



CRC for
Water Sensitive Cities

Use of smart
technologies and
real time information
helps to optimise and
control multiple water
streams

Aquarevo

A smart model for residential water
management

First major
application of rainwater
harvesting for hot water
use in Victoria

AQUAREVO
LYNDHURST

villawood
properties
COMMUNITIES DESIGNED FOR LIVING

South East
Water

Case Study

Prepared by Cooperative Research Centre
for Water Sensitive Cities, September 2017.

 Australian Government
Department of Industry,
Innovation and Science

Business
Cooperative Research
Centres Programme

<u>The context</u>	3
<u>The drivers</u>	9
<u>The innovations</u>	16
<u>The outcomes</u>	28
<u>The challenges</u>	36
<u>The learnings</u>	45

The context

The background is a solid blue color. It features several large, semi-transparent, organic shapes in a slightly lighter shade of blue. These shapes include circles, wavy lines, and rounded rectangular forms, creating a layered, abstract effect behind the text.

[BACK TO MENU](#)

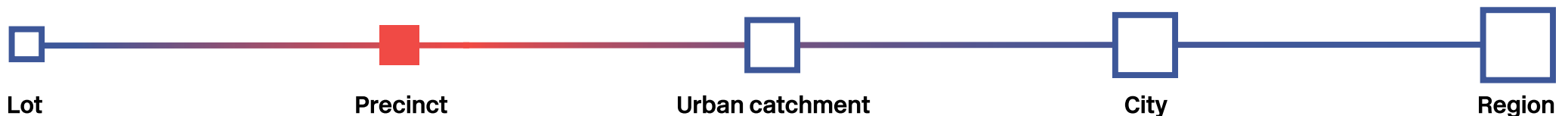
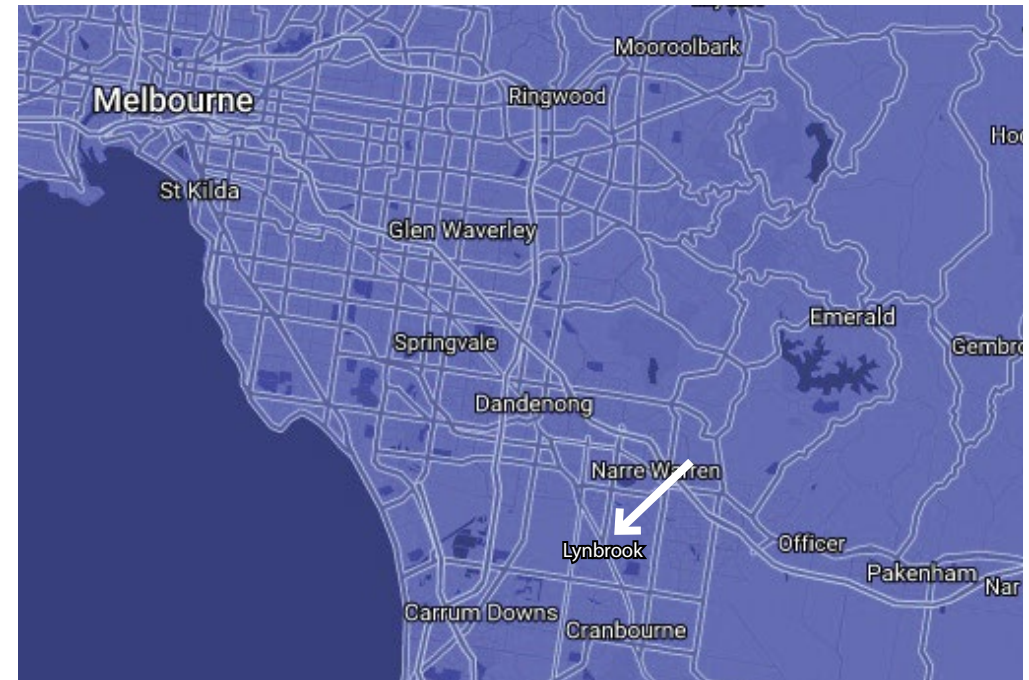
Project location

Aquarevo is an urban residential development located at Evans Road, Lyndhurst (42 km south east of central Melbourne). The site is being developed in a collaboration between the land owner, South East Water, and a property developer, Villawood Properties.

Project scale

The proposed development includes 460 residential dwellings on a 42 ha site.

After the decommissioning of the former wastewater treatment plant on the site there was an opportunity for South East Water to sell the land for development. Instead, South East Water saw an opportunity to play an active role in the development of the site and to demonstrate advances in water management. South East Water selected Villawood Properties as it's joint developer in this landmark project and the whole site was collaboratively masterplanned. By planning at a precinct scale, and with demonstration of best practice water management as a major objective, the site has successfully integrated a range of initiatives.



[BACK TO MENU](#)

Project site

As the former home to a South East Water wastewater treatment plant, the site is a rare, large parcel of land within an existing built up area. The wastewater treatment system included ponds surrounded by a buffer of farmland.

The site is nestled within the suburb of Lyndhurst and it benefits from good access to transport, open space and community amenities. It is also the neighbour to several surrounding developments that have previously demonstrated innovation in water sensitive urban design (WSUD); most prominently, Lynbrook Estate to the northeast of Aquarevo, and Marriott Waters to the south. The former has an international reputation as the first estate-scale demonstration of WSUD delivered through collaboration between the CRC for Catchment Hydrology, Melbourne Water and the former Urban and Regional Land Corporation (now Places Victoria). Marriott Waters was developed by Villawood Properties - the land development company that is jointly developing with South East Water at Aquarevo - and includes an extensive constructed wetlands system. Cranbourne Wetlands (Barnbam Swamp) is also located on the north-east side of the railway line adjacent to the Aquarevo site and is an identified ecosystem of regional and state significance.

Masterplan for the Aquarevo site (August 2017) showing Marriott Waters development to the south and Cranbourne Wetlands to the northeast.



[BACK TO MENU](#)

Collaborators and their roles

Landowner and water utility provider	South East Water (SEW) is the owner of the land and the co-developer of the site. A Victorian government utility, South East Water also manages and maintains the water and sewerage networks to provide water and wastewater services to business and residential customers in Melbourne's south-east.
Development Partner	Villawood Properties is one of Australia's leading property developers who pride themselves on creating innovative premium communities, with a significant focus on sustainability. Villawood is the private development partner for the site, working with South East Water.
Researchers	Cooperative Research Centre for Water Sensitive Cities (CRCWSC) provided in-kind research time and a research synthesis workshop in 2014, producing the document Ideas for Aquarevo and contributed to the development of the landscape plan for the project.
Local government	City of Casey will eventually manage and maintain the public realm in the Aquarevo development and is the planning authority for the site.
Waterway manager	Melbourne Water advised on stormwater management and waterway management for the site.

State regulator	Department of Environment, Land, Water and Planning (DELWP) is the Victorian Government department that sets the legislative and regulatory framework within which water authorities and property developers must operate. DELWP and the Department of Health and Human Services were key support agencies in the development of new water management concepts for the site.
Consultants	Design consultants for the project included Breese Pitt Dixon, Spiire, Winslow Construction. The selling agent was Oliver Hume.
Builders	Due to the unique requirements for water management on each lot, potential home builders were actively involved in the design process, ensuring that their homes could accommodate the requirements. Builders involved in the project include: Amaroo Homes, Arden Homes, Boutique Homes, Bright Homes, Burbank Homes, Dennis Family Homes, Fairhaven Homes, Henley Homes, JG King, Metricon, Porter Davis, Rawdon Hill, Sienna Homes, SJD Homes, Urban Edge Homes.

[BACK TO MENU](#)

Timeline and milestones



The drivers

The background is a solid blue color. It features several large, overlapping, organic shapes in a lighter shade of blue. These shapes include circles, wavy lines, and rounded rectangles, creating a layered, abstract effect. The shapes are distributed across the page, with some appearing behind the text and others in the foreground.

[BACK TO MENU](#)

1. Leading by example

South East Water recognised an opportunity to lead by example, by taking an active role in the development of their land, showcasing new technologies and supporting the ongoing maintenance and operation of these water management systems, including on-lot devices. South East Water has a commercial arm, Iota Services, which develops products and technologies for the water sector. The Aquarevo development was identified as a ready-made demonstration site for Iota Services' innovations and as a broader realisation of South East Water's sustainability values and ambitions.

Villawood Properties were attracted to the project and the partnership because it aligned well with their company values regarding sustainability and innovation, and because it provided an opportunity to deliver an exemplar development in partnership with a public authority and the state government. Villawood were selected as the preferred developer as South East Water were impressed by the level of commitment to the project and their sustainability credentials.

“South East Water saw the site as an opportunity to explore how alternative water supplies could enhance future liveability and to showcase possible initiatives and our technology. We had to firstly think about what initiatives we wanted to showcase and prepare a business case to underpin the proposals.” — Terry Dalglish, South East Water

“Our senior leadership team was heavily involved in the application process to be the development partner for the site. Once the water initiatives started playing out, we were even more attracted to the project as sustainability is highly valued within Villawood. As an organisation we also want to push boundaries, and sometimes this can be difficult in a risk-adverse environment. South East Water was keen to explore and experiment and this is something we encouraged.” — Rory Costelloe, Executive Director, Villawood Properties

[BACK TO MENU](#)

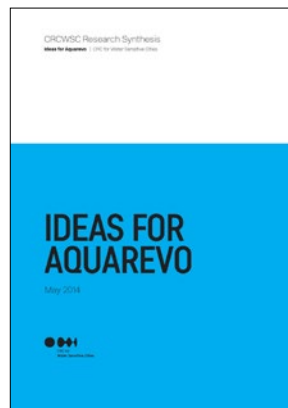
2. An opportunity to innovate and demonstrate

An organisational culture within South East Water that values innovation was a core stimulant for the project. The ideas for the demonstrated technologies and concepts in Aquarevo primarily originated within South East Water, and the business case for investment in the project approved by the South East Board centered on the potential for research and development. This was an opportunity to 'walk the talk' and to demonstrate concepts and technologies to the broader industry.

South East Water and Villawood Properties actively sought to stimulate new knowledge throughout the design process and welcomed collaboration with researchers. An example of this collaboration was a synthesis workshop convened between the development partners and the CRC for Water Sensitive Cities in March 2014. The workshop was a forum for applying relevant knowledge generated through the CRCWSC to the urban planning and design of Aquarevo. Ideas and knowledge shared by the CRCWSC were combined with the expertise and experience of South East Water, Villawood Properties

and their consultants at this workshop to identify specific opportunities to create a water sensitive urban development. The workshop identified a broad range of ideas for the site, encompassing: local and regional connectivity, street form and function, landscape and planting strategies, waterway and drainage design, flooding and stormwater management, and decentralised water and energy systems.

Download [Ideas for Aquarevo](#)



“Proving the technology at Aquarevo then provides the opportunity to take this to other developments.” — Terry Dalglish, South East Water



“The Aquarevo development presented an exciting opportunity to synthesise and apply the latest research from the CRC for Water Sensitive Cities (CRCWSC) for use in practice. The partnership between South East Water and Villawood Properties represents a strategic coupling of technological innovation and design excellence. The CRCWSC’s early participation added an additional dimension to the research – innovation – practice pathway.”

— Tony Wong, CEO, CRC for Water Sensitive Cities

[BACK TO MENU](#)

3. Stimulation through state government policy

The opportunity to demonstrate innovation at the Aquarevo site came at a time when moves towards decentralised water systems and the utilisation of alternative water systems were being strongly supported by the state government. The Office of Living Victoria (OLV) released Melbourne's Water Future in 2013 which was underpinned by the principle of Integrated Water Management, where all aspects of the water cycle are considered together in the urban design and planning process. South East Water recognised the support of the state government as a core driver in the development of the Aquarevo project, as it provided confidence in leading water management in a new direction.

“We had the opportunity to do something really special with the estate. At the time, the Office of Living Victoria had just released their new policy and we were heavily engaged in that process. This development could address initiatives in this policy by applying them on this site.” — Charlie Littlefair, South East Water

4. A holistic business case

A business case was made to South East Water's board to take on the project, whereby it was acknowledged that the costs related to water management innovations would be borne by South East Water and not passed on to the builders or residents. The financial investment was much easier to justify due to South East Water's ownership of the land, which provided a capital budget which could be partially reinvested in innovation on the site. However, overall, South East Water believes that compared with simply selling the land, the joint development model will ultimately deliver more value by bringing broader opportunities for research and development, demonstration and leadership. South East Water were interested in the business opportunities linked to Aquarevo, as it provided a platform for demonstration and promotion of the products and technologies created by Iota Services, creating opportunities to commercialise these technologies outside of South East Water's regulatory boundaries.

[BACK TO MENU](#)

5. Partnership and shared risk

The risks associated with an innovative project such as this were acknowledged by South East Water from the outset and planned for. As development is not within the business remit of South East Water, a developer partner was sought out by asking for expressions of interest from the market. Fifteen developers responded to the request, and Villawood Properties was selected. The joint collaboration between the two partners recognises the shared responsibilities and risks of the projects, and aligns these with the core capabilities of the organisations - with the risk and cost associated with the water initiatives remaining with South East Water, while Villawood Properties took responsibility for the development cost and risk.

Partners from Villawood and South East Water at the Aquarevo site. Left to right: Charlie Littlefair (South East Water), Kevin Hutchings (South East Water), Rory Costelloe (Villawood Properties), Terry Dalglish (South East Water)



[BACK TO MENU](#)

“Their [Villawood’s] philosophy aligns with our philosophy around liveability and sustainability. The beauty of Aquarevo is putting all of this technology in one place - not just at a house level but at an estate level”

— **Charlie Littlefair, South East Water**



Video

<https://youtu.be/ZeMwbN6xluQ>

The innovations

The background is a solid teal color. It features several large, overlapping, organic shapes in a lighter shade of teal. These shapes resemble stylized waves or bubbles. In the bottom left corner, there are two smaller, more defined shapes: a semi-circle and a wavy, mountain-like silhouette.

[BACK TO MENU](#)

1. Rainwater supply for hot water supply

Commonly in metropolitan Victoria, rainwater is captured in tanks from the roofs and provides for non-potable uses such as irrigation, toilet flushing and cold water laundry use in new homes via a dual plumbing system, helping to significantly reduce potable water use. However, hot water systems are not commonly supplied from roofwater in urban environments because of potential health risks. While roofwater is commonly used as a source of water for all purposes, including drinking water, in a rural environment, where a mains source of potable water is available in cities and towns this is generally favoured to minimise risks to health.

In new developments where a recycled water network is available as a non-potable source, rainwater tanks are often not used as they would supply the same uses (irrigation, toilet flushing and laundry). However, where rainwater tanks can be used for hot water supply, recycled water and rainwater tanks can be used together – therefore providing benefits for both urban stormwater and wastewater reduction simultaneously while maximising the proportion of a household's water supply that can be met by alternative sources.

At Aquarevo, a rainwater harvesting system has been designed to minimise any health risks associated

with the use of rainwater for hot water use. It aims to demonstrate how this source can be used to supply the significant portion of household for hot water non-potable demand with a fit-for-purpose water source. The rainwater from each home's roof undergoes screening, filtration, ultraviolet (UV) and heat treatment, before it is supplied to hot water taps in the shower, bath, laundry trough and clothes washing machine via a separate plumbed supply system. Drinking water is automatically supplied to the hot water system as a backup if there is no rainwater in the tank. All taps supplied with rainwater have a special label and these will be provided to builders at Aquarevo, who will take responsibility for fitting those labels.

All of the equipment relating to the rainwater supply to hot water system will be supplied and installed by South East Water. This equipment will remain the property of South East Water and be maintained and operated by them for a period of 10 years from the date of first installation. The OneBox monitoring system on the homes will allow South East Water to remotely control and monitor the water supply to hot water system and ensure the hot water remains at the programmed temperature.

“Collecting rainwater, screening, filtering and treating it, and creating clean, hot water for showers is a logical yet revolutionary measure. If you think about rainwater to hot water, that happens all around farms and rural parts of Australia but we have never done that in an urban environment before.” — Terry Dalglish, South East Water

[BACK TO MENU](#)

The testing and demonstration of rainwater supply to hot water systems at Aquarevo is important for the industry, as it shows:

- That rainwater can be delivered in tandem with class A recycled water supplies to new homes, reducing potable water use in the home by up to 70%.
- That water quality can be managed through screening and pre-treatment to minimise health risks.
- It can be remotely controlled and monitored by the OneBox® system.
- That temperatures in hot water systems can be monitored and controlled to ensure all rainwater is heated to 60 °C.

“Villawood would like to do rainwater to hot water as standard in the Melbournes South East, where we have the support of South East Water. We as a company are very supportive of the water initiatives and we would love to do it elsewhere. Anything that works here will probably become standard.” — Rory Costelloe, Executive Director, Villawood Properties

[BACK TO MENU](#)

Technology focus: Rainwater supply to hot water

What is it?

A system that collects rainwater running off a roof and provides the water for hot water use in the home – in this case, specifically to service hot water supply to the washing machine, laundry trough, shower and bath (but not to the kitchen and vanities). The Aquarevo design includes:

- A rainwater tank with a minimum capacity of 2400 litres, connected to at least 100m² of roof area,
- A gutter guard, gutter stops, leaf diverter and first flush system to minimize the organic load entering the rainwater system,
- A water filter and ultraviolet water treatment device,
- A dedicated hot water system that heats the water to above 60 degrees centigrade, and

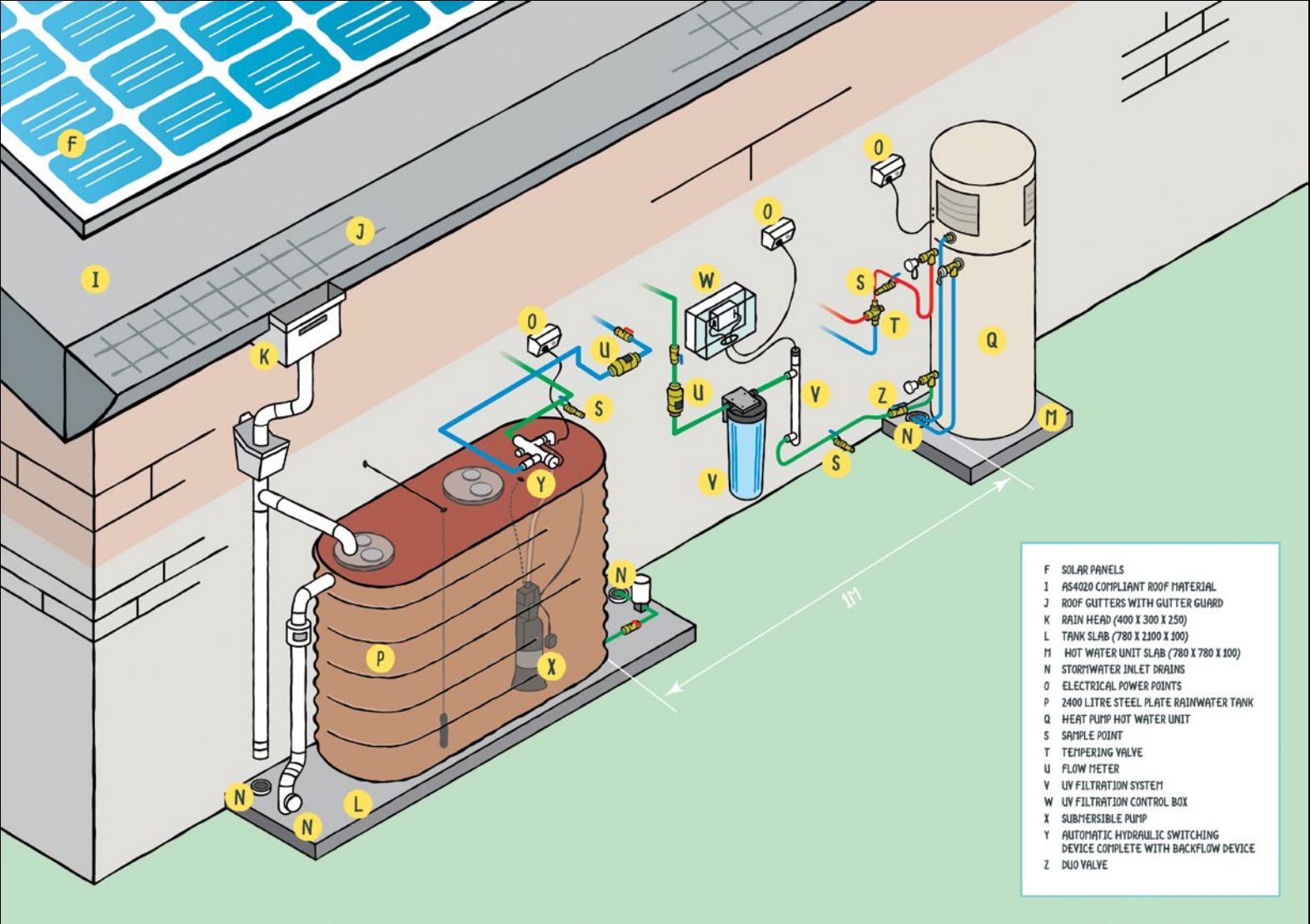
- Plumbed rainwater supply pipes to the selected hot water fixtures. Red pipes are used with green rainwater stickers shown every 300mm (representing one of three water supply pipes in the home, along with drinking water supply and recycled water supply pipes).

Drinking water supply is plumbed as a back-up supply for when rainwater isn't available. The use of a rainwater to hot water system is innovative in an urban environment in Australia. The system underwent extensive system testing at Holmesglen Tafe. Over a period of a year, trials were conducted to better understand household water demand patterns and how to effectively match these with rainwater supply along with water quality management.



BACK TO MENU

Illustration showing the components of the roof water supply to hot water system. Products from the gutter down will be owned, operated and maintained by South East Water.



[BACK TO MENU](#)

What are the benefits?

- **Alternative water use:** Rainwater is captured on-site for reuse as a hot water supply, providing an alternative water supply to drinking water for a significant portion of a home's water demand (approximately 35%).
- **Stormwater runoff reduction:** As rainwater is captured and utilised locally, it is not released to the stormwater system and therefore prevents potentially harmful pollutants and urban flows from harming damaging waterways.
- **Compatible with recycled water supply:** As recycled water is not supplied for hot water use, a rainwater supply can be used in conjunction with a reticulated recycled water supply to a home to provide additional drinking water demand reductions. In the case of Aquarevo, up to 70% less drinking water will be used in each home compared with standard practice.



Video

https://youtu.be/llfcX_8s7Zo

[BACK TO MENU](#)

2. Local class A recycled water supply for non-potable uses

Wastewater is an important water resource, and one which the proposed Aquarevo development will explore and showcase. Wastewater from homes will be transferred to an on-site treatment facility within the estate - continuing the legacy of the site as a water treatment location. The facility will provide Class A recycled water to homes for non-potable uses. While Class A recycled water is commonly provided to new developments across Victoria which are situated near existing treatment plants, Aquarevo integrates a treatment facility on site, which will become operational once most of the site is developed.

Each house has a pressure sewer storage pod buried in their front yard (1000L). Wastewater can then be retained on lot, and pumped to the local treatment plant when South East Water chooses to do so. Approximately 180 homes on-line are required support the operation of an on-site treatment plant, so the plant is planned for construction at that point. In the meantime there is recycled water in the neighbouring Marriott Waters Estate which will be plumbed across to Aquarevo to provide recycled water.

The design and construction of the facility has been tendered, and South East Water is working with the preferred tenderer to integrate the facility seamlessly with the development. The treatment facility has been carefully located in the development, and will be designed so that there are no noise or odour impacts on neighbouring properties. It is hoped that the facility will become a feature in itself, surrounded by landscaping and used as a showpiece for innovation and public awareness.

“A key criteria in selecting the water recycling plant was the amenity of the proposal. This led to the selection of a more natural treatment system, housed in the greenhouse, that would integrate with the landscape proposals. There is potential to include public interpretation material, and we imagine it can become a showcase. This building and the Aquarevo Display home will become future education hubs for Aquarevo as a whole.” — Terry Dalglish, South East Water

[BACK TO MENU](#)

Technology focus:

On-site wastewater treatment and recycled water supply

What is it?

Wastewater generated in homes in Aquarevo will be transferred to a treatment facility within the development site and treated to provide Class A recycled water supply back to homes. By closing the loop, homes in Aquarevo are able to harness local alternative water resources for non-potable uses, including garden irrigation, toilet flushing and cold water supply to the washing machine. Class A recycled water is wastewater treated to Class A standard in keeping with the guidelines set by the Department of Health and Human Services and the Environment Protection Authority. Recycled water taps and pipes will be coloured purple.

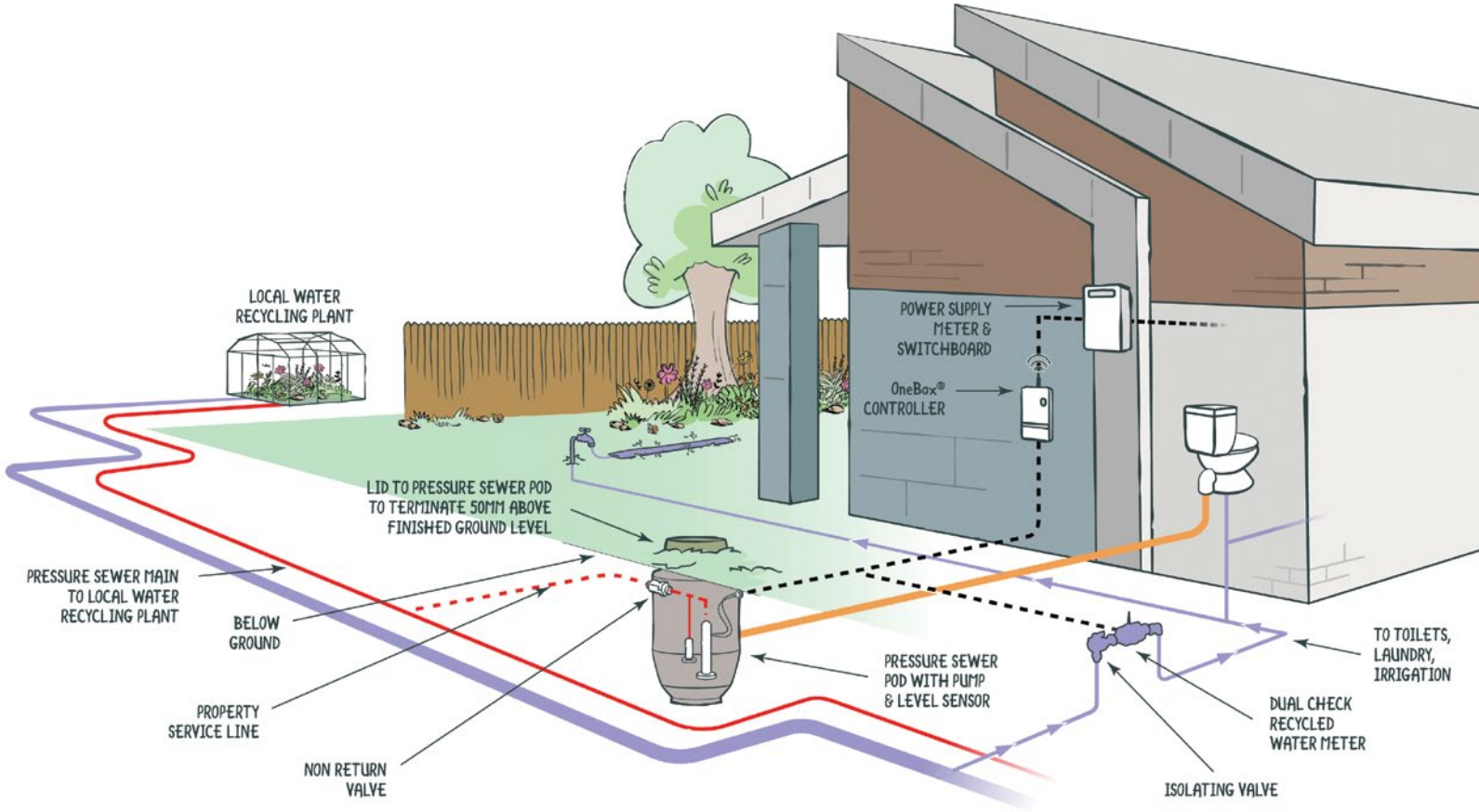
At the time of writing of this case study, a site has been identified for the recycled water plant on the masterplan, but the plant is yet to be constructed. Preliminary concepts for the design include a greenhouse structure, utilizing plants to provide part of the treatment process.

What are the benefits?

- Alternative water supply: Recycled water can supply a substantial portion of the water demands in a home (approximately 35%), reducing the need for drinking water supply to be utilized for non-potable uses where other sources are more suitable.
- Local treatment and management: The Aquarevo scheme demonstrates the use of decentralized water management technology, 'closing the loop' for local water resources and ensuring the development has a minimized impact on broader water infrastructure and systems. The provision of the on-site system avoids the need for wastewater to be transferred substantial distances to a major treatment plant, and by reusing the water, discharges of treated wastewater to the environment are reduced.
- Enhanced feasibility in combination with pressure sewers: Intelligent (pressure) sewers greatly enhance the cost-effectiveness of precinct scale wastewater recycling by eliminating water ingress during wet weather, significantly reducing peak dry-weather loads and enabling real-time monitoring and control of flows within the sewer network.

BACK TO MENU

PRESSURE SEWER & RECYCLED WATER HOUSEHOLD CONNECTION



Wastewater management
for each lot



[BACK TO MENU](#)

3. Tank Talk® and smart infrastructure

The Aquarevo development showcases a number of technologies developed by South East Water's product innovation arm, Iota Services. These innovations include:

- Connections to a pressure sewer system that pumps wastewater to the local water recycling plant, treats the water to Class A standard, and sends it back to each home for use in the garden, toilet or washing machine – closing the loop.
- Rainwater tanks with Tank Talk® technology that receives weather forecasts - then releases water before heavy rainfall to minimise overflows or flooding in local waterways.
- Connection to a OneBox® device that controls the water technology in each home, remotely monitors the pressure sewer and receives information about each home's water and energy use.

Greater real-time monitoring allows South East Water to intelligently manage water supply and wastewater systems, improving efficiency and managing risk. A much greater understanding of how people use water will be developed at the Aquarevo site, helping us to better plan for integrated water management.

“This development could become a template for future developments. We hope to influence policy by using performance data from homes, once the houses are built” — Terry Dagleish, South East Water

[BACK TO MENU](#)

Technology focus: OneBox® System

What is it?

A smart control system developed by South East Water, originally developed for remote control of pressure sewer systems. In Aquarevo, the OneBox® system has been developed to also provide real-time monitoring data and remote control of the on-lot water and energy systems, including:

- Rainwater storage (level monitoring, flushing valve control, pump control, rainwater changeover)
- Flow monitoring (drinking water, recycled water, rainwater)
- Pressure sewer (pump control, level monitoring)
- Hot water system (hot water temperature)
- Power and gas (solar power generation monitoring, mains electricity monitoring, gas main monitoring).

The OneBox® system is approximately the size of a cereal box and is placed on the outside of a home.

What are the benefits?

- **Flood mitigation:** Connecting to a 'Tank Talk®' system, the OneBox® system can be used to anticipate rainfall, so that a rainwater tank can be pre-emptively emptied, creating storage space for the new rainfall to be captured. This refreshes rainwater in the tank, and can also alleviate peak flows in local stormwater systems, providing flood mitigation.
- **Flow control in sewers:** The OneBox® system can also be used to control and plan flows in the sewer system, potentially reducing the required size of sewer reticulation pipework and ensuring flows to the treatment facility are well balanced, resulting in capital and operational savings.
- **System understanding:** The real-time data available from the OneBox® system can allow both a remote operator and the homeowner to better understand how water and energy resources are being used in their home, and to optimize the system accordingly.
- **Pre-emptive maintenance:** The monitoring system allows an operator to identify blockages, pump failures and poor performances early, so that pre-emptive maintenance can be conducted before the customer notices a fault, thereby improving service and minimizing risks.

OneBox® also controls the apparatus for the rain to hot water system and ensures that drinking water is supplied if rain water is unavailable or of water is not to specification.

BACK TO MENU



Various water sources
proposed for each lot ↑

[BACK TO MENU](#)

4. Water in the landscape

The estate will also feature largely stormwater-fed wetlands that are connected to water bodies in the neighbouring Marriott estate. The original alignment was reviewed to see how the community could best benefit from the waterway. As a result, the waterway was changed into a more meandering space to allow more community access and to create an opportunity to grow an urban forest in the heart of the development.

“The site weaves together water and people in unique ways, bringing new connections between community and environment. Water is made the visible centrepiece, becoming an interactive resource.” — Matt Bradbury, Spiire

At the time of writing, landscape masterplanning and design was being completed for Aquarevo, and opportunities for incorporating water sensitive urban design were being explored with City of Casey. South East Water is committed to demonstrating WSUD principles and showing how these systems can work, thereby extending the demonstration of water sensitive city principles into the public realm. The CRC for Water Sensitive Cities is currently supporting the stakeholders through the provision of ideas, research synthesis and design review.

The CRCWSC utilised the Water Sensitive City Modelling Toolkit to inform the strategic planning and conceptual design of stormwater management and green infrastructure initiatives at Aquarevo. The stream health module of the toolkit assesses annual runoff volumes, number of runoff days, filtered flow volumes and pollutant load reductions for a range of scenarios, and compares results against identified objectives and targets. Application of the Toolkit's stream health module showed that stormwater

management initiatives adopted at Marriott Waters and incorporated in the Aquarevo masterplan (such as the linear pond/wetland system) are effective in reducing pollutant loads associated with residential area. Other indicators of stream health (for example, number of runoff days) are not well managed by the adopted stormwater management measures.

The creation of an urban forest along, with well vegetated streets throughout the estate, can reduce peak summer temperatures across significant areas of the site by 1-1.5 degrees compared with a conventional development with limited water and greening of the landscape.

The outcomes

[BACK TO MENU](#)

1. Positive outcomes emerging

Construction at the Aquarevo development has now commenced, sales of the land parcels has begun, builders have been trained and consulted regarding the proposed water management measures and design guidelines have been put in place. From the journey so far, there are already a range of positive outcomes emerging.

2. Water in the landscape creates an uplift in amenity and property values

At the masterplanning level, water and green space was distributed throughout the development, maximising property frontage to water by creating a meandering waterway. Villawood Properties were able to market these properties as waterfront lots, driving premium prices for those sections.

“A meandering waterway means more frontage, which in turn drives premium prices as we can sell waterfront lots, but it also means we can get better landscape outcomes. By achieving premium prices, we can put more investment into the landscape budget, increasing the community value of the development. There is definitely an uplift because there is water in the landscape, compared with just green space. However, if you are marketing waterfront lots you must be clear about what that means. You can’t market waterfront lots if water is only there 5% of the year and then it drains away. Those types of outcomes just don’t work.” — Rory Costelloe, Executive Director, Villawood Properties

3. Sustainability initiatives are a help, not a hindrance

Aquarevo incorporates a range of water management initiatives, as well as some energy management initiatives. These initiatives have always been a clear part of the promotional material for the land, and have to-date been well received and understood by buyers. The first land release of 44 lots (10% of the development) sold out within a day in November 2016, whereas sale of that number of lots would usually take 3 months. However, from a developer’s perspective, the desirability of the land was due primarily to location, with sustainability being a bonus. Buyers were very aware of the proposals for the site and they had to sign a disclosure statement when purchasing, stating that they understood – while sustainability initiatives were a secondary factor for desirability, they weren’t viewed as a negative at all.

[BACK TO MENU](#)

The development attracted a lot of interest from potential buyers that value sustainability. When the development first went to market in 2016, there were 2200 interested people on the database, where 500 would be normal. Accordingly, the additional exposure within the industry due to the novel sustainability measures could have created a new market, although a niche one.

“I believe some of the staff involved are so excited about it that they are even planning to buy a block of land there themselves and join that community.” — Rory Costelloe, Executive Director, Villawood Properties

4. Significant potable water savings

The development is expected to deliver significant savings in potable water use by up to 70% compared with an average new home. This translates to a major reduction in the overall water footprint of the development, and translates to a cost saving for residents.

“We all need to reduce our reliance on drinking water as we deal with the challenges of population growth and climate change. That’s why innovative projects like the Aquarevo development are making our communities more liveable and sustainable for the future .” — David Bergmann, South East Water.

↑
First release of Aquarevo sold in November 2016

[BACK TO MENU](#)

5. Community education and engagement

The proposed water initiatives for the site were a strong part of the marketing material. Villawood Properties doubled the resourcing that would normally be allocated to marketing, creating a dedicated website, brochures, videos and a demonstration suite to support communication of the concepts to residents.

Sales office at the site



In addition to the Contract of Sale, there were two documents put together to help the purchaser understand the proposals in detail. One was the disclosure statement, and the second one was the condition of connection, which usually comes later in the process but which was brought forward to the contract of sale point so that everyone was clear about the requirements. This required education of sales people so that they could explain the role and contents of the documents to ensure the purchaser understood the proposals when buying the lot. The requirements for the design of the homes were also outlined in design guidelines, which were made available to purchasers as part of the disclosure statement.

“The real test will be when people move into their homes, but that is still to come. I think once people experience it first-hand it will be desirable and it will probably become the norm in the next 5-10 years.” — Rory Costelloe, Executive Director, Villawood Properties

[BACK TO MENU](#)

Example of marketing material
provided to residents



EVERY DROP COUNTS
Your Aquarevo home will play a part in helping to secure our precious drinking water supplies.

- 1 million litres of local water storage capacity will be created in the household rainwater tanks
- Up to 70% less drinking water will be used by every Aquarevo home, compared to the average household without any rainwater or recycled water
- Up to 25% reduction in stormwater run-off to reduce the risk of local flooding
- An onsite Water Recycling Plant, the first of its kind in Australia, means that Aquarevo's water cycle will be a closed loop, recycling and reusing water locally
- Help reduce demand on drinking water supplies so there's more available for the future

60 MILLION LITRES SAVED EACH YEAR
THE EQUIVALENT TO 24 OLYMPIC-SIZED POOLS OR 1.2 MILLION SHOWERS



6. Changing practices in the development industry

Collaboration was key to developing the innovations in this project work and helping to reach out to the wider industry. The delivery and ongoing monitoring of these innovations at Aquarevo has the potential to change the industry and how water is managed in urban development.

“The rainwater to hot water system has the most significance and if we can prove that through delivery and data monitoring, then there is potential to change the industry and develop things differently to what we currently do. There is also innovation in the on-site wastewater treatment system, which will be a first of its kind for Australia, but we won't need that until 2018. Tank Talk® and OneBox® have previously delivered, so we are just enhancing those initiatives here.” — Terry Dalglish, South East Water

[BACK TO MENU](#)

Summary of the outcomes

Cities as water supply catchments



- Up to 70% reduction in potable water use is expected to be achieved in homes in the development compared with the average household.
- 1 million litres of rainwater storage capacity will be created in household rainwater tanks.
- Generation of over 1000MWh of renewable energy each year from rooftop solar installations on each home.
- 25% reduction in peak stormwater runoff flows is expected to reduce to the risk of local flooding.
- An on-site Water Recycling Plant, the first of its kind in Australia, means that Aquarevo's water cycle will be a closed loop, recycling and reusing water locally.

Cities providing ecosystem services



- A meandering waterway has been masterplanned into the site to link to the existing Marriot Waters wetlands. This water body provides amenity, habitat and stormwater management.
- The landscape is being designed to incorporate water sensitive urban design and greening measures to enhance amenity and microclimate.
- The urban forest proposed in Ideas for Aquarevo could reduce peak summer temperatures by 1.0-1.5 degrees compared with a conventional estate design template.
- The provision of green landscapes and water features increases the economic value of the estate.

Cities comprising water sensitive communities



- The future residents of Aquarevo have been provided with extensive information on proposed sustainability measures.
- Home builders have been pre-approved for the site, and trained on the water management initiatives proposed, including rainwater for hot water, non-potable supply plumbing and smart metering.
- The OneBox® within each home will provide residents with real time information on their water and energy use, while also allowing South East Water to monitor performance of the water systems.

The challenges

The background is a solid orange color. It features several large, semi-transparent circles of varying shades of orange. A prominent wavy line, resembling a water surface, runs horizontally across the middle of the page. Below this line, there are more abstract shapes, including a semi-circle and a series of connected peaks and valleys, also in shades of orange.

1. Assessing and managing risk

The inclusion of the rainwater to hot water systems in the Aquarevo development was a major challenge for the delivery team. While the proposals were technologically feasible and had been well-tested and trialled by South East Water, the inclusion of the technology as standard for new homes attracted unexpected delays relating to investigations and consultations required to assess and manage potential health risks. The primary concerns regarding the use of roofwater for hot water supply are:

- The possible transmission of Legionnaire's disease via water vapour: Legionella is a common environmental organism which survives and grows in sludges and slimes. Risks of waterborne legionellosis (Legionnaires' disease and Pontiac Fever) are typically associated with water between 25°C and 50°C. Above ground rainwater tanks have been identified as a potential source of Legionella because they tend to accumulate sludges and in Australian summers are likely to contain water between 25°C and 50°C. Legionnaires' disease cannot be obtained by drinking water, instead it is an airborne disease, so exposure could occur via water vapour in a shower or through an air conditioning system.

- Possible increased microbial hazards: Irrespective of the source, water from hot water systems is generally not recommended for drinking and cooking. Vegetative bacteria, including those that cause enteric illness, are sensitive to heat and Pasteur's original studies indicated that inactivation occurs between 55°C and 60°C. Campylobacter, the most commonly detected cause of enteric illness in Australia, is particularly sensitive to heat with inactivation occurring at temperatures above 48°C. Australian Standards for storage of hot water systems require that they achieve 60°C but not constantly. By testing and trialling the hot water cycles and by implementing control and monitoring through OneBox®, supply of 60°C heated water is significantly increased.

The proposed system for Aquarevo includes both ultraviolet treatment and heat treatment, so there are effectively have two treatment barriers in place.

Engagement with Department of Health and Human Services was important to gain their advice and fully understand risks associated with any future failures of the system. This was addressed through regular exchange of information with the department from

early in the process, the development of a Risk Assessment by South East Water, and the creation of a maintenance plan for the site. The development of a risk assessment and the exploration of all potential exposure pathways resulted in the decision to initially implement rainwater to hot water for bathing, showering and laundry trough only. Extensive further testing and monitoring is underway and may ultimately result in rainwater to hot water being extended to all hot water outlets in the house.

“As we are going to be the owner-operators, we needed to invest significant time in testing and trialling every component of the system to our own satisfaction.”
— David Bergmann, South East Water

[BACK TO MENU](#)

Trialling of rainwater to hot water connections at Holmesglen Tafe



[BACK TO MENU](#)

2. Changing ‘business as usual’ in home design

As part of the project, the team consulted with the top 25 builders in the south east to familiarise them with the water management proposals. This consultation was beyond standard practice, but it was necessary to test how the proposals would work on the ground. Extensive consultation resulted in changes to house designs. All of the major builders, except one, eventually embraced the proposals.

Firstly, for all builders, the proposals changed the base design because the plumbing is different with a third source of water coming into the house. The rainwater tank and hot water service on the outside of the house also affected spacing and setback. Usually a 12.5m wide lot will have a 1.5m setback on one side under the Residential Code. The rainwater tank and hot water system occupied some of this standard set-back space. Some builders had the flexibility to change their design, but a lot of the larger building companies couldn't change their standard design, so instead 50% of the lots were widened by 0.5m to accommodate these assets. This in turn impacted on the overall masterplan, resulting in a design change, but efficient urban design meant that only one lot was lost from the development overall.

Another impact on lot design was having the sewerage at the front rather than the back to connect to the sewer pod required as part of the pressurised sewer system. This wasn't a major implication but it required some amendments as to where electricity infrastructure is placed and how utilities affect the placement of the driveway and trees at the front. This required some design integration from the development consultants, and some dispensations from authorities to ensure the proposals could be integrated.

“At first some builders were a little hesitant about rainwater to hot water, but once we got the conversation started with the technical guys it gave them a lot more confidence. They need to understand it to sell it. This was resource heavy, involving a lot of coordination and facilitation of conversations. It was an unforeseen delay, but that is the nature of all these things being firsts and we wanted to be 100% ready and confident about our proposals. We took time to make sure we can answer every question clearly. If I had my time again I would allocate at least 6-12 months between signing agreements and going to market to make sure everyone knows what it is and how it works.” — Rory Costelloe, Executive Director, Villawood Properties

3. Pushing innovation beyond the lot boundary

While the development has successfully integrated on-lot proposals that are largely in the control of South East Water and the home builders, broader initiatives in the public realm have proved more difficult to integrate at this point. As a result, the estate has been pitched as an innovative water and energy estate rather than a “green” estate. Ongoing work is focussing on how to deliver integrated and innovative outcomes in the landscape.

4. A water utility taking on new roles

As land development is an unregulated business for a water utility, these activities first required approval from the Government Land Monitor to sell the land. This was obtained in 2015. The Water Minister also had to approve South East Water entering into a commercial relationship with Villawood Properties.

Prior to each sale the Valuer General sets the ‘floor price’ that lots cannot be sold below. The additional land value effectively created capital that South East Water could reinvest in innovation and demonstration on the site, underpinning the business case for Aquarevo. Essentially, owning the land took away the capital risk for the development, so the only cost risk to South East Water is the investment in water initiatives. Under the commercial arrangement with Villawood, they have taken on the development risk, while South East Water have taken on the water management initiative risks.

For the first time, South East Water will also be supplying, operating and maintaining water infrastructure at an allotment scale. This will include the:

- Rain to hot water system, which comprises a rainwater tank, hot water unit and the connecting pipe work between these
- Rainwater filter and UV treatment unit
- OneBox® technology for monitoring water usage and controlling the pressure sewer network
- Tank Talk® rainwater tank technology, which collects forecast data from the Bureau of Meteorology and decides if and when water should be released from the tank prior to a forecast rainfall event to reduce stormwater flooding
- Pressure sewer system (pod and pump unit)



AQUAREVO

“Innovation is within the culture of the organisation. When an opportunity presents itself to innovate, we will take it. The fact that we are making more value by developing the land than simply selling the land itself means we can put some of that additional capital back into innovation and research which will assist delivery of Aquarevo but will also enhance liveability.”

— **David Bergmann, South East Water**

[BACK TO MENU](#)

5. Investing in innovation

The project incurred both direct and indirect costs for the stakeholders. The capital investment and operating costs of the on-site water systems, were completely funded by South East Water, resulting in no additional cost to home builders or the residents. Any savings to the builder for not having to pay for a rainwater tank to meet their building regulation or stormwater management requirements were offset by the changes required to the design of the home, such as moving the position of windows.

The support of innovation also incurred a significant commitment of resources from both South East Water and Villawood. Four people were directly involved from South East Water on a full time basis, along with further input from at least thirty staff, covering marketing, communications, customer interactions, legal services, asset creation and procurement.

“South East Water is excited about the opportunities arising out of Aquarevo. We are leading the way in terms of the water quality we are getting out of rainwater tanks. We are also developing the on-site wastewater treatment technology. Where we are working outside our boundaries, then Iota Services is our product arm, but where we are sharing knowledge across water companies, that is South East Water led. It is also a reputational advantage as well as a commercial advantage.” — David Bergmann, South East Water

The lessons

The background is a solid teal color. It features several large, overlapping, organic shapes in a lighter shade of teal. These shapes include circles, wavy lines, and rounded rectangles, creating a layered, abstract effect. The shapes are positioned behind the main title and extend across the width of the page.

[BACK TO MENU](#)

This project demonstrates...

- **Rainwater can be utilised as a supply for hot water:** All new homes at Aquarevo will have a hot water system fed by a rainwater tank, with pre-filtration and treatment, unlocking approximately 35% of a household's potable water demand for supply from an alternative source, including supply for bathing, laundry taps and the washing machine.
- **An on-site recycled water plant can be integrated, providing an additional high quality recycled water source to homes:** A further 35% of each household's potable water demand will be substituted by supply of recycled water to irrigation, cold water supply to the washing machine and toilet flushing.
- **Real-time monitoring systems can unlock efficiencies:** The inclusion of OneBox® technology in each home allow both residents and South East Water to monitor water systems and to optimise performance of the rainwater tanks, the hot water system and the wastewater system. The integration of Tank Talk® technology for the rainwater tanks also allows tanks to be emptied when a rain event is predicted, providing on-site detention of stormwater while optimising supply of rainwater to the home.
- **A new model for development can be delivered through collaboration:** By partnering with land developer, Villawood Properties, and engaging extensively with house builders from the beginning, South East Water was able to shape a new approach to estate water and wastewater management.
- **Hassle-free sustainability initiatives are a bonus for purchasers:** While not as important as location, sustainability was viewed as a bonus by purchasers, who were willing to take time to understand and sign up to the proposals at the point of sale.
- **Water in the landscape adds value:** The design of water landscapes through the development enabled more premium waterfront land packages to be included in the masterplan.

[BACK TO MENU](#)

Reflections and what to work on next time...

- **Allow time for innovation and collaboration:**
Additional time was required in the programme to accommodate risk assessments, consultation, and design modifications. However, these were necessary to instil confidence in the stakeholders, provide good information to purchasers and to protect the reputation of the development.
- **Engage the right team and be clear about responsibilities:** The success of the project is partly due to a recognition of the skills of the key stakeholders, whereby development risk was held by Villawood, and responsibility for water initiatives was held by South East Water. Having an engaged and collaborative group of development consultants was also important.
- **Ongoing maintenance still seen as a barrier to greening and water sensitive urban design:**
While landscape plans are still in development, initial discussions regarding increased canopy cover and stormwater treatment were hampered by uncertainty over long-term maintenance of the public realm. Ongoing collaboration with the local council is a recognised need to innovate in the broader landscape.

About us

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) was established in July 2012 to help change the way we design, build, and manage our cities and towns by valuing the contribution water makes to economic development and growth, quality of life, and the ecosystems of which cities are a part.

The CRCWSC is an Australian research centre that brings together many disciplines, world renowned subject matter experts, and industry thought leaders who want to revolutionise urban water management in Australia and overseas.

Date of publication: September 2017

Cooperative Research Centre for Water Sensitive Cities



Level 1, 8 Scenic Boulevard
Monash University
Clayton VIC 3800



info@crcwsc.org.au



www.watersensitivecities.org.au