Stormwater provides a potable solution in Queensland

● The years-long drought experienced by Australia has generated a high level of interest in alternative water supply options. At the Fitzgibbon Chase development north of Brisbane, two systems have been trialled – the Fitzgibbon Stormwater Harvesting system and the PotaRoo potable roofwater harvesting solution. **LIS STEDMAN** reports on the trial and the opportunities it presents.

Australia's long 'Big Dry' has provided urgent impetus for water supply innovation, and although some authorities have turned to high-tech, high price tag solutions such as desalination, other, smaller-scale solutions are being tried that might also provide interesting alternatives.

Finding novel and sustainable solutions is not easy, but a new development at Fitzgibbon Chase, 12km north of Brisbane, is contributing knowledge on stormwater and roofwater harvesting in an unusual pilot.

Brisbane consulting engineers Bligh Tanner's director Chris Tanner explains that the project's initial driver, as with other initiatives, was the long drought. 'Round about 2009, preceding that I don't think we'd had any serious rain for five years, possibly longer. In Queensland it was the worst drought on record. Water supplies were pretty low.'

Bligh Tanner had been undertaking work for the Queensland Water Commission, including in-depth studies into opportunities to harvest stormwater for water supply. 'We found big opportunities,' Mr Tanner says. 'The costs were moderate, comparable to those of a major reservoir, but also with significant environmental benefits.'

Some of these benefits relate to pollution reduction – when stormwater runs off hard surfaces it can become quite polluted, and bad for the ecology in any receiving water. 'The upshot was we were fairly sure a big stormwater harvesting system could give significant environmental benefits. As a result, Queensland Water Commission wanted to do a project to prove this rather than just the theory behind it,' he adds.

Fitzgibbon Chase. Credit: Economic Development Queensland (EDQ).

Bligh Tanner had worked on the first roofwater harvesting development in south east Queensland, at the award-winning Currumbin eco-village, and had produced stormwater harvesting guidelines for water-sensitive urban design capacity building programme WaterbyDesign. The consultancy had also provided inputs to water policy through government agencies and the Pimpama Coomera Waterfutures master plan among others and was therefore a logical choice to partner in the trials.

Fitzgibbon Chase rainwater harvesting installation

Economic Development Queensland (EDQ), the state vehicle for delivering sustainable, affordable housing, was the developer for Fitzgibbon Chase. The 114ha development is mainly residential, a mix of 1300 single detached and multi-unit dwellings in various styles – terrace, loft, villa and town house as well as traditional 'big block' family homes. EDQ decided to incorporate the FiSH (Fitzgibbon Stormwater Harvesting) system into this.

At around the same time a Japanese company, JFE Engineering, had come to Australia, Mr Tanner relates, looking for opportunities in Asia for water supply, water scarcity and sanitation projects. 'They saw Queensland as a good testbed for a demonstration project and linked up with us. We were able to incorporate rainwater harvesting into the same project.' This system, PotaRoo, is a potable roofwater harvesting solution that, together with FiSH, will offset around 50% of the development's potable water supply needs.

FiSH diverts urban stormwater runoff from a channel known as the Carseldine drain and supplies it to the houses via a dual reticulation (third pipe) system for non-potable uses such as irrigation, toilet flushing, and cold-

water laundry. PotaRoo will harvest water from around 500 homes in the development.

The urban stormwater for the FiSH system is collected from a 290ha urban catchment and pumped, via an oil and sediment trap, into a 5ML covered and lined lagoon. The scheme harvests under 10% of the catchment's average annual stormwater runoff, and needs a pumped diversion rate of just 40 litres/sec, aiming to capture low rather than high storm flow events.

A 400,000 litre/day water treatment plant purifies water from the lagoon in line with Australia's non-potable residential water guidelines. Pre-filtration is undertaken using an auto-strainer, and a sand filter provides the main filtration followed by activated carbon to remove organic chemicals. UV disinfection is followed by chlorination using sodium hypochlorite ahead of storage, to provide a disinfectant residual.

PotaRoo scheme

PotaRoo, the potable roofwater scheme, will collect rainwater from around 7.8ha of roof catchment – some 500 homes – in the development when it is completed, taking it via pipes from each dwelling to a series of communal collection tanks. From there it is transferred to a central raw water storage and treatment plant. The treated water will eventually be directly injected into the town's potable water supply if the system is adopted, though initially in the project's first phase it will be injected into the non-potable harvested stormwater system.

The downpipes can take up to 0.83 litres/sec per 100m² of roof catchment, based on a 30mm/hour rainfall intensity. Rainfall over that level will overflow into the stormwater system. The collection systems each drain to a local communal rainwater tank – there are four local tanks for four sub-catchments, with a total storage volume of 915,000 litres. The tanks are flexible and unobtrusive, and are based on reinforced concrete pipes buried beneath parkland and verges. The main 800,000 litre raw water tank sits next to the water treatment plant.

PotaRoo - the potable roofwater scheme. Credit: Bligh Tanner.

This water undergoes a high level of treatment and monitoring to ensure it meets potable standards. Again it is pre-filtered using an auto-strainer, after which sodium hydroxide is used for pH adjustment followed by micro-filtration, which acts as a physical barrier to contaminants and provides a consistent water quality.

Activated carbon then removes organic chemicals, after which an ion exchange system removes zinc. UV disinfection and residual chlorination are the final steps. The project is being commissioned now, Mr Tanner says. Funding came from the federal government, the Japanese government and the state government through its housing development arm. The total project cost is around AUD$17 million ($16 million).

Mr Tanner adds: 'We've looked at the business case for this. It is intended that the projects be handed over to the local water authority, which is scheduled for March 2014, though this is not confirmed. We are doing the business case, and we think the schemes can break even or turn a small profit. They still need to be tested in the harsh light of a water utility. Both projects are completed and are going through final commissioning and documentation, so that the assets can be transferred.'

Validation

The project may seem to have taken a long time but as Mr Tanner notes, 'it was all new, there was no precedent for what the design standard should be for stormwater. It puts the project in an odd space where it can't be approved and can't not be approved. When you talk to regulators about it we are going through a pseudo process for acceptance even though we can't formally tick boxes at the end of the day.'

To help with the validation process the consultancy has established an expert panel made up of practitioners, practising engineers, scientists and regulators, as well as people from the utility to whom the systems would be transferred. This panel has helped to guide the testing and commissioning.

'There has to be seen to be a high degree of rigour to take this forward so everyone can be confident we can produce water of a certain quality, and it can't be less than that,' Mr Tanner explains. He adds: 'Water utilities are notoriously conservative, and very risk averse. They won't take over an asset unless they are very confident.'

Mr Tanner believes that the solutions have a large number of applications. In Australia, domestic potable water from a traditional reservoir source costs around AUD$3.75 (US$3.6) a kilolitre, which he notes is 'a pretty cheap source'. However, all of the country's major catchments are already dammed so additional reservoirs will be hard to site.

The early results from the new hybrid decentralized solution suggest it could be a viable alternative – analysis shows that the amount of pollutants removed by the FiSH system is similar to target urban stormwater pollutant reduction objectives that would normally require construction of bio-retention filtration devices, wetlands or similar systems. This

Alternative water supplies in Australia

Chris Tanner sees the Fitzgibbon Chase development as being far ahead with regards to alternative water source development in Australia and he says this is due to the swing in Eastern Australia from severe drought to full reservoirs, resulting in 'innovation and the extent to which politicians are willing to take any perceived risk with innovative projects [declining] in the water sector'.

'Blackmans Swamp (see links for more information at the end of the article) certainly provided some inspiration, though it was occurring at roughly the same time as Fitz,' says Tanner, with regards to how Fitzgibbon Chase was conceived. 'Prior to Fitz we had already completed a large stormwater harvesting facility for the Southbank Parklands in Brisbane,' he adds. 'Southbank Parklands is Brisbane's premier park as it is central to the city, and is linked to our major museums, libraries, theatres, galleries, etc., and we had feedback from our government that they wanted to do a similar project, but for a residential use. We had also worked on a number of recycled wastewater schemes for "eco" developments. It was a bit like "all roads lead to Rome", especially as we were in very severe drought at the time the project kicked off.

'Generally I'd say that the public think stormwater harvesting is a good idea and they are supportive,' he continues. 'Australia has limited water supplies and the only real options to big dams (and there are not many suitable sites left) is seawater desalination or recycled wastewater,' The cost of desalination and its high power demand limits its use, says Tanner, '[and] the "average punter" sees stormwater [as being] definitely far preferable to use stormwater than recycled wastewater.'

He therefore hopes that, as population increases, 'alternative water supplies like stormwater harvesting will gain more credence over the next ten years. If it stopped raining then it would happen faster!'

Further information

For further information on stormwater standards and sustainable water use in Australia, please see:

- CRC for Water Sensitive Cities: http://watersensitivecities.org.au
- Stormwater Harvesting Guidelines: http://waterbydesign.com.au/stormwaterharvesting-2/
- Department of Environment and Conservation NSW - Managing Urban Stormwater: Harvesting and reuse: www.environment.nsw.gov.au/resources/stormwater/managestormwatera06137.pdf
- Guidelines for Stormwater Harvesting: http://melbournewater.com.au/Planning-and-building/Forms-guidelines-and-standard-drawings/Documents/Stormwater-harvesting-guidelines.pdf
- Blackman's Swamp Creek Stormwater Harvesting Scheme: www.orange.nsw.gov.au/site/index.cfm?display=147115
- City of Yarra - information on rainwater tanks: www.yarracity.vic.gov.au/Environment/Saving-water/What-you-can-do/rainwater-tanks/

means the developer is able to make considerable savings.

Estimates suggest that the stormwater harvesting system will provide 63% of non-potable water uses, around 89ML/year, for the development, and PotaRoo could ultimately satisfy 44ML/year, or around 35% of potable water demand.

'As the population increases we have to have alternative water sources,' he notes. 'Most cost more, such as desalination. Recycled wastewater costs are pretty good but the public perception is poor. We think from a purely commercial point of view there is a good reason to start supplementing supplies with things like stormwater harvesting. There are things that will have to change – the obvious place to harvest stormwater is low-lying land, which is often community parkland. We will have to think about how it can co-exist.'

The need to find alternatives is urgent – Queensland's population growth is such that by 2025 it will have to significantly supplement its existing sources. 'There will be many urban areas throughout the world in a similar situation,' Mr Tanner adds.

The system has another, wider benefit – any runoff that does reach rivers and bays is cleaner, which benefits both humans and the environment. Mr Tanner also highlights some hurdles to acceptance, such as ownership structures and the need to get water companies on board and set up to run smaller, decentralized systems.

He adds: 'I also think that in the less developed world there are probably large opportunities. If you take Jakarta as an example, even if the government had the means, retrofitting the sort of water supply used in the first world would mean ripping up roadways, and I just don't think it's going to happen.

'An alternative where you can perhaps supplement supplies with schemes that have not so much infrastructure has got credibility. It has got to be thought about and examined more carefully,' he concludes. The projects are reported to have generated a significant amount of interest and delegations from Japan, China, Korea, Malaysia and Israel have visited what is seen as a new benchmark for creating water-sensitive cities. ●