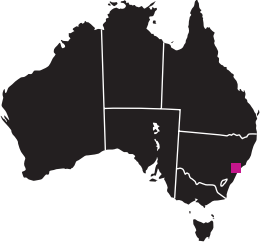




**ROSEHILL**



Public-private partnership supplying high quality recycled water to industrial customers in Western Sydney. Supply commenced in October 2011.

<b>CAPACITY</b> <b>20</b> ML/d	<b>CLASS OF WATER</b> <b>A</b>
<b>TYPE</b> Ultrafiltration and reverse osmosis	
<b>USAGE</b> Industrial processes and irrigation	

# *Rosehill Case Study*

## *Sewage recycling for large industrial customers*

The Rosehill Recycled Water Scheme illustrates how benefits can accrue to a private supplier and industrial customers involved in a recycled water scheme. In this case, some business closures led to reduced demand compared to what was initially predicted, with this demand risk borne by Sydney Water. Overall, despite challenges for some partners, the scheme has been highly technically successful. It has offered significant water security and financial benefits for industrial users, with cost-savings associated with the use of high quality recycled water exceeding expectations for many customers.

### ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) is a flagship research institute at the University of Technology, Sydney. ISF's mission is to create change toward sustainable futures through independent, project-based research with government, industry and community. For further information visit [www.isf.uts.edu.au](http://www.isf.uts.edu.au)

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### ABOUT THE PROJECT

This national collaborative research project entitled "Building industry capability to make recycled water investment decisions" sought to fill significant gaps in the Australian water sector's knowledge by investigating and reporting on actual costs, benefits and risks of water recycling **as they are experienced in practice**.

This project was undertaken with the support of the Australian Water Recycling Centre of Excellence by the Institute for Sustainable Futures (ISF) at the University of Technology Sydney (UTS), in collaboration with 12 partner organisations representing diverse interests, roles and responsibilities in water recycling. ISF is grateful for the generous cash and in-kind support from these partners: UTS, Sydney Water Corporation, Yarra Valley Water, Ku-ring-gai Council, NSW Office of Water, Lend Lease, Independent Pricing and Regulatory Tribunal (IPART), QLD Department Environment & Resource Management, Siemens, WJP Solutions, Sydney Coastal Councils Group, and Water Services Association of Australia (WSAA).

ISF also wishes to acknowledge the generous contributions of the project's research participants – approximately 80 key informants from our 12 project partners and 30 other participating organisations.

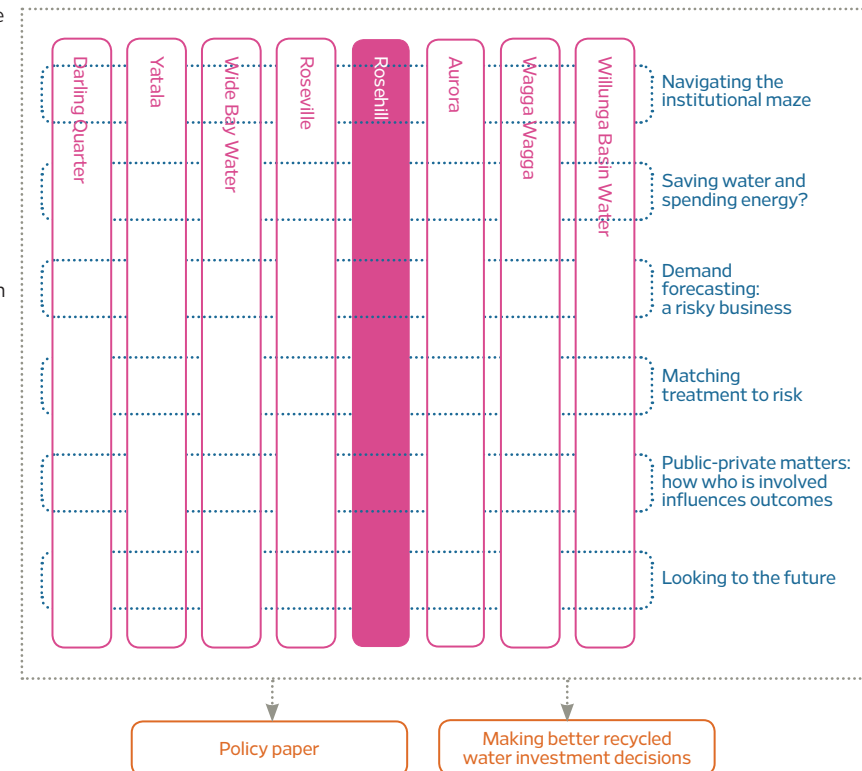
Eight diverse water recycling schemes from across Australia were selected for detailed investigation via a participatory process with project partners. The depth of the case studies is complemented by six papers exploring cross-cutting themes that emerged from the detailed case studies, complemented by insights from outside the water sector.

For each case study and theme, data collection included semi-structured interviews with representatives of all key parties (e.g., regulators, owners/investors, operators, customers, etc) and document review. These inputs were analysed and documented in a case study narrative. In accordance with UTS ethics processes, research participants agreed to participate, and provided feedback on drafts and permission to release outputs. The specific details of the case studies and themes were then integrated into two synthesis documents targeting two distinct groups: policy makers and investors/planners.

The outcomes of the project include this paper and are documented in a suite of practical, accessible resources:

- 8 Case Studies
- 6 Cross-cutting Themes
- Policy Paper, and
- Investment Guide.

For more information about the project, and to access the other resources visit [www.waterrecyclinginvestment.com](http://www.waterrecyclinginvestment.com)



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## Summary

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The Rosehill Recycled Water Scheme illustrates the benefits that can accrue to private suppliers and industrial customers entering the recycled water market. Since the commencement of supply in 2011, the scheme has been providing reliable, high quality water, bringing (largely unanticipated) benefits to industrial customers in the form of cost savings.

The scheme emerged in a context of drought in NSW, at a time when pursuing water security was a major driver for both public and private sector agencies. The Rosehill model is a public-private partnership, with AquaNet Sydney Pty Ltd and Veolia operating the plant and supplying recycled water to Sydney Water, who in turn retails it to six foundation customers in Western Sydney. The partnership structure took time to form, with arrangements between partners and with foundation customers shaping the relative distribution of costs, risks and benefits - including demand risk which has proved an issue for this scheme with one of the foundation customers ceasing operations within five years of the scheme coming online. With a 20-year take-or-pay contract, Sydney Water bears the risk and cost (through their customer base) of any demand shortfall of the foundation customers. For the private partners, securing additional customers has been slower than anticipated, and the scheme has additional supply capacity yet to be allocated.

Overall, despite these challenges, the scheme has been highly technically successful and has offered significant financial and water security benefits for industrial users.

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## The scheme: facts and figures

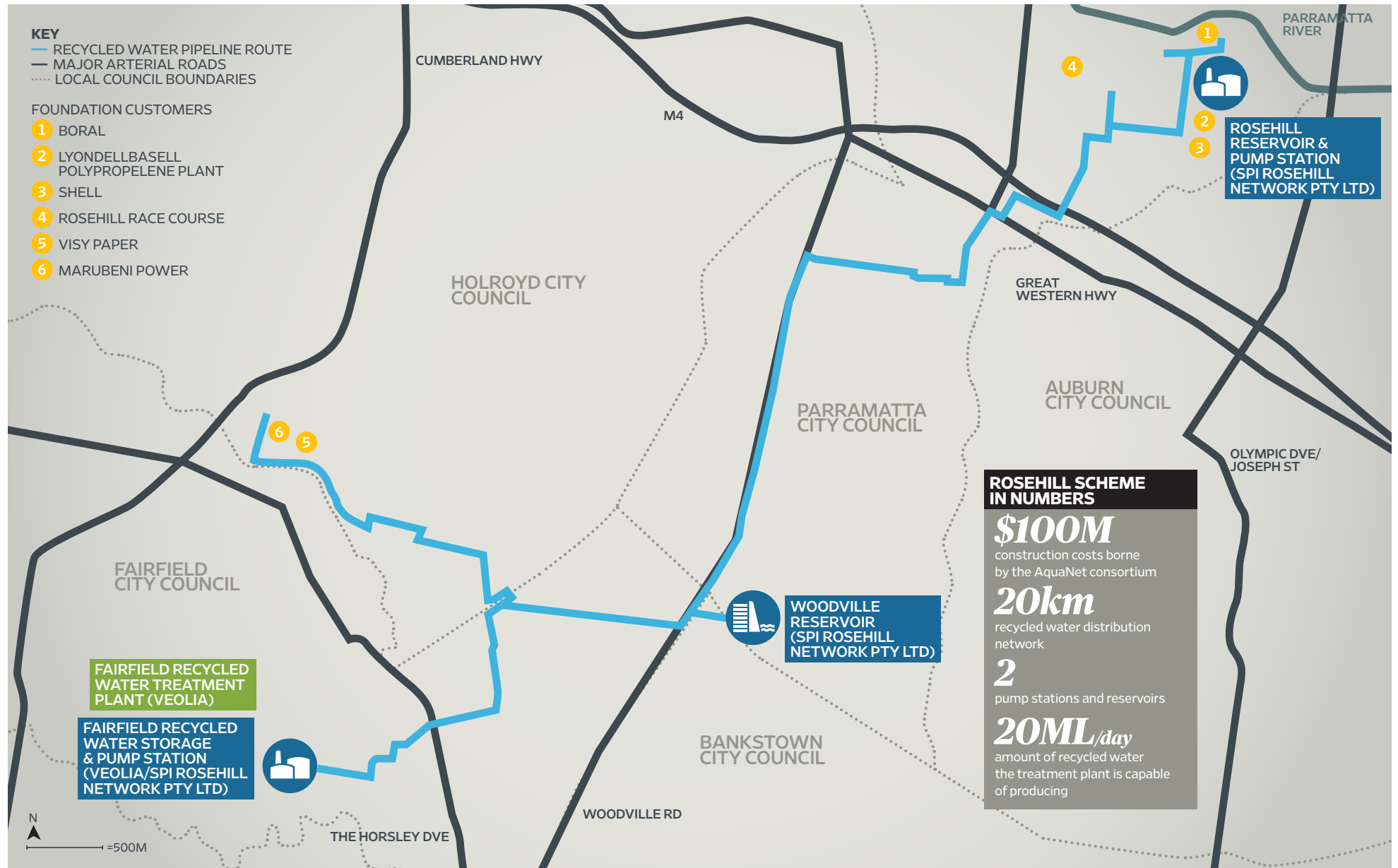
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- The scheme was built and is owned by a private consortium - the Rosehill Recycled Water Scheme (RRWS) - led by AquaNet Sydney Pty Ltd, part of the Jemena group of companies. Veolia constructed and now operates the treatment plant. SPI Rosehill Network Pty Ltd (a Jemena company) owns and operates the network. RRWS

constructed and operates the distribution network, and supplies recycled water to Sydney Water, who in turn retails the water to “foundation customers” in western Sydney: five major industrial users and one irrigation user.

- Sydney Water commenced the public-private partnership (PPP) tendering process for this scheme in December 2005. Construction commenced in November 2009 and supply commenced in October 2011.
- The scheme consists of a recycled water treatment plant and a 20km recycled water distribution network comprising two reservoirs and two pump stations. The treatment involves ultrafiltration and reverse osmosis, and is monitored to meet water quality targets of < 50 mg/L TDS, pH of 6.5-8.5, Chlorine residual of 1 mg/L and turbidity of < 0.5 NTU (Sydney Water n.d.).
- The construction costs of the scheme, borne by the RRWS consortium, were approximately \$100m.
- Foundation customers pay 90% of the potable water price and have 20-year take-or-pay supply contracts with Sydney Water with an opt out clause under certain circumstances after 5 years. Sydney Water has a 20-year take-or-pay contract to purchase 10.5 ML/day from RRWS. There is a shortfall between the cost payable by Sydney Water for the recycled water and the price it charges foundation customers. The NSW Government directed this shortfall to be recovered from the potable water price because the scheme reduced demand on the potable water supply, increased the use of recycled water, and was capable of being expanded (which would reduce the shortfall).
- The recycled water treatment plant can access up to 32 ML/day of secondary effluent from Sydney Water’s Liverpool to Ashfield Pipeline. The treatment plant can produce up to 20 ML/day of recycled water, and has been designed to be expanded to service an additional 5 ML/day.
- Initially, the scheme supplied 10 ML/day on average of recycled water. Currently, an average of about 7 ML/day is supplied by RRWS.
- The scheme is the first to be delivered under the *Water Industry Competition Act* (WIC Act) licensing scheme. AquaNet holds a retailer’s licence, as they may at their own cost extend supply to additional customers.

# Rosehill recycled water scheme distribution



## The short story

### **Pursuing water security was a major driver for both the public and private parties involved in developing the scheme.**

The origins of the Rosehill Recycled Scheme lie in the confluence of public and private interests in developing alternative water sources, driven by the extreme drought conditions affecting Sydney in the early 2000s. In 2005 the Australian Gas Light Company (AGL) approached the NSW Government with an unsolicited proposal to redevelop its disused gas mains as a recycled water distribution network. Their proposal aligned with the NSW Government's plan to ensure water security, which included a wastewater reuse target to create potable water savings of 70 GL by 2015.

### **The tendering and procurement process was extensive and lengthy**

A multi-stage, outcomes-based tendering process commenced in late 2005, and it took more than 3 years for the project to be awarded. The PPP negotiations were dominated by the issue of risk-sharing and design of the commercial model. Both parties have subsequently reflected that more detailed specifications upfront (for example about the relative importance of cost and scalability) would have considerably shortened the tendering process.

### **The WIC Act was considered appropriate for a scheme of this complexity. The costs of approvals were borne by the private sector (with associated public benefits), however an alternative model could have cut negotiation time and costs.**

This private-public recycled water scheme is the first project to be delivered under the regulatory and licensing arrangements established by the WIC Act. From the perspective of those involved, the requirements of the WIC Act were considered appropriate for the scale and complexity of this scheme.

The PPP nature of the scheme meant that the private partner bore the majority of regulatory compliance

requirements (rather than Sydney Water). Nevertheless, public and private parties now consider that an alternative model, in which the private sector builds and operates the plant with Sydney Water operating the network, could have had a number of advantages including cutting negotiation times and providing ongoing clarity of roles in network management of water services.

### **Most customers were initially reluctant to take recycled water. Ultimately, depending on the type of industrial process in question, the benefits of using recycled water surpassed customer expectations.**

Negotiating contracts with foundation customers was more difficult than Sydney Water had expected. A few customers were initially driven by water security pressures, however most were initially reluctant to participate in taking an “unknown” product. Nevertheless, since its commissioning in 2011, the scheme has successfully provided high quality (reverse osmosis, RO) water and for a number of customers this has yielded cost savings far beyond their expectations. Due to the TDS (total dissolved solids) of the recycled water, savings have been made from reduced water and chemical use and reduced equipment replacement rates for cooling towers and boilers. In contrast, manufacturers whose processes do not benefit from higher quality water have not seen the same cost savings. For example one customer's processes have been affected by the higher temperature of recycled water compared to mains water.

### **Both private and public parties saw this scheme as presenting an opportunity to stimulate increased demand for recycled water, but this has not eventuated.**

Demand risk from foundation customers has been borne by Sydney Water through the take-or-pay contract, required to make the scheme financially viable from the private consortium's perspective. With the closure of one foundation customer (for economic reasons), revenue shortfall has increased. Within the context of water security pressures at the time the scheme was conceptualised, this demand risk could have been viewed as providing diversity in securing Sydney's water supply. However, subsequent significant supply augmentations including the Sydney desalination plant have eroded the effective “diversity value” of this and other water recycling schemes.

## Scheme timeline

### 2004

NSW Metropolitan Water Plan released, setting ambitious recycled water targets.

### 2004-05

Markets Needs Assessment for recycled water undertaken by the NSW Government.

### 2005

AGL<sup>1</sup> approached NSW Government with an unsolicited proposal to redevelop disused gas mains for recycled water network in Sydney.

NSW Government directed the project to progress to a 'Registration of Interest' for further consideration.

### 2006

Water Industry Competition Act enacted

Updated NSW Metropolitan Water Plan released, including a target to supply 70 billion litres/year of recycled water by 2015.

### 2007

Alinta (now AquaNet) consortium announced as preferred tenderer

### 2009

Project Agreement became effective when all conditions precedent were satisfied.

Construction commenced

### 2011

Scheme commissioned

The RRWS consortium, although contractually insulated against foundation customer demand risk, originally expected growth opportunities from this scheme. These haven't yet eventuated, due partly to the changed water security context and partly to industry reluctance to use recycled water in the manufacturing of personal use products.

## ***Drivers: the confluence of public and private interests in ensuring water security***

### **Water security pressures facing Sydney during the 2000s inspired both private and public entities to identify long-term opportunities for wastewater recycling.**

During the early 2000s, as the 'Millennium Drought' deepened across much of Australia, the Sydney metropolitan area faced rapidly declining water storage levels and a range of restrictions on outdoor water use. It was during this period of heightened water security concerns that the Australian Gas Light company (AGL) approached the NSW Government with an unsolicited proposal to put its disused gas mains across Sydney to use, redeveloping them as a ring-network for distributing recycled water.

Around the same time, the whole-of-government approach for ensuring water security (articulated in the 2006 Metropolitan Water Plan) included a target of supplying 12% (70 GL/year) of Sydney's water needs with wastewater by 2015. This resulted in substantial work towards identifying the potential for water recycling, conducted by both Sydney Water and the NSW Government. Both Sydney Water and AGL considered that the industrial users around the Rosehill area represented significant potential demand for reuse water that could reduce the demand on potable water supplies.

From the beginning it was clear that government co-investment was required for scheme development:

**"We couldn't have made it work on the actual paid water price at the time, which was about \$1 a kL. So we needed some sort of help to get the project up financially."**

**Most potential customers were initially cautious about taking recycled water, but some were directly or indirectly driven by concerns about the water security of current operations or future expansion.**

Potential customers' initial reluctance to take recycled water arose because they were already connected to mains water, and they did not perceive any specific advantages from recycled water use (as discussed above). However one customer felt strongly concerned by the possibility of restrictions on water-using industries, and saw recycled water as an opportunity to secure a rainfall-independent water source for its cooling tower and boiler operations:

**"The main driver for us wasn't initially cost [savings], but business risk... if it hadn't started raining... they [could have looked] at the major Sydney water users and started to curtail some of [our] water take. So we identified the project as a risk management strategy..."**

Another customer, whose industrial operations previously utilised low-quality recycled water from a neighbouring industry, was interested in the prospect of accessing higher quality water. They were also considering expanding their operations, and felt that during drought no 'social licence' - and no development approval - would be available to connect to mains water to supply a cooling tower they were planning to install:

"We had cooling towers before... up to about 25,000 litres a day in evaporation... so when the recycled water project came along we thought this is a good way of protecting the environment and it would also help us because the water would be [higher] quality..."

"We were at that point in time wanting to increase our capacity to maximum... one of the problems with bringing in an additional tower... with the dams already low and everybody already restricted, the answer would have been no."

## ***Public Private Partnership: Negotiations and decision making***

### **The outcomes-based tender process had time and cost consequences for both public and private parties**

The NSW Government decided to progress the project via an open tender procurement process based on an outcome-based contract. Sydney Water commenced this multi-stage process with a Request for Registration of Interest (ROI), which was based on the broad outcome of the private sector implementing a recycled wastewater scheme in and around Camellia in Western Sydney. The location, scale and end-users were not explicitly specified (see box 1).

#### **BOX 1: REGISTRATION OF INTEREST**

The Registration of Interest for the project issued on 12 December 2005 was outcomes based and required proposals to include:

1. An outline of the proposed scheme
2. The proposed capacity and area to be serviced
3. The preferred source of raw sewage
4. Ability for expansion
5. Which party would take on the role of retailer.

Source: Contract Summary

The winning consortium led by AquaNet Sydney Pty Ltd reported that they invested substantial time and costs (-\$5 million) in tendering in this multi-stage, 3-year procurement process (see timeline). They expressed some frustration that for probity reasons they could not ask Sydney Water to clarify the broad tender requirements and criteria weighting - particularly in regards to preferred scale - until the final stage. Changes to AGL ownership indirectly enabled the consortium's continuing participation in the lengthy process, as each new owner considered the negotiation costs already incurred as sunk costs.

### **Negotiations and decision making timeline**

#### **2005**

NSW Government directed further investigations and detailed planning.

#### **Dec 2005**

Sydney Water issued Request for Registration of Interest. In response, 8 consortia submitted ROIs on Feb 2006.

#### **May 2006**

Sydney water issued Request for Detailed Submissions to 3 shortlisted consortia, who submitted in Jul 2006.

#### **Dec 2006**

Request for Detailed Proposals issued by Sydney Water to two shortlisted consortia. One withdrew, One consortium submitted in Apr 2007.

#### **Apr 2007**

Public Sector Comparator Reference Project completed.

#### **Oct 2007**

Sydney Water Board approved Alinta consortium as preferred tenderer.

#### **Aug 2008**

Project Agreement signed between Sydney Water and AquaNet with Veolia.

#### **June 2009**

Project Agreement became effective when all the preconditions were satisfied.

### Developing the PPP commercial model required extensive negotiations about sharing risks

At the Registration of Interest and Detailed Submission stages, Sydney Water was open to receiving proposals for different PPP commercial models detailing the commercial terms and risk allocation. Most consortia did not nominate a private entity as the retailer. They required certainty of revenue stream via a public entity acting as the retailer and bearing demand risk. Sydney Water considered that acting as retailer and bearing the demand risk was essential for the scheme to get off the ground in a timely way to address Sydney-wide water security pressures:

“I think the strong reasons for [Sydney Water] being the retailer was we thought Sydney Water had to be in there to make it happen. That in terms of providing water services, we were the trusted ones in Sydney to do that. We could also make it happen on time.”

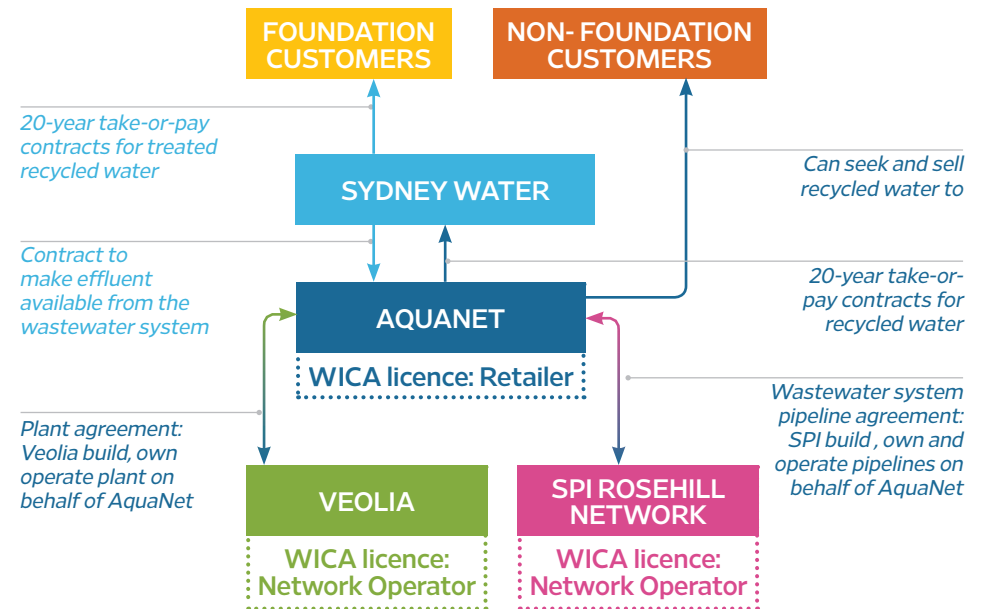
The PPP commercial model was developed and finalised by Sydney Water in late 2006 during the final round of the tendering process (Detailed Proposals). Under this model Sydney Water purchases treated reuse water from the consortium at a take-or-pay volume (payment volume as per contract, irrespective of actual amount used), guaranteeing income for the consortium for 20 years. Sydney Water then acts as the retailer to foundation customers, assuming the demand on behalf of these customers who had rights to terminate their supply agreement after five years if their business activity on the site changed significantly. The private consortium can also access opportunities for demand growth from other customers.

Similar to other PPP models in place across various infrastructure sectors, the risk sharing arrangement in place sees Sydney Water bearing the demand risk, and the RRWS consortium bearing risks associated with development, design, construction and operation. In the context of water shortages occurring at the time, the scale of the plant was at least partly

“We wouldn’t have built the scheme... without Sydney Water bearing the demand risk... So that helped the project go ahead. There’s no way that it would have been approved by all our boards with all these changes of ownerships if there wasn’t reasonable certainty that we had a revenue stream.”

driven by the Metropolitan Water Plan recycled water use target and by the NSW Government’s interest in ensuring the scheme could be expanded to meet what was then expected to be growing demand, which has not yet eventuated.

### PPP model and WICA licences held





**Ultimately, an alternative model of joint public and private involvement could have been more efficient.**

Compared to specifying the inputs required, outcomes-based tendering in theory encourages a greater degree of innovation from the private sector. However, in this case the multi-stage tendering process was extensive and lengthy and both sides concluded that more specific requirements upfront would have saved much time and would not have unduly compromised the level of innovation. There would also be value in the private and public parties being able to work more closely together to develop a recycled water scheme that is both innovative and feasible. This would however require the procurement process to be designed in a way that met probity requirements while enabling flexibility.

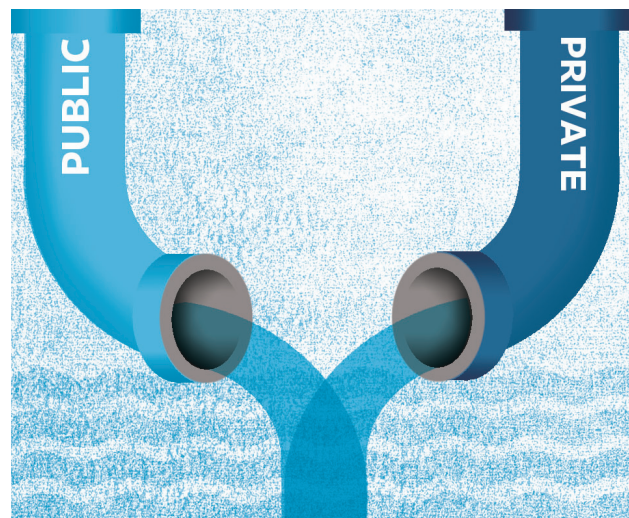
Sydney Water also believed it would be better for the private entity to construct and operate the treatment plant (rather than the consortium operating the recycled water network). The involvement of both Sydney Water and RRWS has resulted in issues where customers are uncertain about whom to contact. Having one network operator who was responsible for both the drinking water and recycled water networks would also streamline maintenance and repair requirements:

“We [Sydney Water] have crews that work this area in terms of the water networks. They would just do the same for recycled water if we operated the network.”

**The WIC Act licensing process was generally enabling, but some areas could be streamlined.**

AquaNet holds a retail licence for supplying recycled water to customers other than the foundation customers, and Veolia and SPI Rosehill Network each hold a network operator’s licence. The RRWS consortium considers the WIC Act regulatory framework to be generally appropriate for schemes of this scale and complexity. One consortium partner noted that the regulations were “written for our scheme” and that the time impost (6 months) was low compared to that required to gain Part 3A planning approval. However they also noted that the financial viability tests meant that the level of approval required from their multinational company was unrealistically high:

“The financial requirements in WICA meant that we almost had to get a guarantee that all the directors in the whole chain were... standing behind this little project. It was just out of proportion. We just couldn’t do it”.



## Demand: anticipated opportunities eventuated as risks

**Most foundation customers were initially reluctant to take recycled water, and negotiated contracts with Sydney Water that included a 5-year opt-out clause**

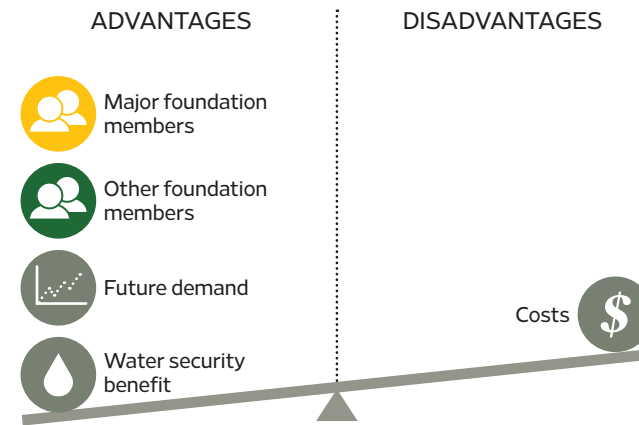
Negotiating supply contracts with foundation customers was a complex and time-consuming task. What was not anticipated by Sydney Water was how reluctant industrial users were to take recycled water. Only one water-using business was strongly motivated by water security drivers, and many of the others were averse to what they perceived to be the “unknown” risks associated with recycled water. The scale of benefits from water quality changes were also uncertain and for most foundation customers did not represent a strong driver for involvement in the scheme. Some plant managers expressed concerns that introducing a new product, recycled water, would create additional work and risk in managing changeover:

“The customers were not keen about taking recycled water...[they] had the attitude ‘I’m happy with the drinking water. You’re now selling me recycled water, and because it’s recycled water I really don’t know what’s in there... I know drinking water, and I’m used to using it. You’re now giving me a different product.’”

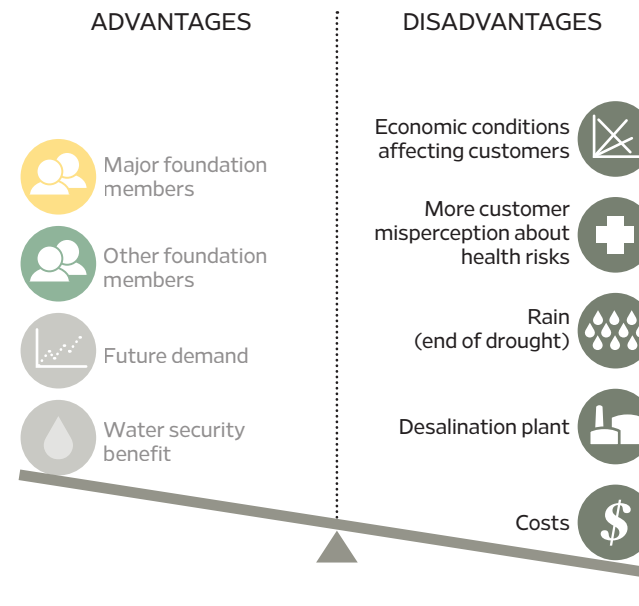
All but one prospective foundation customer was already connected to the Sydney Water network, and none of them was accustomed to the idea of a specific supply contract for their water. Most sought 100% service reliability from the recycled water scheme - they were unaware that existing agreements with Sydney Water, whether residential or non-residential, did not guarantee 100% service reliability.

## Demand risk: the context matters

### THE PICTURE THEN: SAILING ALONG NICELY



### THE PICTURE NOW: A BIT MORE WEIGHED DOWN (CHANGING OF UNCERTAIN CONTEXT)



The limited initial enthusiasm by foundation customers for recycled water also constrained SWC's negotiating position, including their ability to negotiate longer-term contracts without an opt-out clause. Some customers did not want to commit to long contracts as they only have short term business plans and are unsure of the long-term viability of their businesses at their current sites. SWC is contracted to take water for 20 years, but could only secure contracts with customers with clauses allowing them to opt out under specific circumstances after five years, which increased the demand risk for Sydney Water.

**Reverse osmosis (RO) treatment added significant costs, but was (probably) necessary to secure demand**

In retrospect, both Sydney Water and the RRWS consortium questioned whether energy-intensive reverse osmosis treatment was really necessary for this industrial reuse scheme. Not all customers required RO-treated water, and it could have been more cost-effective overall for specific customers to undertake additional treatment as and if required on their own sites. However, at least one prospective customer only agreed to be involved if RO (low TDS) water was supplied, and thus RO treatment was considered essential to secure sufficient demand volumes from foundation customers.

A further consideration was that the consortium believed that due to the log reductions from RO treatment for the removal of viruses and bacteria, without RO it would have been far more complex to meet the health risk management parameters required to gain WIC Act licences.

**SWC ratepayers are bearing the financial consequences of the closure of one foundation customers, but this equates to only a small amount per connection across the ratepayer base.**

In 2012, one major foundation customer discontinued its water-using operations. A further customer, whose business is associated with the operations of the first, is expected to close in 2013. The reasons for closure are not related to water security or recycled water issues, but to broader economic conditions and business plans of the customers.

These two customers, who comprised about 1/3 of the expected demand from foundation customers, will continue to pay their contracted take-or-pay volumes until 2014 (with one currently paying for water they are not using). After that, Sydney Water will face a revenue shortfall of \$4 million a year (Sydney Water 2012). When spread over Sydney Water's customer base, the difference between planned and expected revenue from the Rosehill Scheme due to the closure of one foundation customer is about two dollars<sup>2</sup> on average per property per year across all of Sydney Water's customers.

**The current supply-demand situation is vastly different to the water security pressures which shaped the context for public decision-making during the drought.**

In the context of the drought in the mid-2000s, the magnitude of demand risk was considered relatively small given the potential water security benefits - both in the short term, if the drought had continue and in the longer term as part of a cost-effective diverse portfolio of water security options for the Sydney metropolitan area. In the absence of other major supply augmentations, the scheme demand risk taken by the public could have been viewed as an investment - or as an insurance - against future water shortages.

However, construction of the desalination plant has had substantial consequences for how the demand risk associated with the Rosehill scheme is now perceived. The decision to build and scale-up the desalination plant was made only after the Rosehill scheme tendering process was well progressed. The greater water security benefits to Sydney from taking on the Rosehill scheme demand have been negated in the short term by the end of the drought, and even more significantly for at least the next decade by the supply potential from the desalination plant. So the increased supply available from the desalination plant has effectively reduced the marginal value of replacing potable supply with recycled wastewater.

**AquaNet has also found it far more challenging to attract industry customers than they anticipated**

Under the PPP arrangement, RRWS can, at their own risk and cost, expand the scheme to supply to users beyond the foundation customers.

“I think the plan should be to try and utilise this project 100 per cent. How can we do that? We’ve paid for the plant, so let’s get 20 ML a day out of it... We get 95% of our revenue from the foundation customers [via Sydney Water] so it doesn’t change our equation so much, but what it does do is it just makes more sense.”

A key barrier to RRWS extending supply to other industrial users in the area is that these potential customers consider that the public will not want recycled water to be used in the manufacture of personal use paper and cleaning products. RRWS pointed out the inconsistency in perceptions of risk with recycled water being used widely in the manufacture of packaging including for food, and were frustrated with how public (mis)perceptions of risk have stifled the uptake of water from the scheme:

“The one thing that would really help is if the public perception of having recycled water in manufacture of products [shifted]. It’s a real barrier to us expanding this project. To have a [potential] customer that is located right on our [distribution] line not signing up, is just a real pity.”

Consortium members are also believed that encouraging recycled water use now is important to shift public perceptions, for benefit in future droughts:

“Efforts made now in using and enforcing the use of recycled water will pay in the future. If you can manage to get people to get the most out of this recycled water plant now when water is available, then when you really need to make use of that recycled water [in drought] you won’t have to go and convince people.”

**Diversification of customer types is a sound strategy to mitigate demand risks, but can be challenging**

Having multiple foundation customers has meant that the demand risk is spread more widely than in some other schemes.

“You’ve got half a dozen [foundation customers] which is good. So one closes down, but you’ve still got six or seven meg of load which is good. This plant at least has some diversity... [elsewhere] it’s one plant for one customer.”

Both Sydney Water and RRWS recommended that including residential users in schemes that supply to industrial users would further help to offset the risk of major water-using businesses shutting down after scheme commencement. However, due to the perceived and actual costs of third-pipe systems, as well as current community attitudes to IPR, they acknowledge this has not so far been practicable for Rosehill – even if technically feasible and likely to be cost-effective.

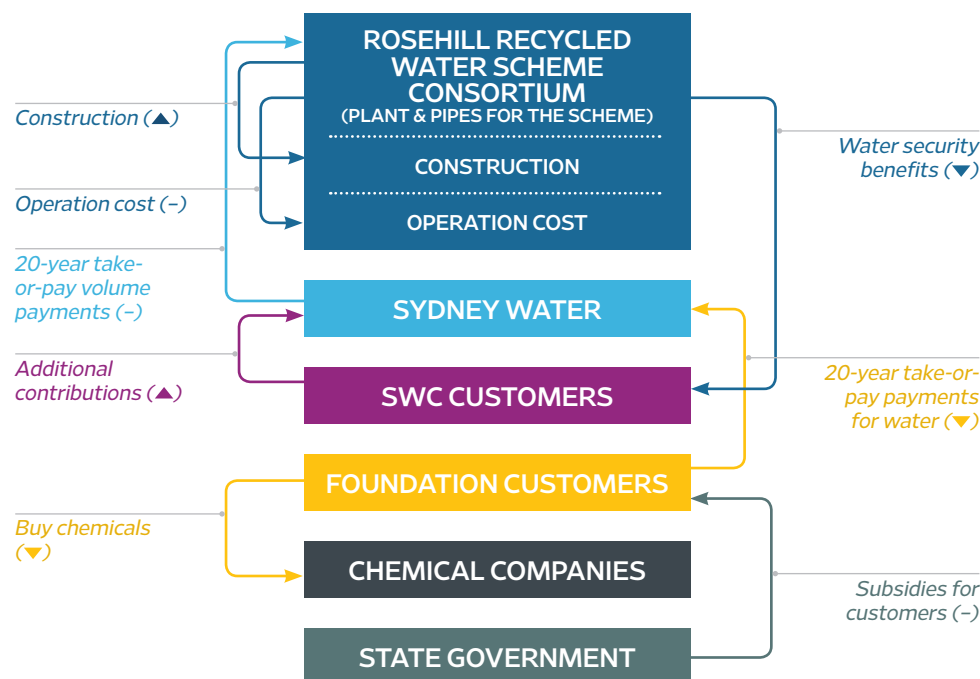
## Foundation customers: overall, substantially positive outcomes

Since commissioning, the scheme has operated successfully with high reliability.

The scheme is regarded by Sydney Water, the consortium and foundation customers as an excellent example of technical success. Continuity of supply within specifications is essential for the industrial customers, many of whom use water in their operations on a 24-hour basis.

## Transfer of value

▲ HIGHER THAN EXPECTED ▼ LOWER THAN EXPECTED - SAME AS EXPECTED



"There's been no unreliability whatsoever since the project came along. We've had no issues at all. We have not had it stop once. That was really important because [if it did] we would have to change over to domestic water to the reactors to be able to keep operating"

"...it's a demonstration that the private sector can provide water services. Successfully do it".

## Using recycled water in industrial processes – particularly cooling towers and boilers – has brought customers substantially greater cost savings than they had anticipated

Compared to mains water of about 200 mS/cm, the RO water quality of 25-35 mS/cm has brought considerable benefits to customers from reduced water and chemical costs, particularly for cooling tower and boiler operations. The savings are associated with lower rates of scale build-up, lower associated chemical requirements, lower cooling tower bleed rates, and much longer timeframes for equipment replacement (see box 2). An industry side-effect however is that chemical suppliers have been adversely affected by reduced sales to these customers.

### BOX 2: RECYCLED WATER VS. MAINS WATER

High quality recycled water beats mains water: savings reported by a customer

#### Cooling towers

- Bleed water – 75% saving. Previously running 8 cycles of concentration, now running 20.
- Chemical program to prevent scale and corrosion – 75% saving (same proportion as bleed water)
- NaCl added as disinfectant – 40 tonnes reduction a year, because scheme water has more chlorine than mains water.

#### Boilers

- Caustic and acid used to regenerate demineralisation plant – 50% saving
- Resin media in demineralisation plant – significant extension of life.

For one customer, the attraction of increased water security was a critical factor in convincing their headquarters to participate in the scheme. This was because avenues for financial benefits (and their scale) were not anticipated:

“The cost savings associated with the chemicals weren’t really appreciated fully. Even all the modelling we did, they kind of underestimated the amount of savings and the amount of reductions in chemicals... There were a lot of onflow savings.”

“[Their] projections said they’ll probably be delivering water less than 50 mS/cm... [now] this water is coming in at about 25-35 mS/cm.”

Adding to the financial benefits, at least some customers were successful in securing state government grants that covered the cost of plant upgrades and conversion to the stainless steel equipment required to take RO water. They reported that although this helped to gain internal approval due to uncertainty about other benefits, they would still have benefited if there had been no subsidy. For at least one operator the payback period - even with no subsidy - would have been months rather than years..

#### **The benefits have varied across different manufacturing processes**

For one customer, the use of recycled water has had an unintended adverse impact. Although the chemical parameters for the recycled water were negotiated between customers and Sydney Water, one parameter that the customer did not seek to specify was temperature. As recycled water is normally a few degrees warmer than mains water, this has impacted on manufacturing processes.

Another customer, who does not require RO water for their manufacturing processes, has not directly benefited from the high quality of water from the scheme. This customer previously accessed cooling tower blow down water from

another industrial customer for free, and due to the reduction in bleed enabled by higher quality water the manufacturing company now needs to purchase additional water.

#### **Industrial customers are accustomed to managing health and safety risks and do not consider that recycled water presents unmanageable health risks, so long as the water stays in spec.**

The industrial customers interviewed for this case study did not consider any recycled water health risks as presenting insurmountable barriers per se for technical management, as there are many risks already managed on site:

“We didn’t look at it specifically from the point of view of risks associated with recycled water. We looked at it on the same basis that we’d look with any change management process or technical issue associated with the plant.”

However, health risks are a concern to foundation customers in relation to protocols for managing events when the water does not meet specifications. Although changes in chemical parameters such as TDS can be analysed quickly and changes managed on-site, one customer was concerned that health parameters take far longer to analyse:

“I don’t think they understand the amount of risk analysis that we had to take in order to get this project happening here. Because you’ve got to bear in mind that it’s not just real risk, it’s a perceived risk. If all of a sudden word got out that we’d been taking out of spec water... You’d have the union walking off the site... and then we’d have all of the potential litigation that comes on to us”.

**The value of recycled water exceeds its price for at least some customers, but this was not known upfront**

The price of recycled water is a key parameter in determining the financial viability and risks of the scheme. A discounted price was considered necessary to encourage potential customers to sign up to the scheme given their degree of uncertainty about risks and benefits. Due to the interdependence between Sydney Water customer contract negotiations and Sydney Water - RRWS contract negotiations, and the general difficulties in securing foundation customers, Sydney Water sought to standardise where possible the terms of customer contracts, including price.

“If you looked at the major customers, on a purely commercial basis the price for recycled water should have been higher than it is... But it had to be where it is at to get them to be part of a ... new scheme. So if you’re doing the next scheme, you might be able to do something different. Because you would be able to draw information from it that could demonstrate they could save a lot of money on the way”.



Both Sydney Water and consortium participants believed that, with more certainty about the benefits and risks of using recycled water, in future schemes it will be important for price to signal value in order to support their financial viability.

“Recycled water schemes have set a price of recycled water less than potable water to encourage customers to connect. The true value that many industrial customers derive from recycled water is not realised by Sydney Water and the broader customer base. Industrial recycled water schemes should not be discounted to entice customers to connect. The price of recycled water should better match the value proposition the customer is deriving compared to their alternatives.”

However, they acknowledged that expectations were already set by the pricing discount, and that the current supply-demand context is not conducive to charging more for recycled water, irrespective of its value:

“Once you’ve started charging the industry less for it, this changes perceptions of what it’s worth, even it is of higher quality and is worth more to them... [To charge more] you’d need a drought environment when they’re under a lot of pressure from the government to say, hey you’re wasting all our drinking water. But right now? Never.”

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## *Summary of key perspectives and lessons for the future*

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### **PPP negotiations are complex and time-consuming:**

The private sector was undoubtedly successful in implementing this recycled water scheme, but at relatively high transaction costs for all parties. Alternative configurations of public and private involvement could have streamlined both the negotiation processes and ongoing delivery of services. These alternatives could include more detailed specification of requirements upfront, and the private sector constructing and operating the treatment plant and Sydney Water operating the network.

### **The water security context for decision-making matters:**

The decision to progress the scheme was made during the context of water security pressures and drought, and at the time recycled water - despite demand risks - provided diversity in water supply in the face of climate change. This value has since been eroded by major changes in the Sydney supply-demand system.

### **Demand risk means commercial risk:**

There are challenges in supplying recycled water to industrial customers as their demands fluctuate in the medium term due to business changes. To develop the Rosehill scheme Sydney Water accepted significant commercial risk through a mismatch between its commercial 'take or pay' obligations to RRWS and those of its foundation customers. It did so without a broad spread of demand (e.g. industrial and residential) to mitigate the risk. Revenue losses incurred due to the contracts with the foundation customers are transferred to Sydney Water's broader customer base through a government directive, effectively underwriting this mismatch. To address the high demand risk inherent in industrial recycled water schemes, future schemes for industrial customers need to incorporate a greater financial margin commensurate with the commercial risk.

### **The price of recycled water could better reflect the value to customers:**

The reduced water and chemical costs, and the equipment replacement cost savings which result from using recycled water in industrial processes are clearly demonstrated by the experiences of some foundation customers. To promote scheme viability, future schemes could consider charging more for recycled water when for some users it is effectively a premium product, compared to mains water. However this may be difficult given the short- and medium-term supply-demand outlook.

### **Perceptions of recycled water health risk have hindered uptake by some sectors:**

Industry concerns about community fears associated with using recycled water in the manufacture of personal use products have hindered the utilisation of the Rosehill scheme to its full value, with some manufacturers unwilling to sign up even if they are next to the supply line. The actual risks are much lower than these perceived risks.

### **Residential users would help to diversify demand:**

Including residential users through non-potable reuse or indirect potable reuse would help to further diversify the scheme and hedge against demand risk. "In view of the changing circumstances and community attitudes, and given the high quality water already produced by the treatment plant, there is long-term potential to cost-effectively extend the scheme to include IPR.

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#### **Notes**

1. Due to changes of ownership, the entity leading the consortium - AquaNet Sydney Pty Ltd - which holds the Project Agreement with Sydney Water, has had previous names including Agility and Australian Gas Light Company.
2. Estimation based on National Water Commission (2012) total of 1,793,000 connections (residential and non-residential).



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