CRCWSC Research Synthesis

Ideas for Aquarevo | CRC for Water Sensitive Cities

IDEAS FOR AQUAREVO

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CRC for
Water Sensitive Cities

CRC for Water Sensitive Cities

Prof Tony Wong
CEO, CRC for Water Sensitive Cities

The CRCWSC is an Australian Government research initiative, established to bring together interdisciplinary research expertise and thought-leadership to revolutionise urban water management in Australia and overseas. Our vision is sustainable, resilient and liveable water sensitive cities.

The Aquarevo development presents an exciting opportunity to synthesise and apply the latest research from the CRC for Water Sensitive Cities (CRCWSC) for use in practice. The site is nested within a developed region, and a number of the surrounding developments have previously demonstrated innovation in water sensitive urban design (WSUD); most prominently, Lynbrook Estate to the north-east 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 is a product of Villawood Properties – the land development company that is partnering with South East Water at Aquarevo. As with Lynbrook Estate, Aquarevo has the potential to deliver the next wave of water sensitive innovation through the three-way partnership between research organisation, water authority and developer.

In the past, WSUD was principally focused on stormwater management, and Lynbrook Estate and Marriott Waters reflect that focus. However, the focus of contemporary research in the water sensitive cities space has expanded, and the latest research now aims to deliver a range of beneficial outcomes, not all of which are water related. A water sensitive city is a city that is designed to deliver multiple benefits to the community and to the environment. The Aquarevo development represents a wonderful opportunity to exemplify this next generation of WSUD, with a broadened focus that includes microclimate, biodiversity, green and blue corridors, climate resilience, urban liveability and technology.

South East Water already excels in the delivery of innovative, water sensitive technology through their commercial arm – iota. Villawood Properties has a state-wide reputation for sustainability and design excellence in urban development. The partnership between South East Water and Villawood Properties therefore represents a strategic coupling of technological innovation and design excellence. The CRCWSC's participation adds an additional dimension to the research – innovation – practice pathway. Ideas for Aquarevo is the early culmination of this partnership, and gives an overview of the ideas generated for the site by our researchers, and also those developed through a collaborative workshop process.

Aquarevo

Aquarevo provides South East Water with the opportunity to demonstrate proof of concept for intelligent systems supporting decentralised water infrastructure as part of a sustainable urban community.

Aquarevo enables Villawood Properties to continue to demonstrate their expertise delivering market leading sustainable urban communities.

The collaboration between urban developer and water utility on urban planning and design unlocks great opportunities for innovative water servicing strategies to support a vibrant, healthy and connected community.

Aquarevo is a 42 ha urban development site located at Evans Road, Lynbrook (38 km south east of central Melbourne). The former wastewater treatment plant site is to be developed through a joint venture between South East Water and Villawood Properties. The proposed development includes approximately 500 residential lots.

South East Water aims to demonstrate integrated water management, including intelligent network technologies and local closed-loop systems at Aquarevo. The site provides an opportunity to apply and showcase the value of smart technologies developed by South East Water, including OneBox (powering Intelligent Sewers and Talking Tanks), in a greenfield metropolitan development. This will inform potential future servicing options for communities without access to centralised infrastructure for water treatment and/or wastewater treatment.

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Aquarevo site, Evans Road, Lynbrook

Villawood Properties seeks to build on their award-winning approach to sustainable urban development by partnering with South East Water. Villawood Properties developed the adjacent Marriott Waters estate.

Aquarevo provides an exciting opportunity to deliver a high-quality urban environment supported by an innovative approach to water servicing. This opportunity is enabled through the business collaboration (underpinned by a joint venture investment) that leverages Villawood Properties' expertise in delivering innovative, community-focused developments and South East Water's experience in providing healthy water for life.

Workshop overview

South East Water and Villawood Properties outlined their objectives and aspirations for the site. Six researchers from the CRCWSC presented key findings from their respective areas of expertise, spanning urban planning, architecture, climatology, water technology and waterway management.

The collaborative 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 one-day workshop to identify specific opportunities to create a water sensitive urban development.

The table-based discussions that followed presentations by CRCWSC researchers 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.

A synthesis of knowledge, ideas and discussions on creating a water sensitive Aquarevo are presented in this document under three broad themes:

a. **Urban planning and design**
Managing stormwater on a flat site to support cost-effective drainage infrastructure deployment and earthworks, while designing to connect to key regional natural assets and creating a more liveable community.

b. **Green infrastructure**
Using water and vegetation to achieve multiple community benefits, including stormwater quality improvement, safe conveyance of floodwaters, improved urban microclimate and mitigation of urban heat.

c. **Intelligent (water + energy) systems**
Identifying distributed, precinct-scale opportunities for cost-effective water services.

The workshop highlighted the important opportunity provided by the Aquarevo development. In particular, how innovative water and wastewater servicing strategies can support and enable an urban community that is more resilient to climate change (in particular extreme heat), more sustainable (in its use of resources) and more liveable (by reimagining the function and form of the public realm).

a. Urban planning and design

Undertake science-informed planning: interpreting the regional socio-ecological context, joined up with local scale considerations, to inform the planning process for the development.

[Prof Darryl Low Choy, CRCWSC/Griffith University]

Responding to the regional and local environmental context

Cranbourne Wetlands (Barnbam Swamp) – on the north-east side of the railway line adjacent to the Aquarevo site – is an identified ecosystem of regional and state significance. The wetlands support vegetation of very high conservation significance and should be managed primarily for conservation (City of Casey, 2013).

The Lynbrook and Lyndhurst Development Plan (City of Casey, 2013) articulates a vision for an environmentally responsive approach to design and development. This includes the application of 'leading practice approaches to environmental management (e.g. stormwater management and revegetation), particularly in relation to development of residential areas surrounding Cranbourne Wetlands'. The development plan references the application of WSUD principles, and envisions expansive (integrated) green spaces and extensive tree planting in local streets, parks and public spaces.

In this context the Aquarevo site becomes an important connecting piece between Cranbourne Wetlands and the South East Green Wedge. To be effective, a corridor through the Aquarevo site requires arboreal, terrestrial and aquatic connections to both areas (via the Marriott Waters waterway corridor). Providing ecological connectivity and minimising edge to area ratios will benefit the environmental performance of the development and maximise the opportunity for successful integration of ecological values within the urban footprint.

Supporting a liveable community

A green infrastructure corridor through the site supports an active, vibrant and walkable community in addition to providing ecological benefits. A corridor linking Cranbourne Wetlands to the South East Green Wedge could also facilitate pedestrian and cycle access to the two metropolitan railway stations adjacent to the site. A diverse, multifunctional green infrastructure corridor would contrast the ephemeral wetland to the east, the linear pond system to the south and the conventional residential development to the west.

Creating an urban forest by extending green infrastructure corridor landscape templates into residential streets provides physical and visual connectivity and provides multiple ecological and social benefits. It also has the potential to provide economic returns through increasing the number of premium properties (those properties with direct visual connection to green space).

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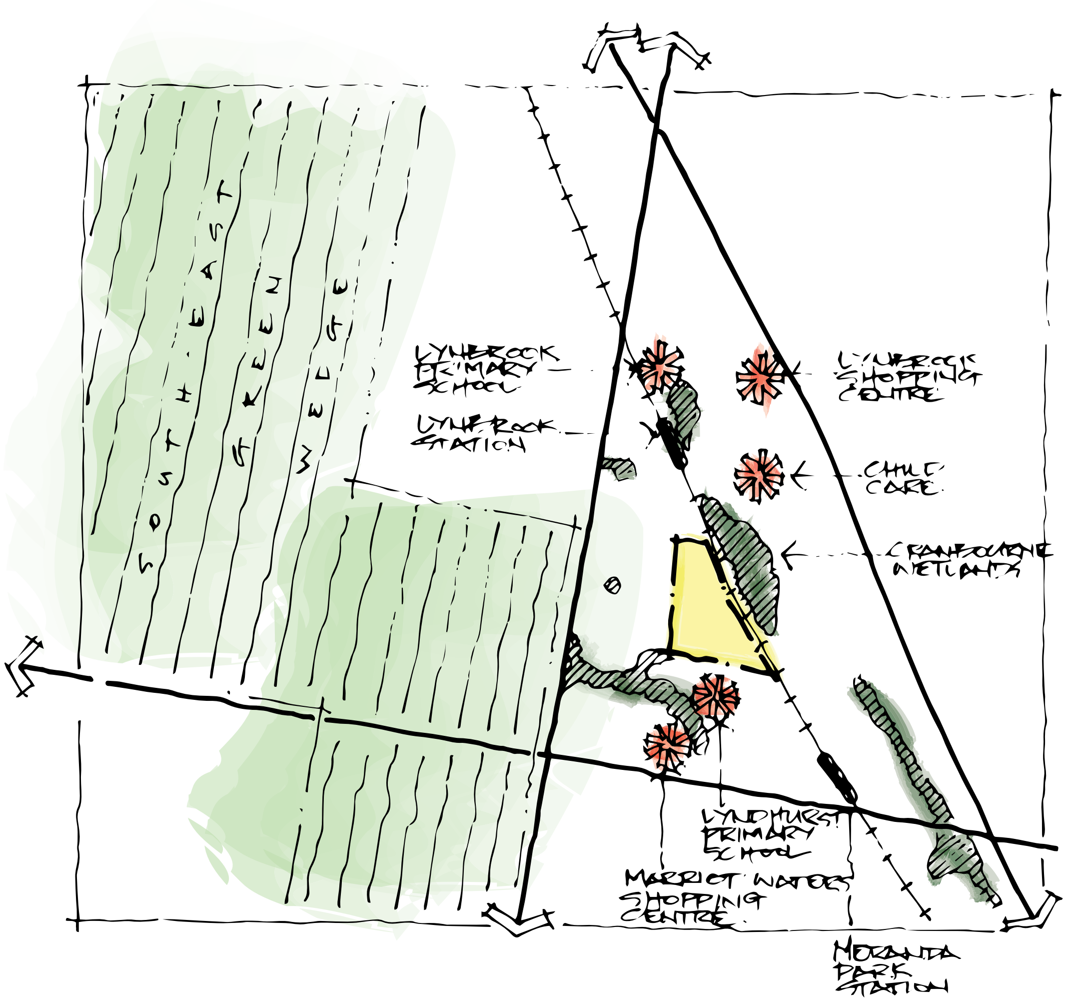
Aquarevo: local context and destinations


SOUTH EAST GREEN WEDGE
LYNBROOK PRIMARY SCHOOL
LYNBROOK STATION
LYNBROOK SHOPPING CENTRE
CHILD CARE
CRANBOURNE WETLANDS
LYNDHURST PRIMARY SCHOOL
MARRIOT WATERS SHOPPING CENTRE

A central green infrastructure spine at Aquarevo facilitates the creation of short residential streets. This in turn enables at-surface stormwater conveyance (for example, bioswales) to be implemented.

Managing stormwater on flat sites

Low-lying flat sites create a number of challenges for urban development, including drainage and creating a development platform above flood inundation levels. A conventional approach to drainage involves the use of a network of stormwater pipes laid at minimum grade to convey stormwater to the receiving waters under gravity. Earthworks involving imported fill are often used to elevate the development platform above design flood inundation levels and/or to provide sufficient cover above underground stormwater infrastructure.

Alternative approaches to managing water at Aquarevo enable the challenges of developing a flat site to be addressed while also creating an urban structure and form that supports a more resilient, sustainable and liveable urban environment.

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Streetscape bioswale, Lynbrook Boulevard [Image: CRCWSC]

At-surface stormwater conveyance is an alternative approach to piped stormwater infrastructure. At-surface systems such as bioswales require longitudinal slopes of 1-2%. Implementing bioswales along short streets (of the order of 100m) to convey stormwater to a central receiving water spine would mean that these systems can be configured to provide the required level of service of conveying stormwater runoff up to 5 year average recurrence interval (ARI) events. Eliminating the need for underground stormwater infrastructure potentially reduces the volume of imported fill required (where ground levels are defined by minimum cover depths above stormwater pipes). Stormwater drainage along Lynbrook Boulevard at Lynbrook Estate is an example of such a system.

This approach compliments strategies for making the public realm work harder (discussed later in this section) and increasing green infrastructure for heat mitigation (discussed in section b).

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Activate the public realm by reimagining the private/public interface, designing multipurpose streets and creating an urban forest. [Image: Prof Geoffrey London, CRCWSC/University of Western Australia; presented by A/Prof Diego Ramirez-Lovering, CRCWSC/Monash University]

Reconsider the relationship between the street and the house to make the public realm work harder to include places of play, productive gardens, urban forest, parking and services. Housing can be designed for the adaptive reuse of car park/garage areas and a productive relationship with the street.

[A/Prof Diego Ramirez-Lovering, CRCWSC/ Monash University]

Making the public realm and the public/private interface work harder

In evolving the structure of the street from being a place for the car to becoming a place for water catchment and management, social engagement, play, ecological value and spatial quality, the patterning of the street can be articulated to deliver a different set of values and outputs socially, ecologically and spatially. By meandering and pooling different spaces within the street opportunities are created for copses of urban forest, water cleansing and play that can be incorporated seamlessly into the fabric of the streetscape.

Active mobility is encouraged through a reimagined streetscape where pedestrian and cycle movement is prioritised and facilitated through a reduced focus on the car and creating of shadeways as part of an urban forest strategy.

The built form can address the varied streetscape condition created through a reimagined streetscape, offering differing housing forms in response to orientation and aspect (for example, west facing housing façades can become living façades and include green technologies as part of the built form).

b. Green infrastructure

Maximise and strategically incorporate into the landscape water and green infrastructure (irrigated where possible) – prioritising areas of high temperature, high solar radiation, and high public use and heat vulnerability.

Propose trees to shade urban surfaces wherever possible to strongly reduce mean radiant temperatures, which in turn significantly reduces heat stress during the day.

[Prof Nigel Tapper, CRCWSC/Monash University]

Vegetation and water for extreme heat mitigation

A study examining relationships between urban vegetation cover and land surface temperature across three Melbourne local government areas identified that in a typical urban landscape, a 10% increase in tree cover can result in a corresponding reduction in land surface temperature of between 0.5°C and 1.0°C (Nury *et al*. 2013). In another study, observed maximum surface temperatures under tree canopies on extreme heat days in Melbourne were 10 degrees lower on average than exposed concrete surfaces (Coutts and Harris, 2013). There are also now empirical evidence that shows well irrigated landscapes will further reduce surface temperatures under extreme heat conditions.

In addition to maximising vegetation cover (particularly tree canopies), taking advantage of the natural wind regime coupled with the availability of water and vegetation adjacent to Aquarevo (especially to the north/north-west and east/south-east) will enhance the local microclimate. Utilising solar reflective roof coatings will also reduce daytime surface temperatures.

An urban forest landscape emanating from a central spine and extending along local streets present the most effective strategy for influencing microclimate and mitigating urban heat.

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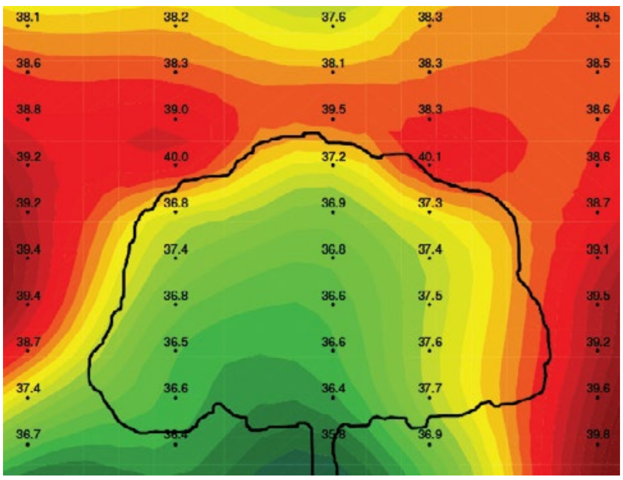
Strategically incorporate green infrastructure for heat mitigation.

Image: Air temperature of an isolated tree at 4pm on an extreme heat day in Melbourne [Source: White et al., 2012]



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Living façades for microclimate improvement, sustained by fit-for-purpose water

Image: Melbourne green façade thermal image at 1pm in summer [Source: Coutts & Harris, 2012]

Water and waterways providing multiple benefits

An urban forest along the central spine presents an opportunity to re-establish a natural waterway and riparian system to enhance biodiversity and ecological value within the development. A distributed waterway within the central spine performs and supports a number of functions including stormwater treatment, flood storage/ conveyance, and passive irrigation/soil moisture replenishment to support vegetation within the corridor. The waterway and central spine also facilitates and encourages passive recreation activities (within a cooler microclimate environment).

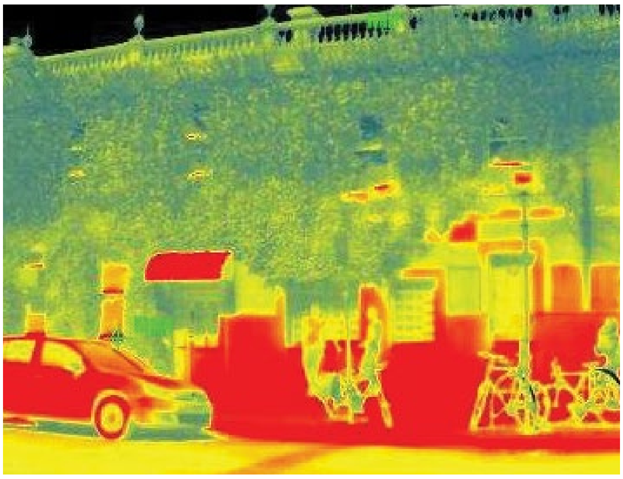
The urban forest extends from the central spine right to the individual allotment through innovative building design. Supported by fit-for-purpose water, living façades can contribute to a cooler microclimate, as well as enhancing amenity along to the central spine and green streets.

Redistribute the waterway corridor within the site, linked with urban forest and mobility considerations to provide multiple benefits, without increasing overall land take relative to the base case masterplan.

[Dr Geoff Vietz, CRCWSC/ Melbourne University]

Consider the strategic placement of living façades for microclimate improvement, sustained by fit-for-purpose water (given their high water demand).

[Prof Ana Deletić, CRCWSC/Monash University]



c. Intelligent (water + energy) systems

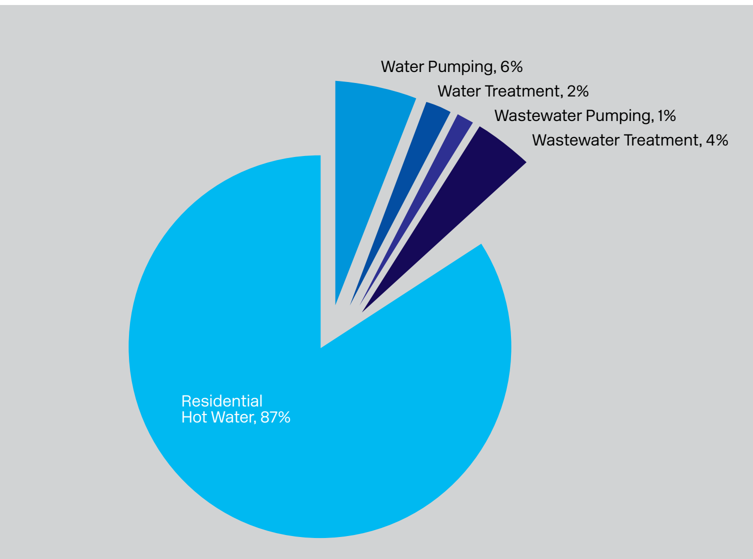
Consider opportunities to reduce energy demand from residential hot water systems (such as solar hot water or reticulated hot water) given that it represents 87% of the energy demand of urban water systems in major Australian cities (Kenway et al., 2008).

[Prof Jurg Keller, CRCWSC/University of Queensland]

Manage water and energy at the precinct scale

The precinct is a critical scale at which to address the water-energy nexus in urban environments. There are multiple sources of water available to Aquarevo with different characteristics, costs and benefits. For example, each source has a particular quality, reliability of supply, capital and operational costs, and energy intensity associated with both treatment and distribution. Aquarevo represents an important opportunity to identify a portfolio of sources to meet potable and non-potable water demands for the development that respond to broader (corporate and community) costs and benefits associated with each supply option.

Given the high energy demand associated with conventional residential hot water production, this is an obvious focus for considering alternative approaches. While precinct-scale hot water production (for example, via trigeneration) has been successfully implemented, a high population density is typically required for this option to be economically feasible. Solar hot water production at the individual house-scale is an alternative option that could be explored.



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Reduce energy demand associated with residential hot water production [Image: adapted from Kenway *et al.*, 2008; presented by Prof Jurg Keller, CRCWSC/University of Queensland]

Non-potable water demands could potentially be met by recycled water (delivered from Eastern Treatment Plant, which is located approximately 7 km west of the site), sewer mining at Aquarevo (accessing wastewater from the main sewer pipe running along the eastern boundary of the site), or precinct scale wastewater recycling (utilising a local package treatment plant).

Intelligent (pressure) sewers, discussed in the following section, 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. While this option involves the construction and operation of additional treatment infrastructure, it reduces the energy cost associated with transporting wastewater to Eastern Treatment Plant and returning recycled water to the site.

Implement pressure sewers

Pressure sewer networks utilise smaller diameter pipes and avoid the need for gravity discharge of wastewater from the site. Pressure sewer technology removes wastewater infrastructure as a constraint on urban structure and provides opportunities for real-time monitoring, control and optimisation of the system.

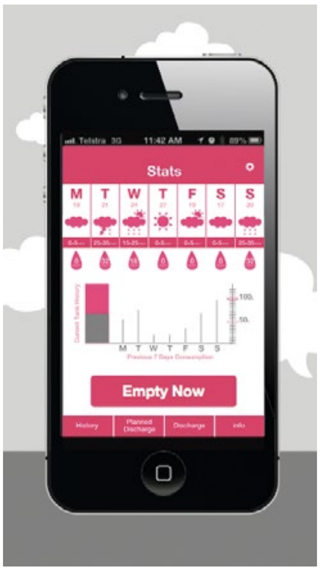
Pressure sewers installed using trenchless technology may not provide capital cost savings in a greenfield application such as Aquarevo. However, the use of pressure sewers enables the benefits of Intelligent Sewers (discussed below) to be realised. Pressure sewers also enable alternative urban forms, including those presented in section a, to be explored.

Implement intelligent, precinct-scale water and wastewater systems

Innovative technologies for the monitoring, control and optimisation water and wastewater systems are currently being developed by iota, established by South East Water. iota's Talking Tanks comprise rainwater tanks connected to OneBox, an automated real-time monitoring and control system. OneBox utilises rainfall forecast and tank water level information to automatically release water at a controlled rate (creating storage capacity) ahead of predicted rainfall events. This reduces the negative impacts of stormwater on local waterways while maximising the availability of rainwater for beneficial use (iota, 2014a).

The ability to centrally manage releases from a network of distributed water storages (rainwater tanks) creates opportunities for providing cost-effective stormwater infrastructure for Aquarevo. Where at-surface stormwater conveyance is implemented (for example, through the use of bioswales), Tanking Tanks enable longer conveyance lengths (and associated street lengths) by reducing runoff from impervious surfaces. Where piped stormwater infrastructure is utilised, Talking Tanks have the potential to reduce the pipe size required to convey design storm events.

iota's OneBox also powers Intelligent Sewers, which combine pressure sewers and distributed sewer storage tanks with automated real-time monitoring and control. Intelligent Sewers provide water authorities with the ability to remotely monitor, control and optimise pressure sewer infrastructure at an individual property, street and network level. Automated, real-time monitoring provides significant benefits in terms of understanding and managing system performance, and being able to undertake proactive maintenance (iota, 2014b). Reductions in peak sewer flows achieved through the use of pressure sewers and real-time control may make local wastewater recycling a viable option at Aquarevo.



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OneBox, powering Talking Tanks [iota]

11 ideas for a water sensitive Aquarevo

The ideas generated and explored through the workshop are presented here under three broad themes: urban planning and design, green infrastructure, and intelligent (water+ energy) systems.

a. Urban planning and design

Managing stormwater on a flat site to support cost-effective drainage infrastructure deployment and earthworks, while designing to connect to key regional natural assets and creating a more liveable community.

1 Create a central green infrastructure spine facilitating short street lengths. This urban structure enables at-surface stormwater conveyance (bioswales) on residential access streets in place of piped stormwater infrastructure to reduce the high volume of imported fill typically required for traditional (piped) stormwater infrastructure on flat sites.

2 Rethink street design options for residential access (and other) streets: urban forest elements, active and passive open space, 30 km/h speed limits, single lane with integrated parking.

3 Rethink street typology options: re-envisioned cul-de-sac streets (with pedestrian/bike permeability), pedestrian friendly streets.

4 Provide connections to adjacent communities and destinations.

b. Green infrastructure

Using water and vegetation to achieve multiple community benefits, including stormwater quality improvement, safe conveyance of floodwaters, improved urban microclimate and mitigation of urban heat.

5 Adopt a distributed (branched) waterway design that incorporates green infrastructure for stormwater treatment and heat mitigation and high pedestrian mobility while also increasing the number of premium properties (properties with water or open space views).

6 Incorporate green streets for heat mitigation: maximise (summertime) tree canopies, maintain water in the landscape.

c. Intelligent (water + energy) systems

Identifying distributed, precinct-scale opportunities for cost-effective water services.

7 Apply a portfolio approach to water supply servicing: utilise fit-for purpose sources matched to demand requirements. This may include potable (mains) water, local sewer mining (or regional recycled water), rainwater or stormwater.

8 Implement system-scale management of water services for catchment-scale benefits (e.g. OneBox powering talking tanks).

9 Implement pressure sewers to reduce the high volume of imported fill typically required for traditional (gravity) sewer infrastructure on flat sites and remove sewer infrastructure as an urban planning and design constraint.

10 Explore sewer mining from the main sewer (located adjacent to the railway line) to reduce potable water demand. This has the potential to provide district (reticulated) heating and cooling in addition to recycled water for the site to address the high energy demand associated with residential hot water generation.

11 Explore opportunities for body corporate style governance structures to manage community assets and infrastructure.

Assessing water sensitive ideas

The CRCWSC is developing a Water Sensitive City Modeling Toolkit (the Toolkit) to support the strategic planning and conceptual design of stormwater management and green infrastructure initiatives at a range of scales. The Toolkit is comprised of a number of interlinked modules covering stormwater infrastructure planning (including stormwater harvesting), stream health, pluvial flood risk and urban microclimate. The stream health module 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 shows stormwater management initiatives adopted at Marriott Waters and incorporated in the Aquarevo masterplan (such as the linear pond/wetland sytem) 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. However, these other indicators are less relevant at this location given the highly modified and degraded condition of the receiving waters.

The Toolkit can also assess the impact of green infrastructure on local temperatures. The microclimate module uses relationships between land cover type and (averaged 11am summertime) surface temperature, derived from remotely sensed data across three municipalities in Melbourne (Nury *et al.*, 2012). An updated version of the Toolkit (scheduled for release in October 2014) will include relationships based on maximum daytime temperatures on extreme heat days. Application of the Toolkit's current microclimate module to quantify the benefits of implementing an urban forest strategy at Aquarevo is illustrated below.

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Incorporating water and green infrastructure reduces land surface temperatures.

A key influencing factor of land surface temperature is surface cover type. Impervious surfaces are typically hotter than pervious surfaces. Increased areas of vegetation and water can significantly reduce local temperatures. The Toolkit's microclimate module has been used to demonstrate the influence of creating a central green infrastructure spine and green streets. A comparison is made with conventional urban development indicative of residential developments in the area that have not adopted a sustainable or water sensitive approach.

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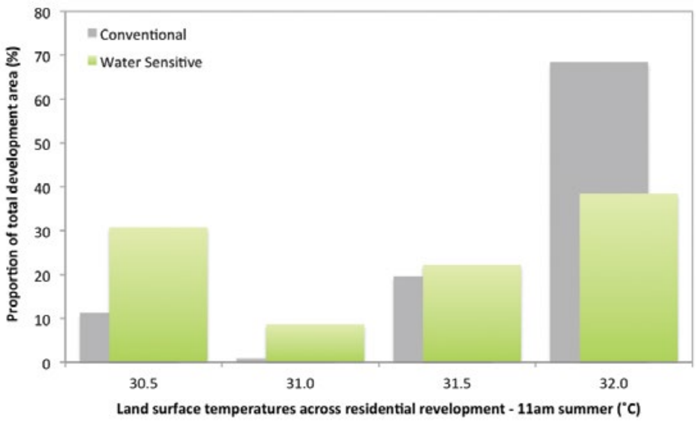
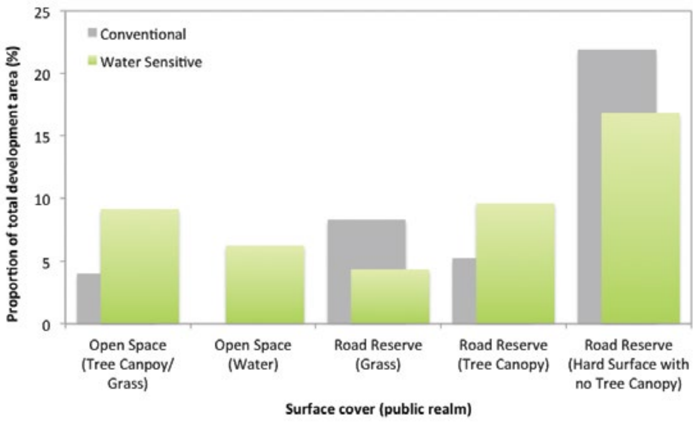
Creating a water sensitive development: increasing water and tree canopy cover in the public realm.

A water sensitive urban development incorporating a waterway corridor, vegetated open space areas and extensive tree canopies in road reserves is shown to reduce 11am summertime land surface temperatures across significant areas of the site by 1.0-1.5°C relative to a conventional urban development with limited water and green infrastructure. Reduction in maximum daytime temperatures on extreme heat days will be much greater.


Conventional
Water Sensitive
Proportion of total development area (%)
80
70
60
50
40
30
20
10
0
30.5
31.0
31.5
32.0
Land surface temperatures across residential revelopment - 11am summer (˚C)

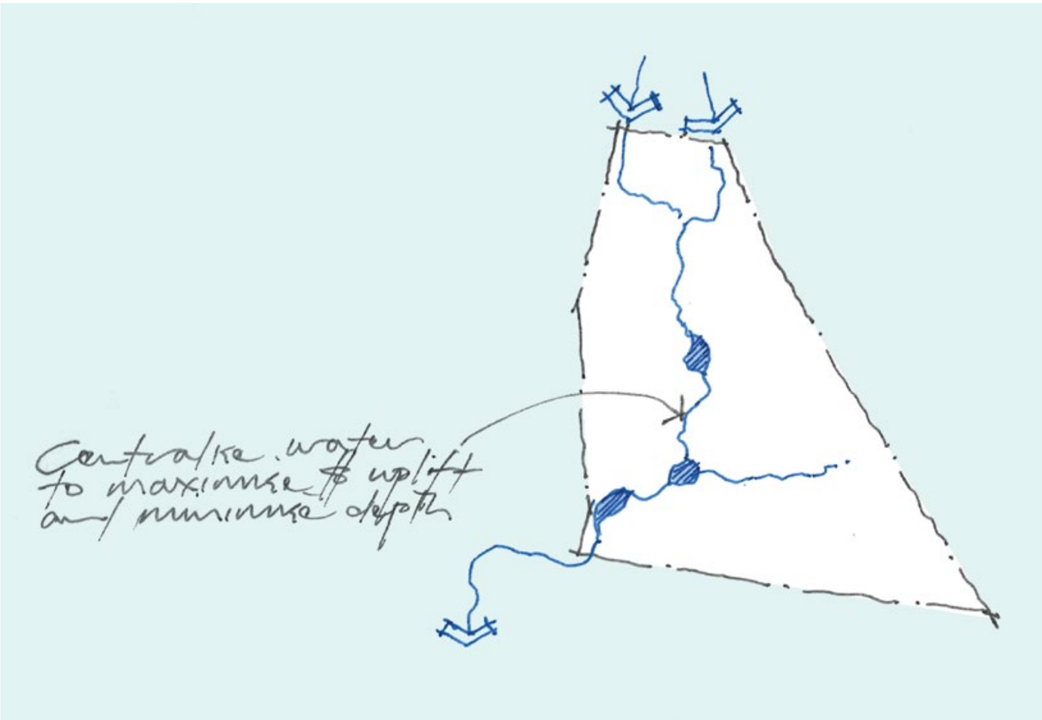

Conventional
Water Sensitive
Proportion of total development area (%)
25
20
15
10
5
0
Open Space (Tree Canpoy/ Grass)
Open Space (Water)
Road Reserve (Grass)
Road Reserve (Tree Canopy)
Road Reserve (Hard Surface with no Tree Canopy)
Surface cover (public realm)

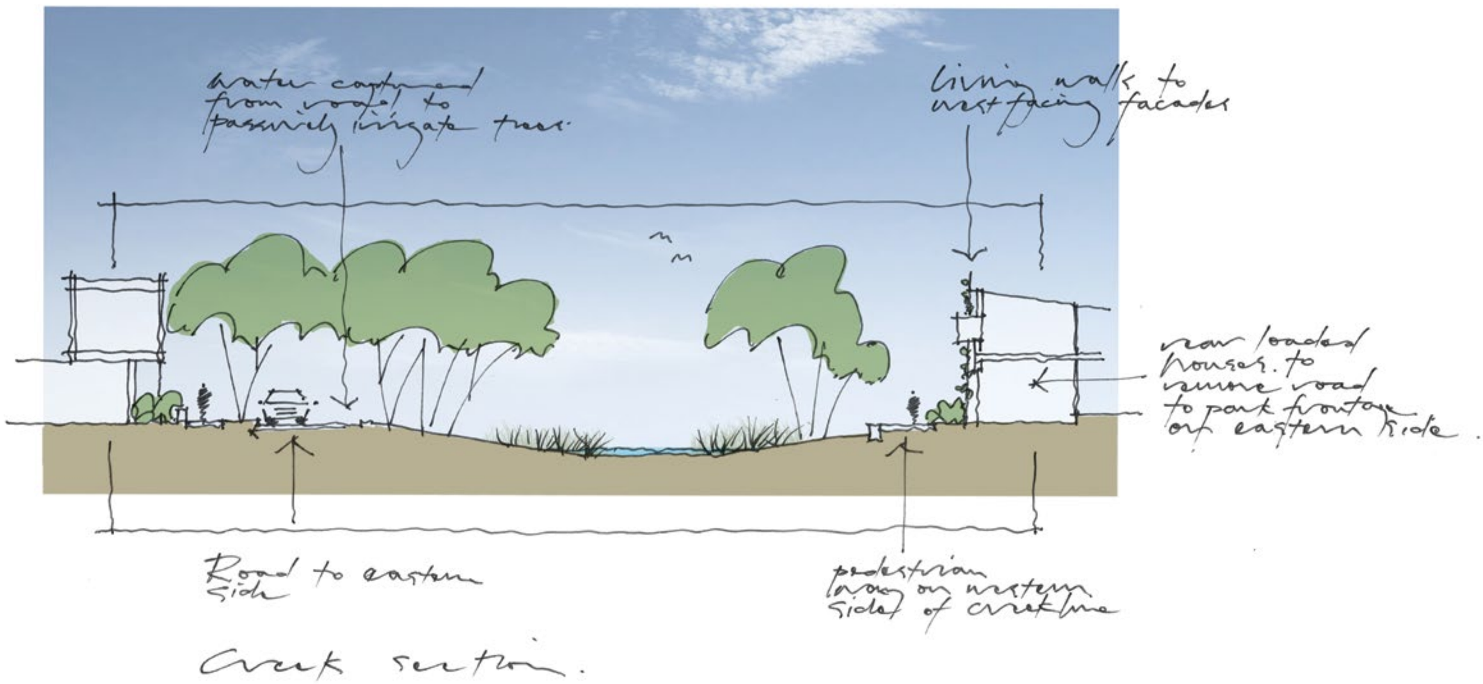
Developing design principles

The 11 ideas for a water sensitive Aquarevo are represented below as a series of layered (interconnected) design principles.

Central green infrastructure spine

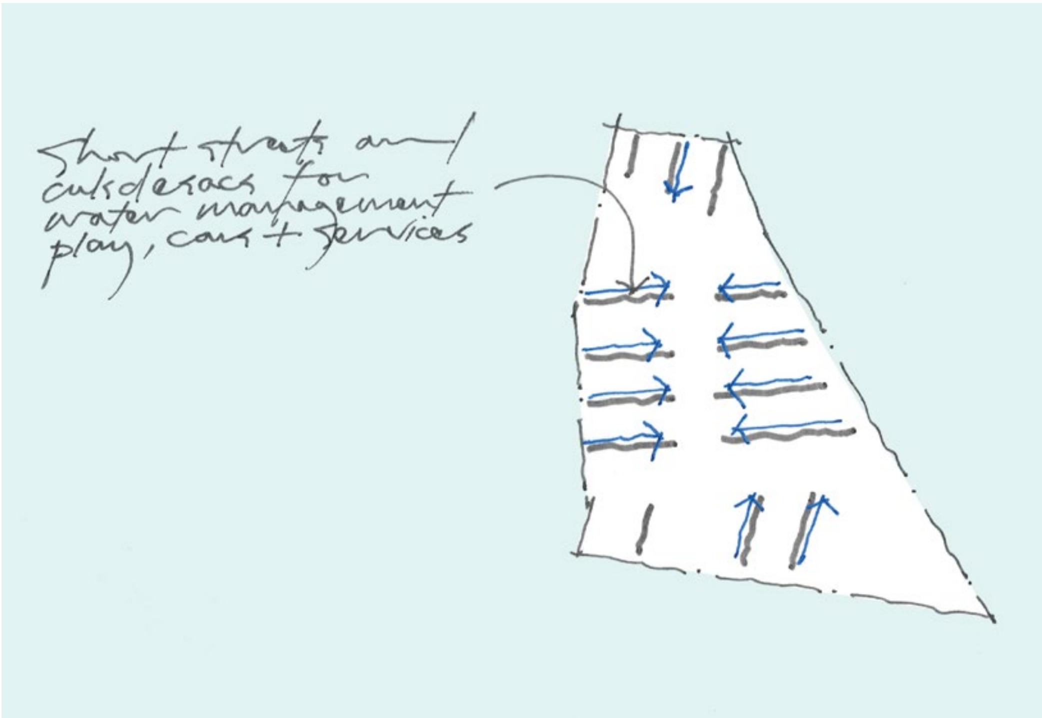
A central green infrastructure spine provides the framework for creating a water sensitive development on a flat site. The central spine sets up short street lengths which enable stormwater to be conveyed at surface. The central location also gives equitable access to this amenity from across the site.

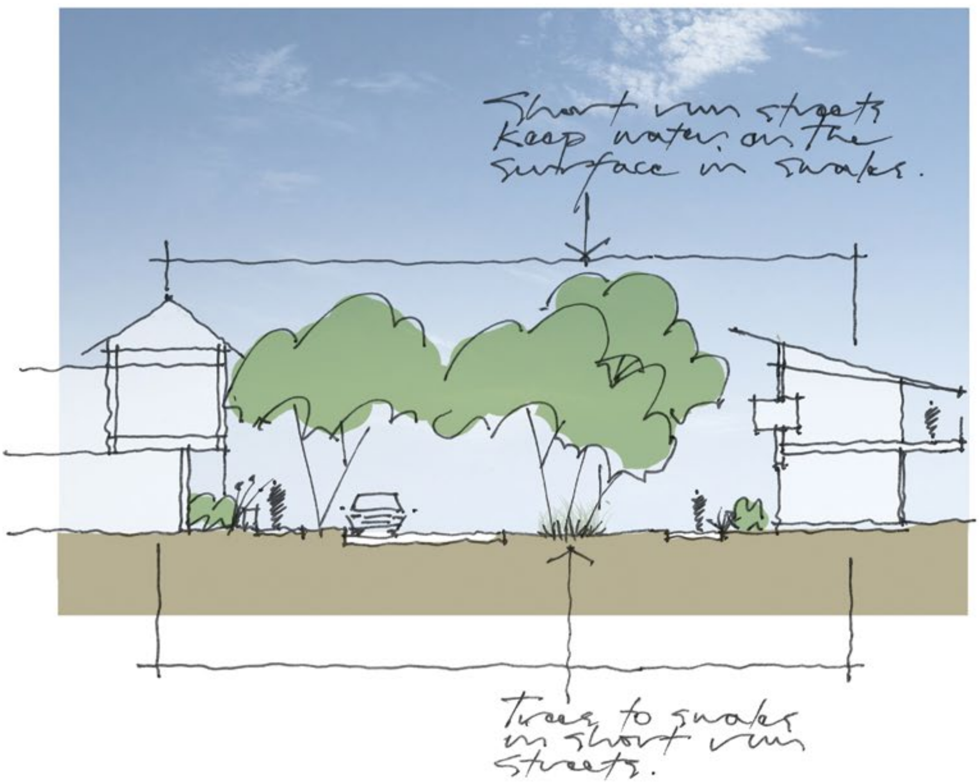



water captured from road to passively irrigate trees.
Living walls to west facing facades
rear loaded houses to remove road to park frontage on eastern side.
Road to eastern side
pedestrian only on western side of creekline
Creek section.

Short green infrastructure streets

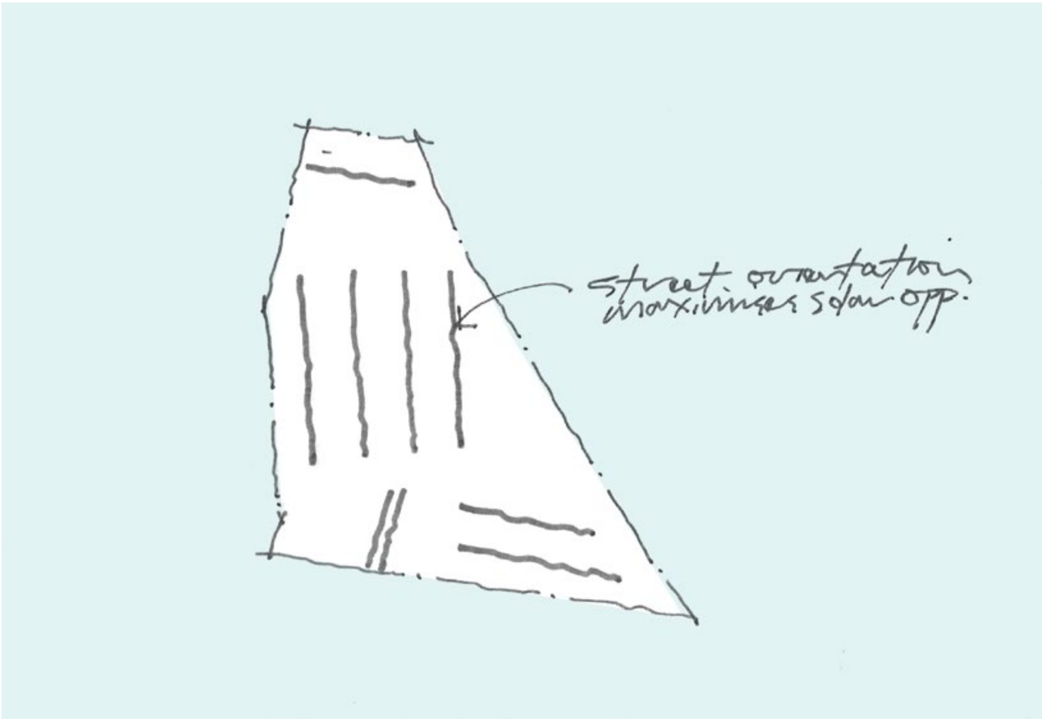
Short green infrastructure streets linked to the central spine allow stormwater to be conveyed along surface bioswales. This eliminates the need for piped stormwater infrastructure in these streets. Short streets also become legible local streets for play and social engagement.




Short run streets keep water on the surface in swales.
Trees to swales in short run streets.

Street orientation and built form

The central spine and short streets enable a variety of street orientations responding to market and builder preferences for house orientation. Short green streets that emphasise play and social engagement also create opportunities for greater connection between the private and public realm through housing typologies and façades.

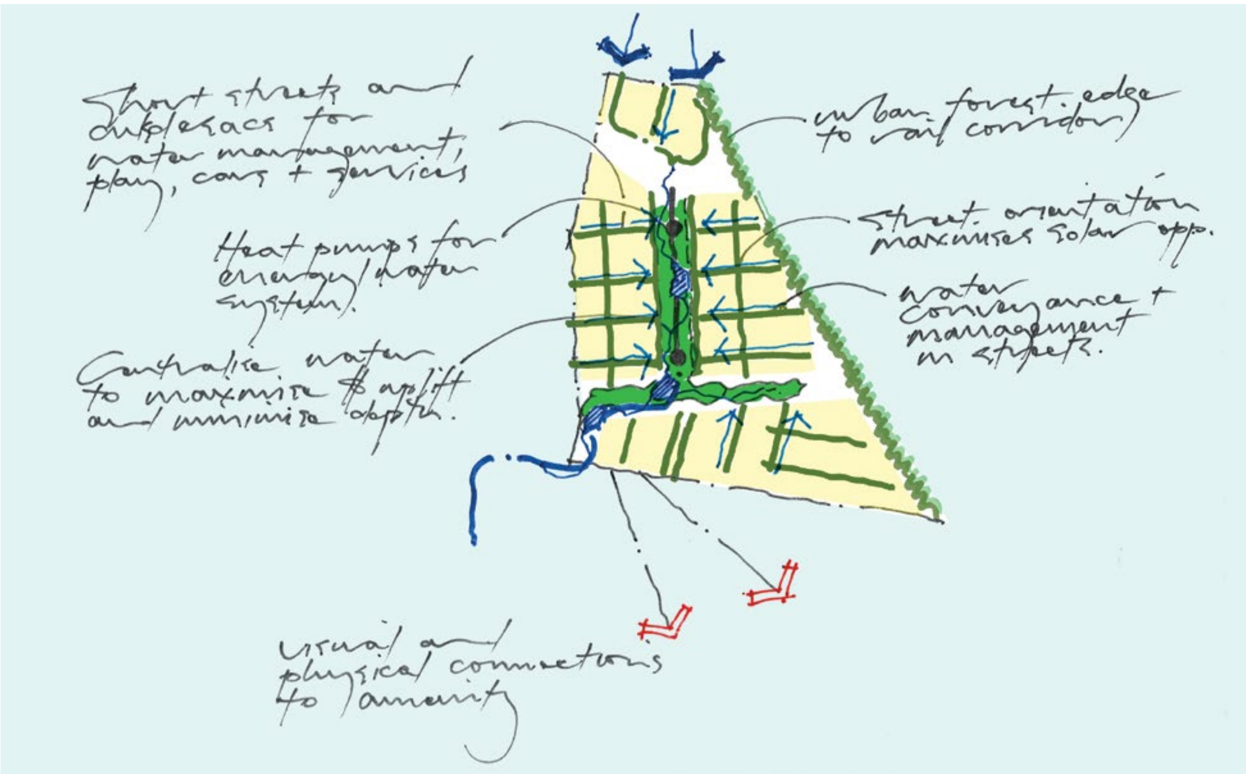


Urban forest

The central spine and short streets provide the platform for an urban forest that permeates the site and also extends along the eastern boundary against the rail line. Extensive actively and passively irrigated vegetation across the site increases soil moisture and evapotranspiration. This provides resilience to extreme heat and prolonged dry conditions and encourages active transport (walking and riding) within the site and to adjacent locations and services.

Living façades (green architecture) on house walls directly interfacing the eastern side of the central spine provide private and public heat mitigation and contribute to the broader community amenity of the open space.

This composite diagram demonstrates how individual water sensitive elements combine to create a legible, connected, greener, cooler, development where site planning and architectural responses are integrated in their intent.



Conclusion

Prof Tony Wong
CEO, CRC for Water Sensitive Cities

Today's cities and towns are faced with growing populations, changing climate, and, due to limited resources and environmental capacity, a diminished ability to cope with the impact of urbanisation. These emerging issues are forcing urban centres to do more with less with respect to water management, spatial planning and urban design. Infrastructure to support new urban communities will need to meet these challenges and also respond to an increasingly engaged community expecting high levels of service and improved liveability.

Ideas for Aquarevo concentrates our efforts in synthesising the thoughts and ideas of our industry and research leaders to bring together excellence and innovation in water servicing, land development and WSUD. Whilst Aquarevo could be developed according to current best practice approaches to land development, the collaboration between the industry leaders involved in this project provides an opportunity to build an exemplary precinct with a focus on resilience to the emerging issues faced by cities and towns.

One of the key innovations identified in the collaborative workshop was the creation of green and blue corridors. The proposed central green infrastructure spine and associated short green infrastructure streets support an urban forest and facilitate a cost-effective at-surface stormwater conveyance system. This presents a unique opportunity to re-establish a waterway that most closely represents the natural environment of this location. These initiatives avoid the need for underground stormwater pipes and provide opportunities for a people-focused street typology that incorporates bioswales and street trees to improve water quality and microclimate. Modelling undertaken by the CRCWSC has shown significant moderation of local summertime temperatures as a result of increased water and trees across the development. The urban forest would emanate from the central urban spine to individual streets and buildings, and would include the creation of living walls that cleanse water for reuse whilst improving the local microclimate. In its entirety, the urban forest and associated green and blue corridors create a landscape that is unique to the area.

Aquarevo also presents the opportunity to utilise new technology to support the real-time control of water infrastructure such as rainwater tanks and sewer systems, fit-for-purpose water production and solar energy as base load for hot water production. All of these initiatives will lead to lower water servicing costs associated with lower energy consumption at the individual household scale, and in the estate-wide water supply and sewerage systems. The ability for household rainwater tanks to pre-emptively release stored rainwater to create flood storage capacity ahead of an imminent storm event will further support the proposed stormwater conveyance strategy and downstream flood mitigation.

Ideas for Aquarevo outlines a range of innovations that, if adopted, would create a significant point of difference for the development, and would position Aquarevo as an outstanding example of a water sensitive greenfield development. The synthesis of innovative technology with cutting-edge science on urban microclimate and contemporary urban design in this document showcases the synergies that can be harnessed through incremental innovation, even as the research continues to develop. The transformation of city into water sensitive city is an adaptive journey. Each new water sensitive precinct builds on past experience and successes in surrounding areas, and applies current insights and knowledge. The commitment of South East Water and Villawood Properties to innovating and learning through doing will delivering Aquarevo as another piece of the jigsaw in transforming Melbourne into a water sensitive city of global significance.

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