ADAPTATION TO CLIMATE CHANGE: A WATER INFRASTRUCTURE SOLUTION?

Michael Norton MBE
Managing Director, Water & Power Business Group, Halcrow

Dr Richard Harpin
Global Business Leader – Water Security, Halcrow

Alexander Lane
Engineer, Water & Engineering Management, Halcrow

Water is our most basic need, essential for life and intrinsically linked with many of our critical national interests. Future climate change and population pressures present significant challenges for those tasked with ensuring security of supply. However is the current preoccupation with demand suppression inhibiting a fully holistic approach? Should greater consideration be directed towards supply enhancement schemes that both take advantage of climate change, and help increase resilience to its effects?

Public health and well-being, food production, energy supply, industry and the environment all require a reliable supply of water and whilst total available water in England and Wales is sufficient to meet total demand, geographic and temporal variations in availability mean that significant regional water stresses exist, especially in the South East. Added to this problem is the need to plan for an uncertain future. Projections of UK climate predict reductions in summer river flows and increases in winter flows, which is a similar effect to quicker passage of water across the landscape. Assessments of future climate projections by the Environment Agency (2008) have shown that by 2050, annual average river flows may reduce by up to 15%. Local reductions in summer and autumn flows could reach 80% whilst flows in winter could increase by 15%. In addition, depending on Government action, social mindset and lifestyle choice, water demand in 2050 could be between 15% less and 35% greater than that experienced today. Clearly these extremes need to be built into future planning.

The growing appreciation of UK water stresses coupled to the fact that domestic consumption dominates abstracted water has led to a focus on reducing this demand. The proliferation of metering and efficiency initiatives is now widespread and growing; however do such measures represent a suitably holistic solution? Whilst the Environment Agency Water Resources Strategy (2009) advocates a 'twin-track' approach, it is made clear that demand suppression measures should be considered as a priority. UK citizens currently use an average of 148 litres of water per day (l/p/d) compared to 493 l/p/d Australia, and 575 l/p/d in the USA. Defra's aspiration is to reduce this further, to 120 l/p/d.

Water storage represents an often overlooked option. By capturing the predicted increases in excess winter river flows, schemes that store more water take advantage of future climate change. By slowing down water transfer across the landscape, they also act against the trends of climate change, storing excess winter water for use in summer, and also increasing the resilience of the built environment to other potential future impacts such as flooding.

- Reservoir construction enables the storage of excess water and therefore permits maintenance of supply during periods of relative water scarcity. Whilst large dams and reservoirs have traditionally been opposed by large proportions of society, their construction can have multiple benefits, not just for water resource security, but also for the environment and economy. Many water companies identify reservoir construction as essential to meet future water demands and corroborate their economic viability against a variety of alternative measures.
- Smaller scale water storage can also provide broad benefits, especially within the agricultural sector. Whilst generally constituting only a small proportion of total water use, on hot summer days

Farm storage - Mullens irrigation lagoon, Wiltshire (Source: Halcrow)

Large scale storage - Graig Goch reservoir, Mid-Wales (Source: Halcrow)

agricultural use can dominate. Small reservoirs permit the capture of excess winter flows and therefore ensure summer supply without environmental conflict. The farmer can then plan cropping and product supply with far greater certainty.

- Sustainable drainage systems (SUDS) comprise a variety of localised interventions that mimic natural catchment responses. In order to slow water passage over seasonal time frames to provide benefit for water resources, SUDS that direct runoff into the ground such as permeable paving, should be prioritised.
- Aquifer storage and recovery (ASR) describes the process of pumping excess surface water flows below ground to be utilised in the future, often in response to droughts. Several schemes exist, contributing small additions to the supply resource, although larger schemes are present in the Lee Valley and at Enfield-Harringey in London.

A primary constraint upon the application of supply enhancement measures is the common requirement for high upfront investments that may initially outweigh financial gain. Securing funding is therefore of key importance, and in this respect consideration should be given to the price we assign to water. When compared against the cost of other household outgoings, notably those for energy, water comprises such a small proportion that for all but the poorest, any incentive to reduce usage is small or absent. An increase in annual household bills of £100, whilst pricing water still a long way short of its true economic value, would provide additional potential annual investments to the water industry of £2.4 billion, an amount not inconsistent with infrastructure investments in other sectors. Clearly, the value of safeguarding our future water security is incalculable. However, as an indicator it is estimated that the Environment Agency's regulation of abstraction protects resources worth some £72 billion.

The above discussion demonstrates how consideration of water storage measures provides a viable means of increasing water resource security and resilience to future climate change. Furthermore, by combining intervention measures that act at different geographic scales, alignment can be achieved both with the general concept of slowing down water throughout the catchment, and with the widely prophesised aim of a 'big society' in which integrated communities consider their wider environment. In view of the long time that storage projects take to promote we should be considering options now.

RESEARCH AND TRAINING: UNIVERSITY PARTNERSHIPS FOR A BETTER RAILWAY

John Amoore
R&D Specialist, Network Rail

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