IWM case study 8

AQUAREVO, MELBOURNE

Project description

Aquarevo is being developed on a former wastewater treatment plant owned by South East Water. It is located at Lyndhurst, 50 km south east of Melbourne's CBD and will have 460 houses upon completion.

Each home at Aquarevo is plumbed with three types of water: drinking, recycled and rainwater. Each property is fitted with a 2,400 litre rainwater tank, to capture water from the roof. After filtration, ultra violet and heat treatment, this water is used in the home to supply hot water in showers, baths, laundry and washing machines.

Pressure sewer pods are located at the front of each property where the waste is stored and intermittently pumped through the pressure sewer network to a proposed local waste recycling plant (WRP), treated and then returned for use as Class A recycled water. This water will be available for use in gardens, toilets and washing machines.

Each Aquarevo home is installed with OneBox® which monitors and controls remotely the rain to hot water system, the pressure sewer, records information about each home's water use and energy use and TankTalk®.

South East Water's TankTalk® technology is connected to each rain tank which receives weather forecasts data and then releases water to stormwater before predicted heavy rainfall, to create more storage capacity for fresh rainfall and to mitigate localised flooding by 25 per cent.

Figure: Masterplan of the Aquarevo Estate, Melbourne. Source: South East Water

Project drivers

VISION AND OBJECTIVES

Aquarevo is to be a blueprint for water-sensitive communities, both in Australia and beyond, with highly efficient water and energy housing capable of being adopted anywhere, including remote communities.

All water sources are to be available for use, finding better ways to use water without losing the health and liveability that it provides.

THE PROBLEM

Climate change, population growth and water scarcity will continue to challenge the water industry, so using all alternative water sources, ensuring resilience and liveability outcomes are achieved without jeopardising public health.

Stakeholder and community engagement

A stakeholder and community engagement plan was developed for the Aquarevo project to ensure that stakeholder and potential purchasers were aware of all the initiatives and requirements prior to purchase.

A separate engagement plan was developed and implemented to support the Environment Protection Authority (EPA) Victoria works approval submission for the Aquarevo WRP.

The stakeholders involved in the project included:

- South East Water
- Villawood Properties
- Cooperative Research Centre for Water Sensitive Cities (CRC WSC)
- City of Casey
- Melbourne Water
- Department of Environment, Land, Water and Planning (DELWP)
- Numerous consultants, contractors and builders

Engagement for planning of the Wastewater Recycling Plant was undertaken to address concerns related to perceived health issues around recycled water and having water recycling plant in a housing neighbourhood. Key principles included:

1. Engage before we engage

This allows the project team to tap-into insights not previously identified during preliminary desktop investigations.

2. Setting the foundations

An integral part of the engagement strategy was the development of an online hub with OurSay. This was done to provide purchasers of land a portal to visit, to ask questions in real time and view collateral information about the development.

3. Implementing engagement

Engagement and communication activities with the broader community were implemented including the online forum, community information sessions, community pop ups, social media, print media and emails. A Virtual Reality model of the WRP to assist with engaging the community is on the Aquarevo webpage.

During construction of the development a high level of interaction with the Aquarevo community was achieved via a series of events, including meet the builder events, community Christmas parties and family days.

Prior to purchasing lots at Aquarevo, all purchasers are fully informed of the water and energy saving features mandated for each home, and for the future waste recycling plant (WRP), including hard copy communications and events.

When houses were completed, all new customers were visited by South East Water staff and provided with an Aquarevo brochure. This contains all information about the development and the details of all the initiatives. This also included a thorough briefing of all equipment, South East Water maintenance responsibilities.

After 3 months another customer visit is arranged to check on all equipment and undertake another water sample as per the periodic water sampling regime.

Outcomes sought

The standout outcomes related to this project were:

Outcome 1a – Connection with water and water literacy

Outcome 3a – Policy, legislation and regulations; and 3c – Cross-sector Institutional arrangements and processes

Outcome 4a – Diverse and fit-for-purpose water systems services

Outcome 4c – Integration and intelligent control

Outcome 6c – Urban heat mitigation

Options assessed

During the initial planning and design stages, South East Water and Villawood Properties conducted a workshop with CRC for Water Sensitive Cities (CRC WSC). The aim of this workshop was to identify specific opportunities to create a water sensitive urban development. Options considered included:

- Intelligent water and energy systems – Rain to hot water system;

- Harvesting rainwater for hot water end-uses combined with the use of Class A recycled water for toilets, gardening and washing clothes. As a result homes can use up to 70 per cent less potable/mains water;
- Tank Talk technology including OneBox®;
- Adoption of wireless technology that releases water to the environment, minimising nuisance flooding and the assessment of this technology to reduce infrastructure required in drainage works;
- Closed loop – Recycled water system;
- Identifying systems and opportunities that can be distributed across the site for the use of recycled water and efficient sewer services. This includes the development of a pressure sewer system and a waste recycling plant on-site; and
- Urban heat mitigation – consideration of greening nature strips, including tree canopies and implementing waterbodies over the estate to reduce the heat island.

Discussion

INTELLIGENT WATER AND ENERGY SYSTEMS – RAIN TO HOT WATER SYSTEM

This is the first instance of a rain-to-hot water system being used in an urban setting. The rainwater tanks will store one million litres of rainwater at Aquarevo and use TankTalk® wireless technology which receives weather forecast data and then releases water before heavy rainfall to create room to capture new rainwater and reduce stormwater run-off by 25 per cent. Every Aquarevo house is fitted with a system that collects rainwater off a roof, screens, filters and treats it and then provides it for hot water use.

Image: Monash University rainwater to hot water study. Source: South East Water.

A rigorous Quantitative Microbial Risk Assessment (QMRA) by Ecos was used to assist in optimising the design of the rainwater to hot water system, to create a system that delivered the required log4 dose and a micro DALY of <1 (as recommended by the World Health Organisation for drinking water).

Subsequently, a study by Monash University's Environmental and Public Health Microbiology Laboratory (EPHM LAB) focused on assessing the performances of the filter, UV and heat-pump treatment-train to treat roof-harvested rainwater as an alternative supply of hot water for each household part of Aquarevo.

Finally, this system was tested and studied at a purpose-built test rig at Holmesglen TAFE with a program logic controller ‘PLC’ to run simulated daily household usage scenarios to demonstrate the heat treatment performance and test the design and its components.

ONEBOX+® AND TANKTALK TECHNOLOGY

Using innovative technology developed by South East Water, the OneBox+® device monitors and controls the pressure sewer system; the rain-to-hot water system and its treatment and filtering functions; and the rainwater tank, including tank levels through TankTalk® and hot water temperatures to make sure it stays at the programmed temperature.

Image: OneBox technology by Iota. Source: South East Water.

It also tracks each home’s water and energy (gas, electricity and solar power) use through their individual digital meters. Residents can see all their water and energy usage data in one place – through the ‘mySouthEastWater’ app, supporting ongoing community water literacy (**Outcome 1a**).

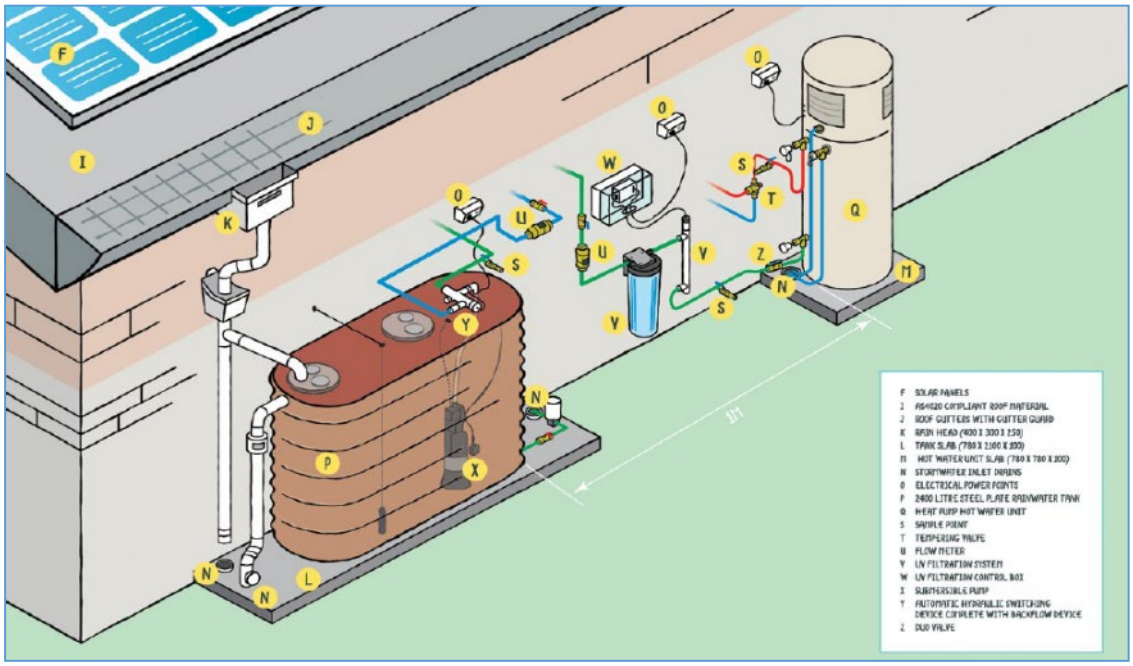

Figure: Schematic of rain to hot water system. Source: South East Water.

CLOSED LOOP – RECYCLED WATER SYSTEM

To use recycled water, wastewater will be treated at a local WRP. Each Aquarevo home uses Class A treated recycled water for toilet, washing machine and garden uses. The water recycling plant will be an Organica Food Chain Reactor called a ‘Bluehouse’, the first of its type to be built in Australia. The Bluehouse will treat all wastewater from the estate to Class A standard.

South East Water intends the Bluehouse to be constructed in close proximity to adjoining residential houses. Studies have been undertaken into customer engagement, odour modelling and noise assessment. A 25m buffer will be sufficient to ensure any odour emissions or nuisance noises are mitigated.

Image: Pressure sewer pod. Source: South East Water.

Each house has a 1,100 L pressure sewer storage pod in their front yard. When wastewater volumes reach a set level, the OneBox+® controller will activate the pump and transfer the waste to the WRP, thereby remotely monitoring and regulating sewer flows. The WRP will look like a natural garden within a greenhouse to blend into the surrounding landscape.

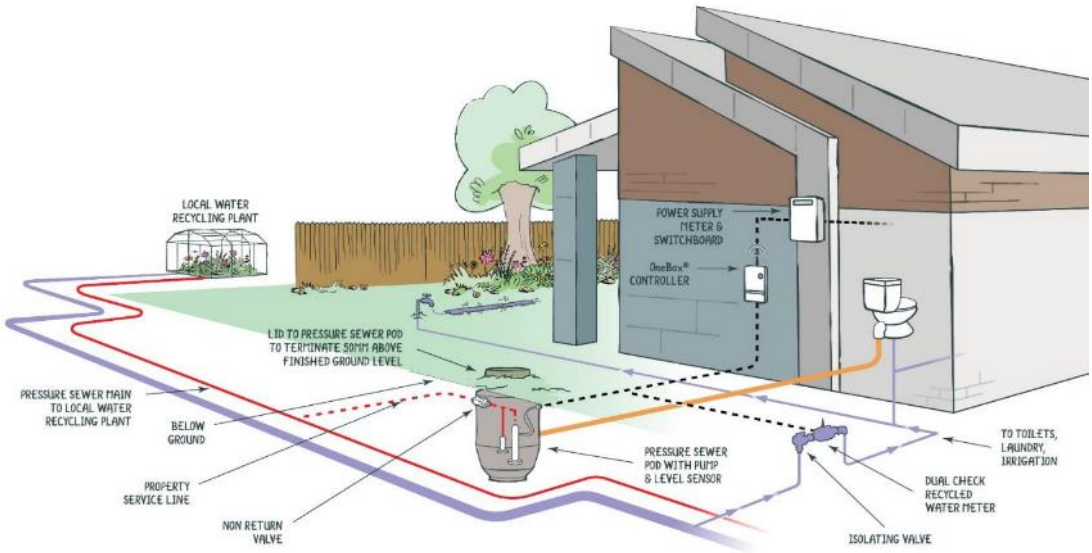

Figure: Schematic of the pressure sewer system. Source: South East Water.

Image: Proposed water recycling plant at Aquarevo (artist's impression). Source: South East Water.

URBAN HEAT MITIGATION

The development plan for the Aquarevo estate included an important connecting piece between Cranbourne Wetlands and the South East Green Wedge. The intention was to create a corridor through the Aquarevo site which requires arboreal, terrestrial and aquatic connections. This supports an active, vibrant and walkable community in addition to providing ecological benefits. A corridor link would facilitate pedestrian and cycle access and by extending green infrastructure corridor landscape templates into residential streets, provides physical and visual connectivity with multiple ecological and social benefits. It also has the potential to provide economic returns through increasing the number of premium properties with direct visual connection to green space.

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 Celsius. Street trees will be watered by a dedicated irrigation system drawing from the WRP. In addition maximising vegetation cover (particularly tree canopies), taking advantage of the natural wind, availability of water and vegetation adjacent to Aquarevo will enhance the local microclimate.

At the Aquarevo home, to address the challenge of irrigating the plants only when required, the installation of several temperature and moisture sensors around the landscape to measure real-time ambient temperature and moisture content of the soil. The sensors send this information to the OneBox®+ controller via wireless communication working on Zigbee protocol. If the OneBox®+ controller decides irrigation is required at a particular zone, it sends a signal to activate the solenoid feeding water to that zone and the zone is irrigated. When the required level of irrigation is achieved, as indicated by the soil moisture sensors, the OneBox®+ controller deactivates the solenoid.

Evaluation and financing

The commercial model between South East Water and Villawood Properties is based on each party's financial contribution to the project. South East Water was responsible for all the water initiatives into the development and for the contribution of the land that is owned by South East Water. Any costs that were considered additional to basic development costs, would be borne by South East Water.

Villawood Properties would be responsible for all development costs and accordingly accepted the development risk. Based on the contributions there is a percentage financial return to South East Water and Villawood Properties.

The project is funded from regulated income from the South East Water customer base. All expenditure and income generated, is treated as regulated income and expenditure.

Reflections and lessons learned

South East Water and Villawood Properties have stated that the Aquarevo project has demonstrated:

- Rainwater can be utilised as a supply for hot water
- A local WRP can be integrated, providing an additional high quality recycled water source to homes
- Real-time monitoring systems
- A new model can be delivered through public / private sector collaboration

LESSONS LEARNED

1. Challenges to existing regulation, policy, statutory requirements

- To supply rain water as a source of non-drinking water required south East Water to undertake extensive risk and mitigation. To comply with existing Drinking Water guidelines, it also required the customer to install a second hot water system to provide hot water to areas of the house where a customer would ingest hot water (kitchen and vanities) thereby ensuring that those taps were provided with drinking water.
- Being the first-of-its-kind development that integrates water and energy management, there were several challenges to overcome. However, Villawood and South East Water adopted a highly collaborative approach with the City of Casey and relevant authorities, including Melbourne Water, Cooperative Research Centre for Water Sensitive Cities, Department of Environment, Land, Water and Planning, Victorian Department of Health and Human Services, EPA Victoria and Monash University, to identify risk, solve problems and resolve issues early and in a positive manner.
- Due to the unique requirements for water management on each lot, Villawood Properties and South East Water engaged extensively with house builders so they understood the initiatives and could modify existing house designs.

- South East Water had to deal with the many challenges posed by the DHHS and EPA in instigating reform, seeking works approvals and challenging regulations while still ensuring the safe supply of water.
- Existing Environment Protection Authority (EPA) guidelines for Water Recycling Plants are based on open plants. The proposed Water Recycling Plant at Aquarevo is housed in a container. As such guidelines do not exist that stipulate the buffer zone required between the plant and residential properties.
- The works application has been submitted to the EPA is being assessed at the time of writing this case study (July 2020).

2. Allow time for innovation and collaboration

- In order to accommodate risk assessments, consultation, and design modifications, extra time was required during the development of the program. These aspects were necessary to protect the reputation of the development, instil confidence in the stakeholders and to provide good information to purchasers.

3. 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 Properties, and responsibility for water initiatives was held by South East Water.
- Ongoing maintenance still seen as a barrier to greening and water sensitive urban design.
- During the initial plans to increase canopy cover and to introduce stormwater treatment, uncertainty over long-term maintenance of the public realm caused a hindrance to these initiatives. Ongoing collaboration with the local council recognised a need to innovate in the broader landscape.

4. Lack of community interest in wastewater

- During engagement activities it was found that there is a lack of interest in wastewater and its disposal by the general public. Given that the WRP only serves the Aquarevo estate, those outside this community attribute to the low interest.
- Customers are not well versed in Melbourne’s standard water and wastewater infrastructure and plumbing.
- A lot of time has been spent educating customers on the Aquarevo initiatives as well as standard water and wastewater infrastructure.

5. Educating builders and plumbers

- Ongoing training of builders and their plumbers to ensure proper installation of rain-to-hot assets is crucial to the success of the project. A lot of time was spent monitoring and reacting to house construction with builder intervention.

6. Recycled water irrigation to public areas (ultimately council land)

- The inclusion of recycled water for irrigation purposes throughout the estate was limited to the trees in the nature strips and the parkland / wetland areas.

- Council did not allow irrigation of the grass area in the street nature strips.
- The irrigation of the trees was funded by South East Water and provision allowed for grass irrigation in the future if this was allowed by Council or operated and maintained by South East Water.
- It was important to ensure that Aquarevo vision remained a green estate.
- It is expected that if Council do not accept responsibility for public land irrigation then South East Water would accept this responsibility.
- It was imperative that provision for irrigation be included in the development and responsibility could be determined in the future.

Image: The Aquarevo House. Source: South East Water.