A case study of stakeholder analysis in China' illustrates the complexities involved in ensuring equitable distribution of drinking water in Shenzhen, China. Eight main groups of stakeholders were identified, ranked from the most important to the least and included: water companies; government; consumers; polluting companies; communities; experts; the media; and non-governmental organisations. The key players, however, have contrasting agendas and the integration of these is a necessity for the future effective and efficient management of the water supply system in China.

In the event of water scarcity, Ameyaw *et al.* (2013) present an approach to improve equity when intermittent water supply, and indeed demand, is introduced as a water supply management strategy. This study proposes an approach to achieving equitable water distribution in a cost-effective manner in water stressed regions, particularly in developing countries. This was achieved by studying existing intermittent supply systems, and simulating a simple water supply network subjected to intermittent water supply. The study found that equity under intermittent supply conditions is

doi: 10.2166/aqua.2013.001

measurable and can be improved through optimal location and sizing of elevated source reservoirs. Based on findings, a simple multi-objective optimisation model was proposed to measure and improve equity and minimise cost in intermittent distribution networks.

In addition to assuring water supply to meet human, social, industrial and other economic demand, water companies are expected to maintain environmental standards. One strategy to achieve this is by reducing the environmental impact and carbon emissions from water supply and distribution processes. Smyth *et al.* (2013) discuss water efficiency as a means of reducing carbon emissions, using a Northern Ireland water supplier as an example. Their investigations centred on demand-side interventions initiated by the water company, proposing that less demand makes it possible to achieve carbon savings from reduced water treatment and distribution. They also found that targeting household water heating contributed to savings in net operational emissions. The combination of the demand side interventions also resulted in significant annual cost savings for the water company. Although the paper shows that water efficiency is beneficial to both the water user and supply, the authors recommend further research to explore social and cost benefits.

Water supply can be boosted by the use of harvested rainwater, but there are potential problems inherent in harvesting water which may have collected both chemical and biological pollutants as it flowed into the collection vessel. Adler *et al.*'s (2013) paper proposes a technological solution for rainwater harvesting at the community scale in which the key component of the system was a silver ionising unit 'known for centuries to be a powerful disinfectant'. Settling tanks and filters were also designed into the system to maximise its performance. Installed into 12 rainwater harvesting systems in rural Mexico, the systems required community input into maintenance, but as long as this was undertaken adequately, the resulting harvested rain was of drinking water quality. Currently, particularly in the UK, harvested rainwater cannot be used to supplement potable water supplies, but this study has shown that with community engagement, coupled with suitable technology, harvested rainfall can be used for potable supplies leading to greater efficiency overall.

Charlesworth *et al.*'s (2013) paper on the sustainable management of surface water assesses the opportunities and benefits of soft and hard surface water management solutions at the building and development scale. Using three case studies from the UK and Spain (two educational buildings and a housing development), the authors investigated the efficacy of extensive green roofs only, or a combination of measures such as porous paving, bio-retention systems and swales. In one of the case studies presented, surface management systems were installed and monitored. Preliminary results show positive benefits for the attenuation of storm water by increasing the time to peak. The extensive green roofs also offer additional carbon sequestration and storage benefits. Live case studies such as this provide valuable insights into surface water management solutions and will continue to provide valuable data which can be applied to other buildings and developments. The paper further highlights the benefits of targeted water efficiency studies in real contexts to fine-tune existing knowledge and improve future water efficiency and management strategies.

Lastly, this and the other papers in this edition confirm that singular measures are beneficial but a systemic approach that combines the most effective water efficiency interventions yield even better results. However, all the authors agree that further studies are required.

This special edition provides a much needed avenue to disseminate water efficiency research, but more importantly the editors hope that it further raises awareness and recognition of multi-disciplinary water efficiency research within the academic community.

Guest Editors
Sue Charlesworth
Coventry University,
UK

Kemi Adeyeye
University of Brighton,
UK

REFERENCES

Adler, I., Hudson-Edwards, K. A. & Campos, L. C. 2013
Evaluation of a silver-ion based purification system for

rainwater harvesting at a small-scale community level. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 545–551.

Ameyaw, E. E., Memon, F. A. & Bicik, J. 2013 Improving equity in intermittent water supply systems. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 552–562.

Balnave, J., Adeyeye, K. & Bicik, J. 2013 A comparative study of attitudes and preferences for water efficiency in homes. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 515–524.

Charlesworth, S. M., Perales-Momparler, S., Lashford, C. & Warwick, F. 2013 The sustainable management of surface water at the building scale: preliminary results of case studies in the UK and Spain. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 534–544.

Pullinger, M., Anderson, B., Browne, A. L. & Medd, W. 2013 New directions in understanding household water demand: a practices perspective. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 496–506.

Smyth, B., Crilly, A. & McDowell, K. 2013 Water efficiency as a means of reducing carbon emissions in Northern Ireland (NI) water. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 525–533.

Wang, J., Ge, J. & Lu, Q. 2013 Stakeholder involvement in the drinking water supply system: a case study of stakeholder analysis in China. *Journal of Water Supply: Research and Technology–AQUA* **62** (8), 507–514.