Alternative urban water servicing, Queensland, Australia

Country: Australia
Landuse: Regional
Scale: Regional
Objectives: Water, Land, Climate
Ownership: Private
Intervention: Policy and Planning

Location:
South East Queensland, Australia

Overview
The objective of this case study of the Ripley Valley Development Area is to test alternative water-servicing scenarios and provide a new perspective to complement broader sustainability assessments of urban water. It proposed new urban development on the fringe of the high-growth, sub-tropical region of South East Queensland, Australia, designed to accommodate 120,000 people/50,000 dwellings by 2030. It was selected because:

- Being a new urban area, both the pre- and post-development states are assessed
- Prior hydrological modelling had been undertaken, providing some of the required data
- Alternative water servicing options had been scoped. It presented an opportunity to evaluate innovative solutions for securing water supply in a region predicted to experience water stress with climate change but which also improves its natural environment and enhances liability for its residents. The urban system boundary was defined as the outer edge of the built-up areas with an area of 3,002 ha.
Project Description

Rainwater and storm-water scenarios:

If rainwater or storm water is harvested and used to a conservative extent (in garden irrigation and toilet flushing), a modest reduction in the storm-water runoff ratio (post-development flows relative to pre-development flows) would be expected, reducing it from 2.5-fold to 2–2.3-fold respectively.

In relation to resource efficiency, an internal harvesting ratio of up to 45 per cent could be achieved through rainwater or storm-water use, although in practice around 20 per cent is more likely based on conservative practices. For storm-water use, there could be a small energy saving of 12 KWh/year if use is maximized because pumping at this larger scale can be more energy-efficient, whereas conservative use gives a similar overall energy use to the base case.

<table>
<thead>
<tr>
<th>Alternative water servicing options</th>
<th>Storm-water use: In urban areas</th>
<th>Rainwater use: In households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservative implementation</td>
<td>Storm-water runoff is harvested from all hard surfaces (roofs, roads, car parks) within the urban system boundary. Volume harvested is assumed to be limited by maximum harvestable volume</td>
<td>Storm water is treated by sand filtration and supplied for irrigation within the urban system boundary. Ten per cent of maximum harvestable volume is used to irrigate 304.5 ha designated as open space in the planning scheme (parks, sports fields, green corridors, street landscaping etc.)</td>
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<tr>
<td></td>
<td>Volume harvested is assumed to be limited by the maximum harvestable volume and the volumetric reliability of the tanks</td>
<td>Volume harvested is assumed to be used for some sub-potable demand (garden irrigation and toilet flushing)</td>
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</tbody>
</table>

Figure: Ripley Valley Master Planned Area Structure Plan
Wastewater recycling scenarios at different scales

Decentralized grey water recycling at the household scale also reduces demand for external water supplies but comes at a considerable energy cost of 43–80 kWh/year. This is because the on-site treatment (sand filtration and UV disinfection) and pumping are relatively energy inefficient.

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<td>Wastewater recycling: In urban area</td>
<td>Wastewater from all residential and commercial dwellings (80 per cent of water supply) is treated at a local wastewater treatment plant to secondary level with disinfection suitable for irrigation, stream discharge and sub-potable use. 5 per cent of treated effluent is used for irrigation within the urban system boundary in the same way as the conservative storm-water use scenario.</td>
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<td>Wastewater recycling: Outside urban area</td>
<td>Like wastewater recycling within the urban area, except that treated wastewater is supplied to an adjacent agricultural area 4–8 km outside the urban system boundary. The recycled wastewater is used to irrigate vegetable crops.</td>
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<tr>
<td>Grey water recycling: In households</td>
<td>Grey water from residential and commercial dwellings (approximately 70 per cent of total wastewater) is collected in individual tanks. It is treated using sand filtration and UV disinfection at the property and supplied back to the same property. Of the total 6.46GL/yr, 34 per cent of generated grey water is used for sub-potable demand in residential and commercial dwellings within the urban boundary (garden irrigation and toilet flushing).</td>
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<tr>
<td>Grey water recycling: In appliances</td>
<td>Recirculating showers are installed in all residential dwelling to recycle shower water. Water and electricity for water heating are assumed to be reduced by 70 per cent.</td>
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</table>

**Timeline**

Year of research: 2016; Year of implementation: 2011

**Authorities Involved**

- The Urban Land Development Authority (ULDA), Queensland, Australia
- Ipswich City Council

**Funding and costs**

Approximately $ 103,254,588

**Strategies and Interventions:**

In this study area, several water-servicing scenarios are developed based on various modes of fit-for purpose water supply (rainwater/storm-water harvesting and wastewater/grey water recycling) at different urban scales (whole urban area, household appliances).

The servicing scenarios are development-based on various modes of RWH and recycled wastewater use fit-for-purpose at different urban scale.
Results/ Observations

An analysis of the scenario is used to show how it can be used to assess alternative urban water servicing options. The new insights relate to the extent to which alternative water supplies can influence water efficiency and hydrological performance of the urban area.

Over the longer term, the trust and understanding built through the work of such a task force could begin to capitalise on the opportunities such partnerships breed. For example, the possibilities of providing integrated water services, energy and food production systems could be explored, by finding new business models for service delivery with Queensland Urban Utilities and other third-party providers.

In the longer term, the Ripley Valley PDA would benefit significantly from an urban water management servicing strategy that is based around an Urban Metabolism Framework that coordinates a holistic effort on accessing multiple sources of water, stabilising and rehabilitating waterways and safe conveyance and detention of flood waters.

The notion of water supply services based on a portfolio of water sources, including a designer recycled water scheme would mean that affordable fit-for-purpose water is available to key stakeholders in the valley, particular Ipswich City Council who is largely responsible for delivering and maintaining a regional network of waterway riparian and lush bushland green corridors.

The availability of recycled water may also be an important catalyst for establishing and supporting a regional horticultural industry that potentially converts a wastewater disposal problem into $20M p.a. business.
Before and After

### Key Learning Points

- When the use of harvested rainwater and stormwater is maximised it can potentially reduce the scale of annually-averaged stormwater runoff to near pre-development levels, whereas conservative use has only moderate influence.
- Use of harvested rainwater/stormwater may offer more metabolism benefits than wastewater recycling.
- Harvesting precipitation falling on the urban area (rainwater, stormwater) can positively influence both water efficiency and restoration of natural hydrological flows (especially runoff), whereas wastewater recycling only influences water efficiency;
- The extent to which alternative water sources are used needs to be maximised to give noticeable benefits

### Additional Information

**Sources and References:**
