Australia has more water supply dam capacity per capita, which includes Ord River Dam on the edge of the country's largest artificial lake by volume, Lake Argyle. Photo: cc Graeme Churchard

WATER TECHNOLOGY WARMS TO CLIMATE CHANGE

by Chelsea Wallis

Rising temperatures in the biennial release of the Bureau of Meteorology and CSIRO's State of the Climate 2014 are as expected – Australia is getting hotter.

Engineers are anticipating future scenarios of even warmer temperatures, more extreme fire days and an increased likelihood of drought and flooding. But there have always been elements of sustainability in design for water utilities. Similarly, there are elements in the conversation about climate change that research has always taken into account when engineering for water security.

But is that enough? *Water Engineering Australia* looks at the major stakeholders and investors in water technology to find out to what extent climate change is driving innovation in the water utilities industry.

COMMUNITY NEED

Prof David Schlosberg, who specialises in environmental politics in the Department of Government and International Relations and codirects the Sydney Environment Institute at the University of Sydney, is investigating Australian attitudes towards climate change.

"Clearly what's happening is the idea of climate change itself has become ideological and there is polarisation there," he said.

"When you ask if people believe in climate change, you'll get responses aligned with their political ideology. The real question has more to do with peoples' own consideration of their everyday life and whether water quality or water preservation in times of drought is the important thing to participate in.

"You're going to get a lot more people answering 'yes' and a lot more public support for issues like that, which don't have the polarisation."

That said, Schlosberg added Australia has been well ahead of other industrialised countries in terms of climate adaptation policy.

"There's more and more adaptation planning now: in the UK after the last floods, and Obama in the US has just announced adaptation hubs and money for adaptation planning – but it's just starting now," he said.

"Australia has been thinking about this a bit longer than other countries, led by the more vulnerable states. And although Australia has been ahead of the game, there is now a growing disconnect."

> "What's happening is the idea of climate change itself has become ideological and there is polarisation.

His most recent project investigates the development of climate adaptation policy by local councils, and preliminary findings show a disparity between how the community understands adaptation issues and how local governments articulate it.

"If you look at community dialogue, the newspapers, websites and Facebook feeds of community groups, water is one of those things that we found in the top five terms that come up in community discourse across the country – that is one example of an intense interest in things that have to do with everyday life," Schlosberg said.

"Councils, at least in the language of climate change adaptation plans, are focused on their own risk and liability. There is an intense public interest in adaptation and I think it differs from governmental interest in terms of a focus on people's basic needs and everyday life."

REGULATION AND COMPLIANCE

For the wider engineering community, sustainability initiatives and action on climate change is often a manifestation of an individual firm's values, such as environmental initiatives or time saving, and/or enforced compliance to government rules. It begs the question: How much are climate policies rewarding good behaviour versus punishing bad behaviour, and are we on target or missing the mark?

Adj Prof David Hood, former national president of Engineers Australia and a science and engineering faculty member at the Queensland University of Technology, flags policy as a potential inhibitor to innovation in the engineering sector.

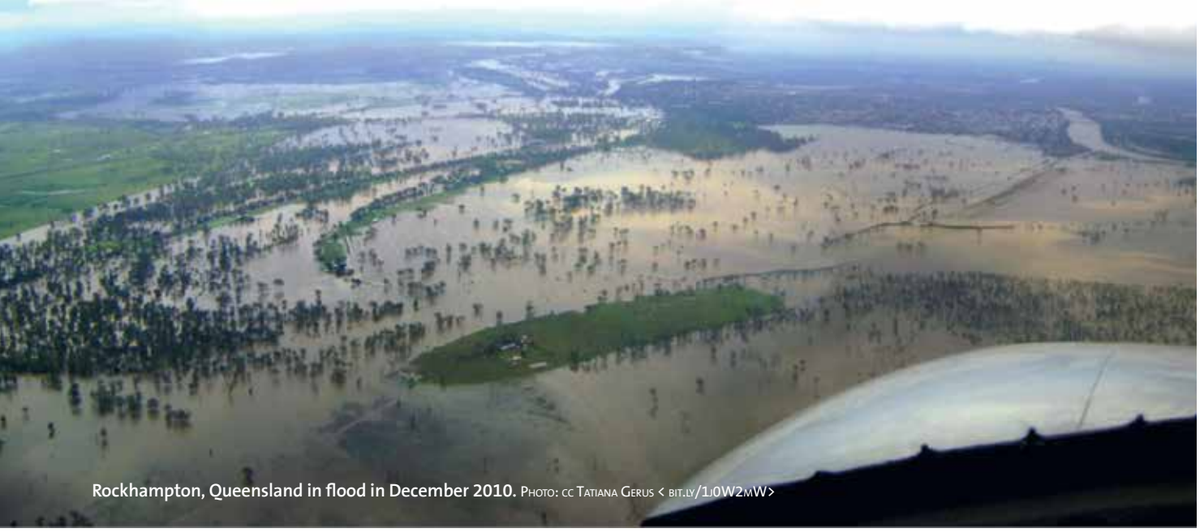
He sees a general acceptance of climate change and the need to do business differently in order to protect the environment. However, Hood also perceives a number of leaders, including engineers, falling into the small percentage of the community who may never change: the ultraconservative, risk averse group that either relies on proven, tested and safe solution or simply doesn't accept climate science.

"Unfortunately, the current political regime is rubbing out sustainability and eliminating what they call 'green tape' [environmental regulation]," Hood said.

"It's going to have a negative effect on jobs for environmental and sustainability engineers, and if companies no longer need to comply, they will no longer need to employ people with the skills to keep them from legal challenges."

The elimination of sustainability regulation would spell disaster for innovation. But even the existing guidelines don't go far enough for Hood.

"The Building Code of Australia,



Rockhampton, Queensland in flood in December 2010. Photo: cc Tatiana Gerus < bit.ly/1.0W2mW>

along with local governments, regulates minimum requirements for energy, insulation, water and so on. But the whole framework, while much better than in the past, is still just minimising the negative impact, and when you put up a high rise, high star rated building it's a significant impact on the Earth," he said.

"Even the Green Building Council of Australia (GBCA) star ratings can only minimise impact through a series of credits for doing good things. In the end, the 6 Star Green Star rated [a voluntary environmental rating system that evaluates the design and construction of buildings and communities] buildings still have a negative impact on the environment, though it is a smaller negative impact. They are not regenerating lost natural capital, such as clean air clean water or new ecosystems, for the rest of society."

For example, Hood said a developer who is trying to maximise returns may choose not to put a green roof on a new building to replace lost vegetation on a greenfield development, even though it might help bring the project's eco footprint closer to net zero. Two factors might change this mindset: either legislation forcing developers to calculate the net zero end into their bottom line or research that demonstrates improving social and natural capital on a project will add value to the business.

Hood has recently launched a project called Blue Australasia, which is based on the blue economy principles espoused by Dr Gunter Pauli which moves beyond 'green' initiatives and finds new ways for industry and individuals to work collaboratively within natural systems.

"By using cyclic, systemic, bio mimicry based regenerative processes, we not only eliminate the negative impact, but work at delivering abundance by simultaneously restoring natural and social capital," Hood said.

"Blue economy principles dramatically reduce costs, maintain profits, eliminate waste, and secure happiness and wellbeing for all.

"Unfortunately the changes may not necessarily bring immediate change. Developers often want immediate cash return on short investment, say in less than three years. So the problem is, a lot of the things that add holistic and shared value come in the form of 5-10 year returns, and longer term improved shareholder value."

INSPIRING BEST PRACTICE

For now, organisations such as the GBCA appeal to morality. As the data continues to demonstrate climate variability, the GBCA sees Green Star ratings as a tool that encourages industry to look beyond the minimum.

The council is encouraging projects like the Housing NSW Redfern Housing redevelopment in Sydney that was awarded a 5 Star Green Star rating in 2009. The building is climate change adaptable for the future while assisting tenants to lower their energy bills and reduce greenhouse gas emissions. In addition to components such as natural building materials and native landscaping, the development features rainwater harvesting for toilet flushing and laundry as well as a greywater treatment system for landscape irrigation.

"One of the things we're trying to do is not just look at the building level but at the community level at what makes a community sustainable: the ability to harvest, recycle and produce its own water, energy, resources and materials," CEO of the GBCA, Robin Mellon said.

"But that also means resilience. True sustainability appears at many levels. It's at a moral level – we should be using less to achieve more. It's at an economic level – if we use less it will cost less. It's at a safety level as well – if climate extremes continue, are we going to be prepared?"

Mellon points out that Australia is more familiar with managing scarcity than it is managing abundance when it comes to resources such as water.

"Australians in general take pride in doing more with less," he said.

"We've seen it when Brisbane's water patterns change really rapidly in response to a drought – that flexibility is still there."

Mellon observes this flexibility as two changes of attitude. The first is the increased need to recognise supply and demand side solutions, where the water is coming from and how the public is using it. Consultants, architects and everyone involved now understand that it's not just one solution, it's multiple.

The second is a growing awareness that having clever design isn't enough.

"It has to be the meeting point between quality building designs, such as systems, water tanks, rooves for water capture; good technology, such as filtration systems, diversion systems, low flow shower heads, clever systems; and good behaviour," Mellon said.

"You can have the best design and the best technology and if people don't want to do that, it all falls apart. Here, we're starting to see that convergence is necessary to make this work."

THREAT MULTIPLIER

Australians are used to dealing with a variable climate, and for water utilities this means managing the natural variability of the water supply to ensure population demand for water is met.

As a consequence, Australia has more water supply dam capacity per capita than any other developed country, according to Lucia Cade, chair of the Western Water Corporation, past president of the Australian Water Association, and director – strategy and development, water and infrastructure services at AECOM.

"The whole point of the engineering discipline is to develop creative solutions to support progress and address the world's problems, building for the long term," Cade said.

"In this sense, sustainability has always been at the core of what we do.

"Climate change is magnifying the natural variability of our climate which is changing how we respond to providing sustainable water services in the future," Cade said, describing it as a 'threat multiplier effect' taking hold.

"The threat multiplier of climate change is that we're finding droughts are more severe and more frequent, so we need a different portfolio of water supply options that includes more or bigger dams, recycling storm and wastewaters, and new technology.

"Equally with flood mitigation, the threat multiplier is that cyclones are trending south in the southern hemisphere, so we're seeing bigger events further south on our coastal cities. This means the flood mitigation infrastructure that we needed 50 years ago is increasing in size and changing in nature, particularly in those coastal zones."

The engineering response has largely been to innovate around treatment technology, membranes and fit-for-purpose water, according to Cade. She also sees innovation in asset management and optimisation of operations as key to effective and sustainable water supply services that minimise the impact on the natural environment.

A LIKELY SCENARIO

Over the last 5-6 years, in response to recent droughts and ongoing challenges of population growth and increasing urbanisation, jurisdictions have diversified water portfolios by introducing new sources such as recycled wastewater, stormwater, rainwater and desalinated seawater. Consequently, utilities are now dealing with a variety of water qualities and capacities. From relatively few centralised water source locations, they are now looking at potentially distributed supply locations from stormwater harvesting to rainwater harvesting at the household level.

With these changes, various jurisdictions are finding they need more information and capability to manage and optimise their portfolios. It's an area the CSIRO is putting a significant amount of research into.

"There's a focus on modelling and optimisation tools to assist water managers with the long term planning and management of diversified water supplies," Karen Rouse, theme leader urban water at CSIRO said.

"At the same time, those tools will have an application in terms of linking short term operational decisions to medium and long term planning objectives to ensure long term options are not curtailed. For example, a water resource manager may decide to maintain a particular water level in its reservoirs to provide a high degree of short term supply reliability, but in so doing sacrifice an opportunity to access more of the surface water source long term."

Coupled with optimisation is the ability to adjust to what customers want. As consumer water bills continue

> "Unfortunately, the current political regime is rubbing out sustainability and eliminating what they call 'green tape' [environmental regulation].

The recycled water complex at Bolivar, South Australia. Photo: CSIRO

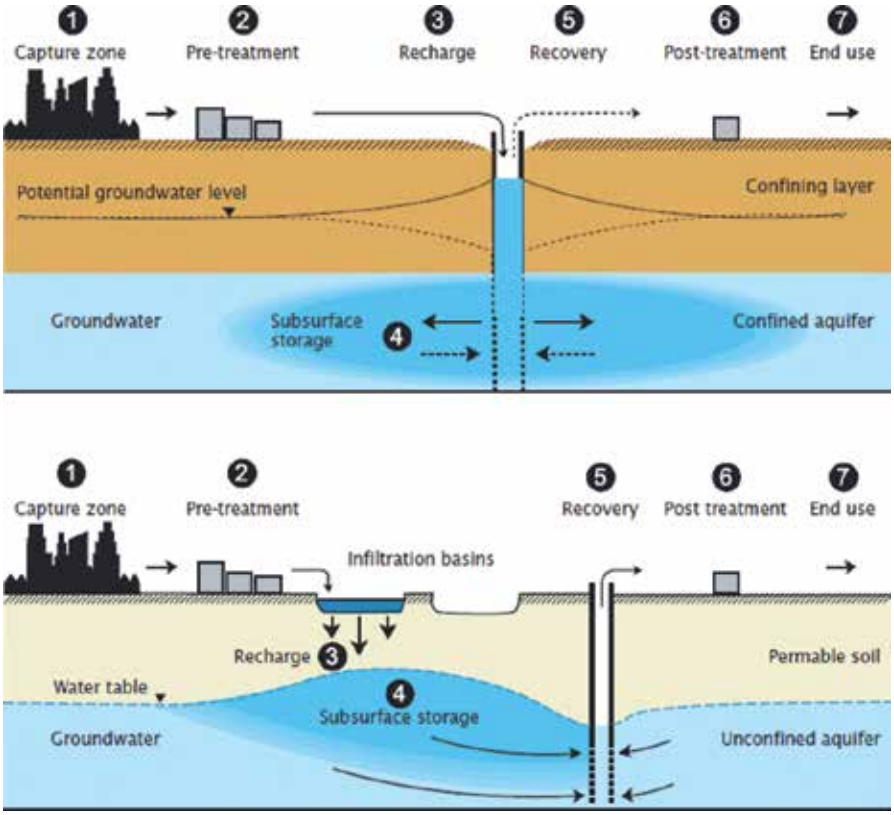
to go up, Rouse said, there is an interest in the research and operations space around what customers are willing to pay for in terms of fit for purpose supplies.

"As part of the Managed Aquifer Recharge and Stormwater Use Options project undertaken as part of a Goyder Water Research Institute and National Water Commission initiative, CSIRO focused on the recycling of stormwater and which uses people were comfortable with," Rouse said.

"We discovered that people were open to the potential reuse of recycled stormwater for drinking purposes, provided it was adequately treated and the organisations undertaking it were trusted. Where that existed, people weren't opposed to potable use, provided some of the other conditions were met – cost and affordability is still a large consideration for consumers."

As a driver of water availability, Rouse sees climate change as part of the suite that researchers need to consider to do their jobs well. It's established practice in water utilities to look at the last 100 year record and model forward, so it's reasonable to take into account that the last 10 years and computer simulations of future climate indicate a different direction from the previous 90 years.

"Scientists are logical and they want to produce the best results, so they'll use the best and most relevant information available in their research to get there," Rouse said.



Elements of managed aquifer recharge. Aquifer storage, transfer and recovery in a confined aquifer (top), and soil aquifer treatment in an unconfined aquifer (bottom).
IMAGE: CSIRO

> "[There is] increased need to recognise supply and demand side solutions, where the water is coming from and how the public is using it.

In anticipation of future water supply challenges and potential scenarios in Australia, the CSIRO was responsible for overseeing the guidelines for managed aquifer recharge in the mid 2000s, which helped to make the development possible. Aquifer recharge and groundwater replenishment takes recycled household and industry wastewater through an advanced purifying process, injects it into groundwater aquifers, and draws it out again decades later as part of the drinking water supply.

Stormwater runoff in Adelaide. PHOTO: CSIRO

"Our research made it possible for people to understand what the risks were and how risk could be managed across a diverse range of regulators and practitioners," Rouse said.

"And that's where research fits. It's not just about solutions to short term problems but, perhaps more importantly, it's about having the foresight to identify over the horizon challenges and plan and develop a scientific response to ensure fit-for-purpose solutions are available when they are needed." ■