CRC for
Water Sensitive Cities

Transformation of an inaccessible infiltration basin into a community park

White Gum Valley

A waterwise way of living

New model for community bore water supply to residents and open spaces supporting a 60-70% reduction in water use

Case Study

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

Photo credits: Josh Byrne & Associates, and LandCorp

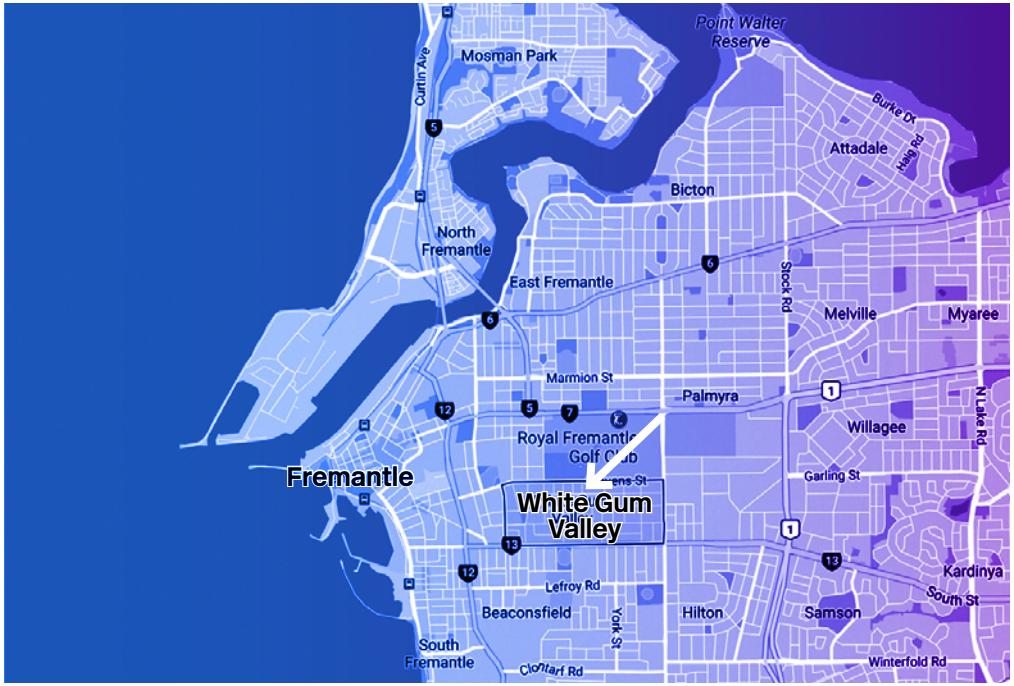
Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Programme

The context

BACK TO MENU

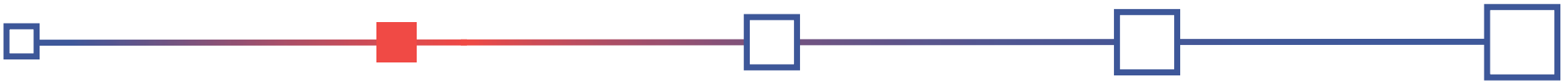
Project location

The White Gum Valley (WGV) development is an infill development located approximately 3km inland from Fremantle in Western Australia.



Project scale

The proposed development includes more than 80 residential dwellings on a 2.29 ha site and is classified as a medium-density infill development site. The development incorporates a range of building typologies: with detached housing around the perimeter, and increasing density towards the middle of the development, where there is group housing. The WGV development is expected to accommodate approximately 180 new residents through a range of housing options including apartments, maisonettes and 23 single residential home sites. It also includes the winning design of the Gen Y demonstration house competition, which provides apartment style living for young professionals.



BACK TO MENU

Project site

The site was previously a school for children with special needs (Kim Beazley School) which closed in 2008. The site is opposite the Royal Fremantle Golf Course and Booyeembara Park within the suburb in White Gum Valley, a suburb established in the late 1800's within the City of Fremantle.

WGV Flythrough August 2015
https://youtu.be/20DVsMpjyTw

→

Visualisation of the White Gum Valley development

→

Collaborators and their roles

Development Partner	LandCorp is the Western Australian Government's land and development agency. Across the State, LandCorp develops land for living and land for working to create places to build social and economic prosperity. LandCorp has invested in a new approach to development at WGV through its 'Innovation through Demonstration' program.
Water utility provider	Water Corporation (Water Corp) manages and maintains the water and sewerage networks to provide water and wastewater services to business and residential customers in Western Australia. Water Corp is a project partner that has utilised WGV as a waterwise development exemplar.
Researchers	Cooperative Research Centre for Water Sensitive Cities (CRCWSC) is a project partner, providing support for ongoing monitoring of the site and dissemination of lessons. Cooperative Research Centre for Low Carbon Living (CRCLCL) is running a four year 'Living Laboratory' research project to capture and communicate key findings from WGV in relation to mainstreaming low carbon residential precincts.

Local government	City of Fremantle will eventually manage and maintain the public realm and community bore system in the WGV development and is the planning authority for the site.
State Regulator	Department of Water (DoW) manages all water resources in Western Australia. The department is responsible for water supply licensing, development of stormwater management guidelines and the facilitation of necessary approvals for non-potable water supplies.
Consultants	Design consultants for the project included Coda Studio (estate architects), Josh Byrne & Associates (landscape, water and sustainability), Urbis (town planning), Tabec (civil engineering).

Timeline and milestones

2003 & 2004

LandCorp and the Department of Education worked with the local community to develop a plan for the future use of the Kim Beazley School site. A series of workshops were held with a Community Focus Group, including representatives from the White Gum Valley Precinct Group, but no final Structure Plan was submitted for approval.

2008

The Kim Beazley School closed. LandCorp was asked by the Department of Education to undertake the demolition and remediation of the site and to develop a Structure Plan.

2009

LandCorp reviewed the site in its context and identified it as an opportunity to collaborate with others to construct a development that used less energy and water resources.

Mid 2011

LandCorp appointed planning consultants to review the plan developed by the Department of Education's consultant and concluded that the plan could do more to satisfy infill targets or reflect current thinking around diverse typologies and more climate responsive housing.

Nov 2011

A series of community workshops were held to assist with the production of a Local Structure Plan. This opened up a conversation around the need for more diverse housing and the potential for climate responsive housing. Demolition of the Kim Beazley School buildings and former playgroup centre was completed.

Mid 2012

Josh Byrne & Associates were awarded the contract for landscape architectural services.

Sep 2013

The Local Structure Plan was advertised for public comment by the City of Fremantle. A community information session was held on Saturday 21 September at the White Gum Valley Primary School as part of the comment period.

Nov 2013

A second community information session was held on Tuesday 26 November.

Apr 2014

City of Fremantle applied for a public interest exemption under the Water Services Act 2012. Department of Water undertook a public interest assessment in consultation with the Department of Health.

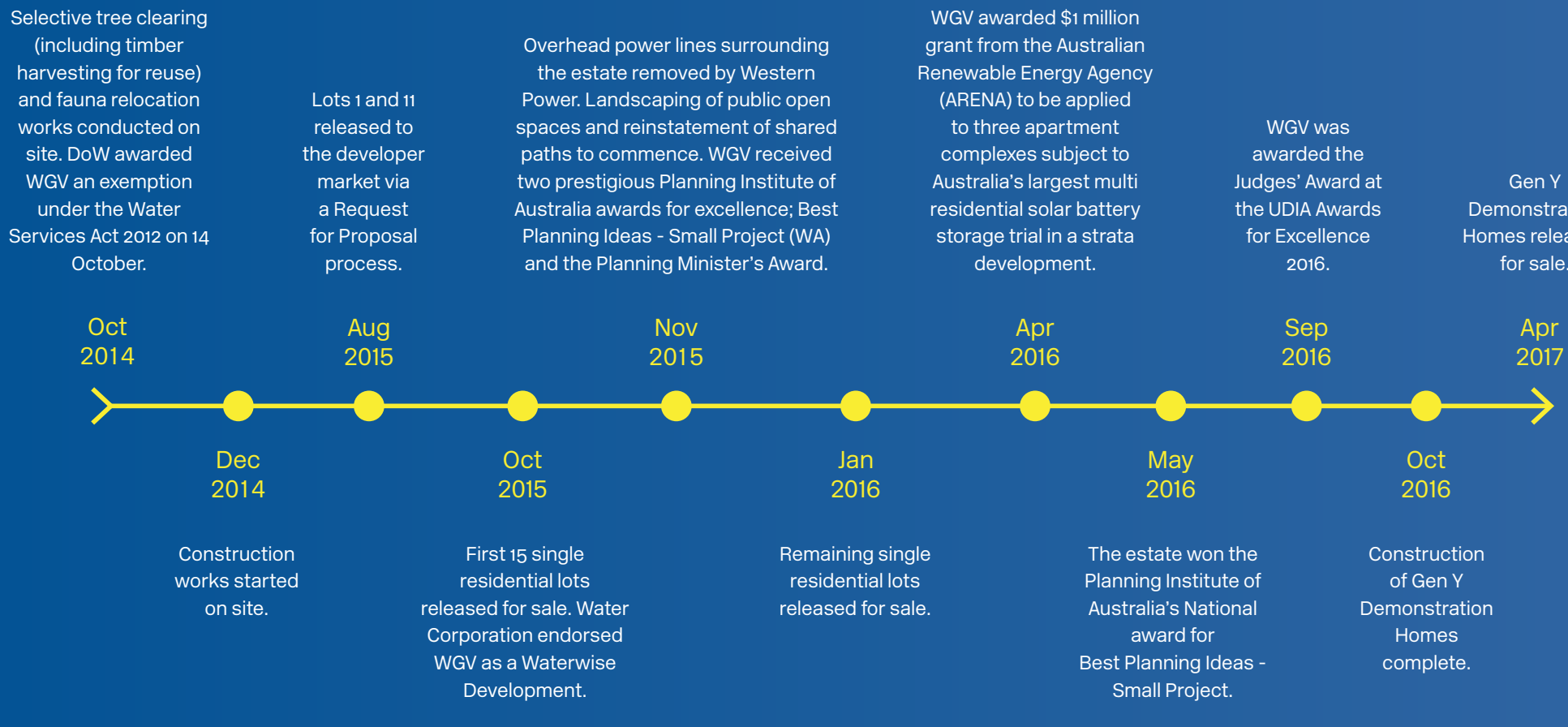
Aug 2014

The Local Structure Plan was endorsed by the Western Australian Planning Commission.

Sep 2014

The subdivision plan was approved by the Western Australian Planning Commission.

Timeline and milestones (cont.)



The drivers

1. Community expectations

The broader White Gum Valley community is a well-informed, environmentally conscious community with very strong local government representation. As a result, when the site was earmarked for development, a traditional approach was not considered acceptable by the community, particularly the Local Council Precinct Group. This interest led to an ongoing process of design, refinement, and community consultation.

Originally, when the school site was earmarked for development, the Department of Education were looking to divide the site into 400m² lots, which would have traditionally provided the highest return. However, a structure plan could not be agreed at this stage, as the community was concerned that this proliferation of a traditional sub-division model only created one type of residential housing offering, which did not reflect the changing housing needs of the community where both young professionals and single parent households required a new model. A precinct design process was undertaken with the local community which highlighted a strong desire for diverse housing types to suit people at different stages of their lives, and to demonstrate what could be done in terms of energy use, water use, biodiversity and tree retention. The council and LandCorp responded to these expectations by focussing on White Gum Valley as a site to try new models.

The Mayor and Ward Councillors had a "consistent focus for WGV as an exemplar development that went well beyond a standard suburban development to something that demonstrated strong sustainability and good social outcomes" — Mayor Brad Pettitt, City of Fremantle

"There was an expectation from within the local community, articulated through the local precinct group, that there would be design excellence on the WGV site" — Josh Byrne & Associates

2. Developer-led innovation through demonstration

As the developer of the site and a government agency, LandCorp played a key role in driving a new vision for development on the site. LandCorp identified the site early on as an opportunity to try something different and innovative. They came up with the ideas in the first instance for a sustainable development, using less of the earth's resources and collaborating with others. With a progressive team within LandCorp and an open-minded development manager, LandCorp applied a mandate in their corporate charter to develop working partnerships with the public and private sector, present industry leadership and help facilitate innovation in the rest of the industry. There were two key mechanisms through which LandCorp were able to apply this at WGV:

- The proactive support of innovation on the site through their program "Innovation through Demonstration". WGV was identified as a key project within this program. This gave LandCorp more flexibility in terms of proposing initiatives "out of the ordinary". Such initiatives were more likely to receive support from management.
- The application of the One Planet Living (OPL) Framework, a sustainability assessment framework which was being applied to a development site for the first time in Western Australia.

"LandCorp explored the ideas of the community and went further, raising the bar beyond the expectations or ideals of the community" — Mayor Brad Pettitt, City of Fremantle

Visualisation of the WGV site showing the SHAC building and the landscaped infiltration basin in the foreground.

→

BACK TO MENU

3. Alignment of ambitions of key stakeholders and consultants

Innovation on the site benefited from the support and input of a range of stakeholders, each of whom brought their own ambitions to the table, often supported by accreditation systems or corporate commitments. Key alignments included:

- **Culture of learning and innovation within the City of Fremantle**: The local council was very supportive of a new approach within the development, representing community ambition and a desire for change. The current Mayor, Brad Pettitt, was a key champion for the project from a senior level. Council officers were encouraged to try new things and have an open mind to innovation. The council itself had also committed to be a OPL council, so this was an opportunity to apply the same sustainability principles at a residential precinct level. WGV contributed to council's efforts towards maintaining their international certification level. Under the OPL framework, WGV received national, and then international certification as a 'One Planet community'.
- **Committed and ambitious consultants and housebuilders:** The project benefited from the commitment and persistence of champions within the design consultant group and developers on site. Josh Byrne & Associates were engaged to provide landscape design services initially but expanded to include sustainability and water advice for the site, identifying additional opportunities that went above and beyond their scope. The sustainability initiatives were furthered by apartment developers who saw an opportunity to use sustainability as part of their sales campaign. Yolk Property Group have created Evermore WGV, the first OPL apartment development.
- **Alignment of interests of the water utility:** Water Corporation were strategically looking to place increasing emphasis on the Waterwise Development and Waterwise Council programs to help increase capacity within those two areas. As well as targeting individual householders with waterwise messages, Water Corporation wanted to work with developers to help showcase better ways to design and develop at the community level, and also work with Councils to support their community engagement programs.
At the time of the WGV development, they were

"We want to be a Council that pushes the boundary and innovate - there is an underlying view that business as usual can't be sustainable and can't continue, so we have to innovate... because we are really serious about the One Planet Living objectives and reducing our ecological footprint, it's forcing us to really think about how we can do that in clever ways and through innovation that doesn't necessarily cost more, and often that has the great side effect of growing community" — Mayor Brad Pettitt, City of Fremantle

"The kudos that comes with One Planet Living became a major driver for increased appetite for the adoption of innovation at WGV" — Josh Byrne & Associates

looking for an exemplar project to showcase Josh Byrne & Associates to identify and review water innovation opportunities, an activity that was otherwise beyond the scope of the engagement as consultants. Modelling showed that mains water consumption could potentially be reduced by 60-70% per person, depending on dwelling type, compared to the business-as-usual figure for residential households in Perth. The idea for WGV as a waterwise development exemplar was presented to LandCorp and Water Corporation, and in principle, both approved all of the ideas proposed. The mains water consumption reduction targets set for the development were aligned with the targets and initiatives set out in an earlier Water Strategy for Perth.

- **Support from Department of Water**: With an overarching view of the state's water resources, the Department of Water was also very supportive of water management initiatives on-site, promoting stormwater management, groundwater management and water efficiency. The Department of Water played a key role in facilitating approvals for new initiatives.

"Given the serious water situation in Perth, there was a thirst for innovation, and boots-on-ground examples" — Josh Byrne & Associates

"As the agency responsible for the sustainable management of the State's water resources we are very, very interested in how to identify effective water saving approaches and promote the uptake through collaboration" — Don Crawford, Department of Water

There was a mutual desire between the Department of Water, LandCorp, and Water Corporation to get better water sensitive urban developments happening ... recognising our respective and comparative risk profiles, we can consider putting ourselves further out at the leading edge with these types of opportunities. Department of Water is supportive of such practices from the perspectives of water sensitive urban developments and wiser use of water.

— Greg Claydon, Department of Water

The innovations

1. Design guidelines and a sustainability upgrade package to make greener living easy for residents

LandCorp developed design guidelines for single residential lots built in the development, as well as a comprehensive guide for residents that articulates the wide range of sustainability initiatives that have been implemented on the site, and how residents can help achieve the One Planet Principles. The Design Guidelines are a contractual condition between the buyer and LandCorp. The design guidelines for single dwellings include a sustainability upgrade package where residents can elect to take advantage of a sustainability rebate to assist in improving the environmental performance of their home. To receive the package, the owner must comply with the design guidelines and install a minimum 1.5kW photovoltaic solar power (PV). The value of LandCorp's contribution to the package is $10,000 which is available to all single residential lots.

Taking up this offer will have a positive impact on reducing the environmental footprint and running costs of the participating households. The sustainability package includes:

1. Roof top PV system upgrade: The supply and installation of a complete 3.5kW solar PV system. This upgrade will supersede the mandated minimum 1.5kW solar PV system.
2. A plumbed rainwater tank: The supply and installation of an above-ground plumbed rainwater tank (minimum 3,000L) with pump and accessories. This augments the mandated rainwater-ready plumbing.
3. Shade tree: The supply and planting of a large (100L pot size) deciduous shade tree. This augments the recommendation for deciduous shade trees.

The package also includes 12 months of support from the nominated suppliers to ensure that the expected benefits are achieved.

2. Rainwater supply and water efficiency measures

WGV homes are targeting a 60%-70% reduction in mains water consumption across the various typologies. This equates to 30kL - 40kL per person per year, in contrast to the Perth average of 106kL per person per year. Key mains water saving initiatives include a community bore irrigation supply for use in both public and private gardens, as well as lot-scale rainwater harvesting systems for toilets and washing machines. There will also be advanced water efficiency measures and real time monitoring in the homes, which are outlined in the Estate design guidelines.

Design guidelines for indoor water efficiency

DEVELOPMENT CONTROLS:

- All shower fittings to be minimum 3 star WELS rated maximum 7.5L/minute consumption.
- All WCs to be minimum 4 star WELS rated.
- All basin taps are to be 6 star WELS rated.
- All other taps excluding outdoor and bath taps to be 4 star WELS rated.

DESIGN GUIDANCE:

- Consider selecting 4.5 Star WELS rated dishwasher and 4 star WELS rated washing machine.

Design guidelines for alternative water sources

DEVELOPMENT CONTROLS:

- All toilets and washing machine cold taps are to be installed with dual plumbing to allow for the future connection to an alternative water source (e.g. rainwater), without breaking the fabric of the building.
- Provide sufficient space for future installation of a rainwater tank (minimum capacity of 3,000L) close to a rainwater down pipe/s with a minimum roof catchment area of 70sqm, an external power outlet, a garden tap or mains water take off point, and the dual plumbing pipe work. The supply and installation of a 3,000L rainwater tank is available through the sustainability package.

DESIGN GUIDANCE:

- Install a 3,000L rainwater tank with pump and mains water backup valve connection to the dual plumbing as an alternative water source.

3. Passively irrigated trees and water efficient landscapes

Water sensitive landscaping features have been integrated into the public and private realm across the site, including:

- Water wise trees, shrubs, and lawn varieties incorporated into public areas;
- Four passively irrigated street trees are being trialled which benefit from stormwater runoff from the road for irrigation;
- A list of suitable Waterwise plants is provided to residents within the WGV Design Guidelines to assist residents with their own gardens;
- Guidance is provided for water efficient planting techniques, irrigation and creation of permeable surfaces; and
- As part of the sustainability package, homeowners were also offered a large (100L pot size) semi-mature shade tree for their backyard which will be managed for the first year.

BACK TO MENU

Design guidelines for water efficient gardens

The adoption of water efficient technologies will help you to establish a successful water efficient and low maintenance garden. All lots will be serviced by the community bore which will provide groundwater for irrigation.

DEVELOPMENT CONTROLS:

- An automatic irrigation system including a rain sensor using a programmable controller must be connected to the purple meter provided by LandCorp. The water source for the purple meter will be supplied by a community bore that will operate during set time periods. The bore will not operate during the Winter Sprinkler Ban or on days where sufficient rain has occurred.
- Water efficient in-line drip irrigation must be installed for all garden beds.
- Private water bores are not permitted.
- Any outdoor swimming pool or spa must be supplied with a cover that reduces water evaporation and is accredited under the Smart Approved Watermark Scheme.
- Indoor and outdoor taps must not to be connected to the community bore supply.
- Spray irrigation may be used on turf areas only.

DESIGN GUIDANCE:

- Consider establishing irrigation for the first two summers and then for extended dry-hot periods only.
- Consider adopting hydrozoning principles which involves grouping plants with similar water needs together in an effort to be more water efficient.
- Consider incorporating irrigation control technologies such as evapotranspiration sensors or soil moisture sensors to ensure efficient watering of landscaping when community bore system is active or operational.
- Consider grading to create micro swales and basins to help to recharge the soil moisture and reduce run off from stormwater.

Technology focus:
Passively irrigated trees

What is it?

A tree pit irrigation system that collects stormwater road from the adjacent road and directs it to the soil base of a tree to support healthy soil moisture levels and increased tree health and canopy growth.

Four trial trees have been designed with City of Fremantle for inclusion in White Gum Valley. The trees are placed adjacent to stormwater pits, allowing stormwater to infiltrate into the soil base, supporting the tree. The free-draining soils in this part of Perth mean that underdrainage is not required

What are the benefits?

- **Alternative water use**: Stormwater runoff is utilised for irrigation of trees.
- **Stormwater infiltration and treatment**: Stormwater is captured in the soil system, and filtered before it infiltrates into the groundwater system. This prevents pollution of groundwater resources, while also managing urban stormwater runoff.
- **Healthy trees and canopy**: Irrigation of trees supports healthy canopy growth.
- **Food production**: The public trees planted at White Gum Valley include citrus and fruit trees which provide local food resources for the community.

Passively irrigated street tree adjacent to the Gen Y House

↓

4. Communal bore for garden and open space irrigation

A major innovation for the site was the creation of a community bore for irrigation of public and private green spaces. While there was a licensed groundwater bore already on-site for irrigation of the school's open space in the land's previous use, the creation of supply to private lots is a unique water supply model. City of Fremantle will operate the system and become a water provider for the scheme, with the community potentially managing the system in the future. Water use will be separately metered at each lot, but residents will be charged for the supply under a special area rates zoning.

"I just love that we have permanently designed garden settings that will be waterwise forever, and the concept of third pipe schemes so we can substitute potable water with community bore water is a great concept" — Sue Murphy, Water Corporation

Technology focus:
Non-potable supply for irrigation from a community groundwater bore

What is it?

A groundwater bore is used to pump out groundwater for irrigation use on-site. The bore supplies both public and private realm irrigation, meaning that a connection is provided for use in individual properties. A total of 5000kL/annum is supplied by the scheme, with 2000kL supplied to open space, and 3000kL supplied to individual properties. A non-potable distribution (purple pipe) system like this will be one of the first to be operational in Western Australia. Groundwater is only supplied directly to the irrigation system, not to the garden tap, to minimise any risk. For the first two years of operation it will be managed by LandCorp, after which time the council (City of Fremantle) will take over operation.

What are the benefits?

- **Open space and landscape irrigation from an alternative source**: Groundwater supply (where less is extracted than infiltrated) will be used to support green spaces and trees on site, providing amenity and microclimate benefits.
- **Property water use reduction**: The irrigation supply to gardens will significantly reduce the potable water demand of households.

↑

Community groundwater bore pump house and storage tank (February 2017).

BACK TO MENU

5. Landscaped infiltration basin and on-site stormwater retention

Stormwater runoff from a 12ha catchment (excluding the WGV site) currently drains to an infiltration basin or sump located adjacent to the WGV site. Infiltration basins are common features in the Perth urban landscape, ensuring that stormwater is infiltrated into the ground to reduce drainage requirements. Unfortunately, these assets often become maintenance burdens for councils and unsightly blights on the landscape for local communities – fenced off, with steep sides and overgrown with weeds they are regarded as unsafe and an attractor for anti-social behaviour. The infiltration basin alongside the WGV site became a key water management innovation for the site, even though it doesn't manage stormwater from the site itself. Instead the WGV development includes retention of a 1 in 20 ARI storm on-lot and infiltration galleries within the street network to manage a 1 in 100 ARI event.

Proposals from the design team led by Josh Byrne & Associates included the landscaping of the basin as a community asset while maintaining its current drainage function and infiltration capacity. The proposal considered examples of infiltration cells used by other local authorities, which became a key part of the business case. A major driver for the conversion of the sump was the creation of a usable public open space and the increase in tree canopy. The conversion required significant capital investment which was funded by LandCorp and City of Fremantle. The total cost of $500,000 included $450,000 for civil works and the storage cells, and a further $50,000 for landscaping. The business case for LandCorp was the creation of a new amenity for the development and both existing and new community residents while for Council it was an opportunity to demonstrate best practice and create a new community asset.

↑

On-site information board for the landscaped infiltration basin

Technology focus: Landscaped infiltration basin

What is it?

An infiltration basin collects stormwater from urban environments and allows it to gradually soak into the ground where permeable soils allow. A useable landscape can be created on the surface of an infiltration basin by including underground storage, and above ground storage which will only be engaged during high rainfall events when the landscape provides a dual function. Given the infrequency of these events, the landscape can support public amenity and greening most of the time.

What are the benefits?

- **Multifunctional landscape:** The basin becomes a useable public open space, providing amenity, habitat and canopy cover for the local community to enjoy.
- **Flood mitigation:** The basin provides storage of urban stormwater flows.
- **Groundwater recharge:** Stormwater is infiltrated into the ground to replenish groundwater resources

Bubble-up pits installed in the basin where water can rise into the aboveground storage area once the underground storage area is full

→

Constructed above ground landscape (July 2016), with the WGV construction site on the left. The wooden pole in the foreground has depth measurements to provide a reference and interpretation during flood events.

→

The outcomes

1. Sustainability accreditation helped to communicate and benchmark achievements, improve reputation and ultimately sales.

WGV achieved several accreditations in recognition of the sustainability initiatives applied on site:

- Western Australia's first residential project to achieve national recognition and the second project in Australia and 11th in the world to achieve International Endorsement as a One Planet Community through OPL. The 2016 assessment of progress against One Planet Living targets is available here.
- Water Corporation's Waterwise Development endorsement. WGV will be subject of a three year monitoring program as a waterwise development exemplar.

Stakeholders recognised that the use of a sustainability certification framework like OPL helped to identify different elements of best practice design that could be taken forward as well as missed opportunities to go back to. The use of a framework was critical for communication, clarity and understanding – providing a benchmark to work to. It was felt that the frameworks allowed collaborators to better communicate and authenticate the value of different initiatives to the project team, and to business case managers that needed to sign off on any initiative that was beyond business-as-usual.

The well-articulated sustainability initiatives helped to "sell" the project to relevant stakeholders and to create buy-in to the initiatives. LandCorp felt that the profile and international recognition of the project helped with sales.

"It was a way for us to record some of the really good stuff that we were doing... eventually it did become something that's marketable and promotable, and helps tell the narrative about the project in a visually accessible way" — Warren Phillips, LandCorp

"There is a real sense of pride in the Fremantle community that there is a development of this quality and that Fremantle is showing national leadership in terms of what a sustainable community can look like" — Mayor Brad Pettitt, City of Fremantle

VIDEO
Innovation through demonstration at White Gum Valley
https://youtu.be/n_7f_ynBw8I

→

WGV lots sold well, with sustainability a key marketing factor for some developments.

→

2. Award-winning example of sustainable medium density infill housing

WGV is a recognised model of good practice medium density development for Western Australia and nationally, and it has received a number of awards recognising its approach and sustainability initiatives, including:

- Planning Institute of Australia Award for Excellence: Best Planning Ideas - Small Project (WA);
- Planning Institute of Australia Award for Excellence: Planning Minister's Award;
- Planning Institute of Australia's National Award: Best Planning Ideas - Small Project;
- Judges' Award at the UDIA Awards for Excellence 2016;
- 2016 Australian Urban Design Awards: Australia Award for Urban Design, Policies, Programs and Concepts - Small Scale; and
- Finalist in the 2016 Banksia Sustainability Awards.

3. Creation of a new model that can be replicated in other developments

The White Gum Valley development demonstrated a number of water sensitive city concepts that can now be applied elsewhere. Through demonstration, the project has created a precedent to be followed, where the hard work has already been done to develop a model for design, governance and delivery. Key replicable initiatives include:

- The creation of community bore non-potable network, where the council acts as a local water supplier under a water supply exemption and recoups costs through a special area rate charge;
- The retrofit and transformation of an infiltration basin (or sump) as a multi-functional landscape;
- The use of a sustainability upgrade package to encourage residents to buy into initiatives including a rainwater tank, solar energy and mature shade trees; and
- The reduction of potable water use in a household to 60-70% below the average for Perth.

"The community bore provides a governance model that can be replicated. WGV is the first development where there has been a proper, ongoing model that is not only environmentally sustainable, but is also sustainable from a governance and financial perspective because it is wrapped up in well-thought and documented local government frameworks. This is likely to become the 'new norm' " — Mayor Brad Pettitt, City of Fremantle

Stakeholders have seen the value in these demonstrations and are actively exploring opportunities to replicate them elsewhere. City of Fremantle and LandCorp are currently exploring an opportunity to implement a community bore on a larger scale in the Knutsford development in Fremantle and scale-up some of the learnings from WGV. The Council is also actively looking to share the learnings with other local governments.

City of Fremantle is also identifying other potential sites for sump conversions, and has developed a program where these conversions will be rolled out over the next few years.

LandCorp expects that WGV will set a new benchmark for developments within LandCorp and will also set an expectation from councils in Perth.

"The beautification of the sump demonstrated what we could do with a range of sumps all over the city. There's a real opportunity for seeing how this worked - it was a learning process that actually might be played out in terms of retrofitting more of these across the city" — Mayor Brad Pettitt, City of Fremantle

"Councils are expecting more. The more these projects happen, the more likely the next Council will insist on the incorporation of innovative features such as landscaped swales and underground systems into new developments as business as usual" — Warren Phillips, Landcorp

4. A living laboratory for further learning

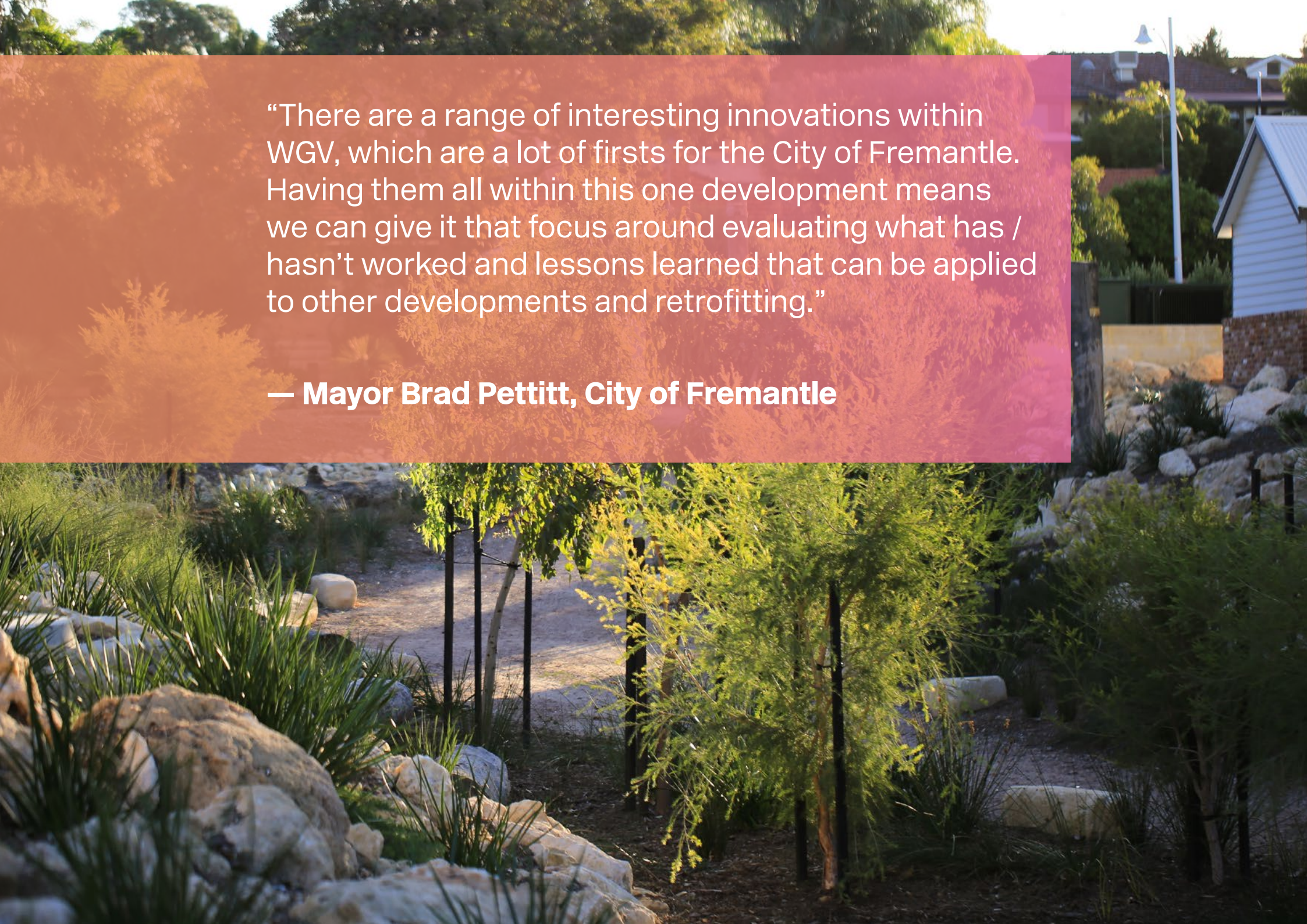
The learning from WGV will continue after construction. The project has received funding from Water Corporation's waterwise program for ongoing monitoring, and this has been expanded with support from other stakeholders including LandCorp, Department of Water, City of Fremantle and the CRC for Water Sensitive Cities. The monitoring programme includes:

- Monitoring of real-time water use in households to validate the potable water use reductions planned for the site;
- Metering of the community bore water use and groundwater levels; and
- Monitoring of water levels in the infiltration basin.

The monitoring of water initiatives is complementary to a 'living laboratory' program of monitoring and information sharing on energy and carbon related initiatives led by the CRC for Low Carbon Living. The combination will provide reference data for sustainability initiatives which can then inform future best practice.

"WGV presents an amazing opportunity to showcase not only water innovations in terms of design and technology but also an opportunity for us to capture data and share data and have this as a shared learning exercise like no other project that is happening certainly here in Western Australia but perhaps also nationally" — Josh Byrne & Associates

"With these types of demonstrations, try to get as much out of it as you possibly can, not only the good publicity about it, but also some of the fundamental science inputs to it" — Greg Claydon, Department of Water



"There are a range of interesting innovations within WGV, which are a lot of firsts for the City of Fremantle. Having them all within this one development means we can give it that focus around evaluating what has / hasn't worked and lessons learned that can be applied to other developments and retrofitting."

— Mayor Brad Pettitt, City of Fremantle

Summary of the outcomes

Cities as water supply catchments

- The site demonstrates waterwise principles, driving an expected 60-70% reduction in potable water use in homes in the development compared with the average Perth household.
- Alternative water sources are supplied for open space irrigation, garden irrigation (groundwater) and indoor toilet and laundry use (rainwater).

Cities providing ecosystem services

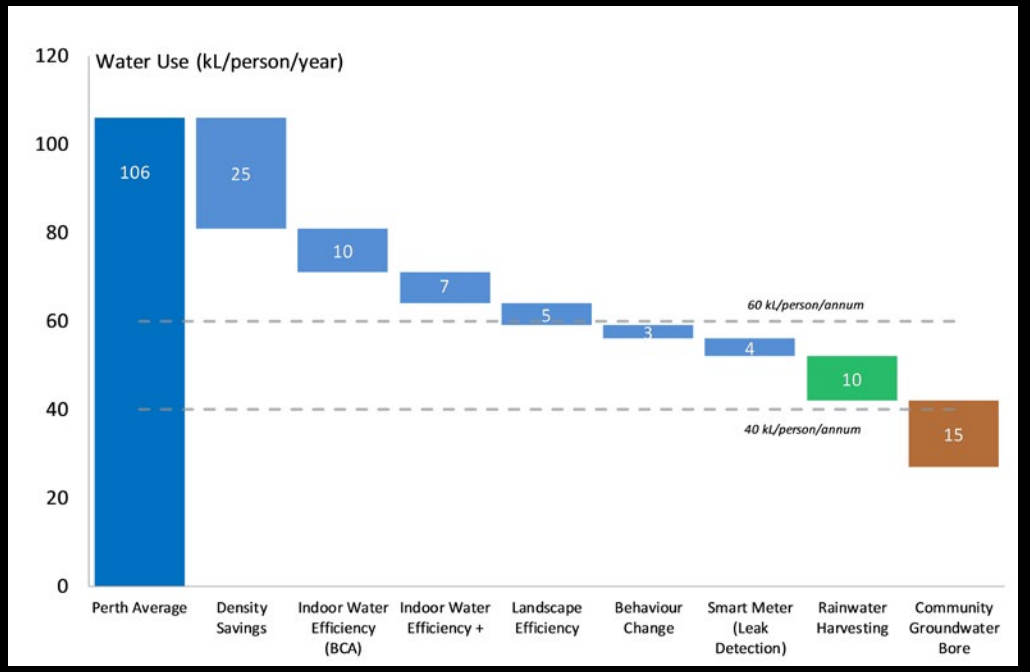
- A 2000m^3 infiltration basin is converted to a community landscape, providing amenity, habitat and canopy cover.
- The landscape is being designed to incorporate water sensitive urban design and water efficiency measures to enhance amenity and microclimate in a Perth climate.
- Four trial street trees incorporated passive infiltration from road runoff.

Cities comprising water sensitive communities

- Real-time monitoring of household water use will promote understanding of water use patterns and assist in future learning.
- Communities buy in to sustainability features on-site through compliance with design guidelines and incentivised investment in water and energy measures for their home.
- Home builders use sustainability as a selling point.

VIDEO
Integrated urban water management
https://youtu.be/Uv7CdBBgyJo

→



Anticipated water savings compared with Perth average (Credit: Josh Byrne & Associates)

→

The challenges

BACK TO MENU

1. Managing risk in the design of the landscaped infiltration basin

The proposal for the landscaped infiltration basin represented a significant change of practice in Western Australia, creating usable public space combined with a water management asset. To maintain the functionality of the basin, storage needed to be provided below the ground surface, at a significant depth to intercept local drains. While no records were available to demonstrate the basin filled regularly, modelling indicated it was undersized for its catchment. There were several risk factors that needed to be addressed by design and discussed with the council who take ultimate responsibility for the operation of the basin.

A risk management strategy was put in place to ensure the asset remained safe and functional. The strategy ensured design maintained current storage capacity and that the space was overlooked through passive surveillance. It also included a maintenance pathway and incorporated gross pollutant traps to prevent blockages. Active monitoring of the sump levels is being undertaken to observe its performance. A recent 1 in 50 ARI storm in Perth caused the basin to fill to 1.2m, showing that flood modelling for the sump was overestimating flows. Depth meters have been installed to provide ongoing monitoring.

Discussion around risks and design solutions were underpinned by precedent studies, highlighting good practice examples from elsewhere and similar conditions where a certain design response is considered suitable. For example, there was a question as to whether the site should be fenced because of its steep sides and possible presence of water. The example of the publicly accessible rock causeways in Fremantle Harbour was a reference point to question this.

Construction of the storage cells under the sump landscape (Credit: Josh Byrne & Associates)

Constructed aboveground landscape (February 2017), with the SHAC building nearing completion on the left. The maintenance pathway through the basin is used as an informal pathway for the local community.

2. Governance model for community bore water supply

While councils and other open space managers commonly utilise bore water for irrigation of their own open space assets, there are regulatory barriers regarding the supply of a water source to individual property owners by an external party. To do this, an external body would have to act as a retail water service provider and comply with the regulations and requirements of such a retailer around water quality and health protection. The proposal to extend the bore supply on site to supply individual household garden irrigation therefore require an external party to become a supplier and an exemption to be granted under the Water Services Act 2012. As the State water retailer, Water Corporation could have operated the scheme, but it was not of a scale to justify their involvement. Scale can often be a barrier to the governance of decentralised non-potable water supply schemes, but WGV has created a possible model for governance.

City of Fremantle became the preferred operator for the scheme, given their familiarity with running similar bore supply schemes for irrigation of their own assets. The Department of Water played a key facilitation role in engaging and gaining approvals from relevant stakeholders and the Water Minister to obtain an exemption from the water provider licence under the Act. The Department of Water determined that the use of the bore was considered low risk in terms of water quality and the impact on groundwater resources, and importantly, as the council was the proposed manager, there was a range of checks and balances already in place.

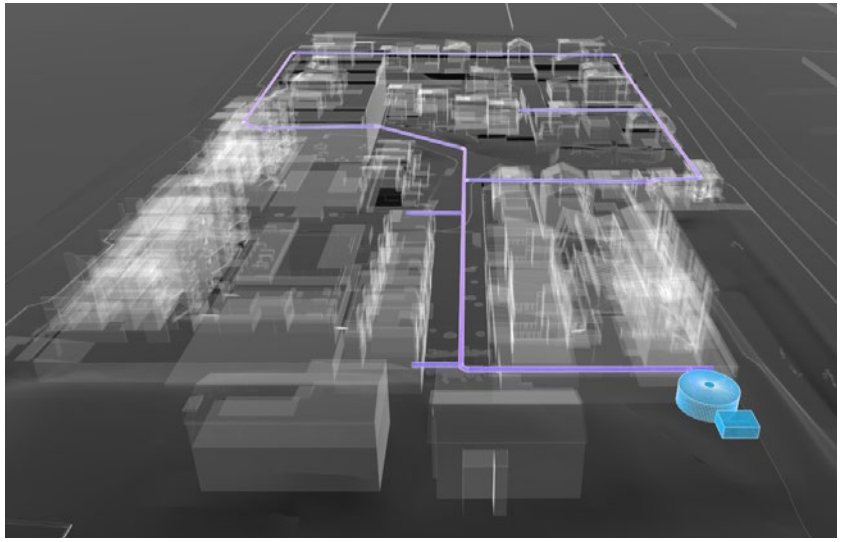
It was recognised that it was unreasonable to require ongoing monitoring of water quality data as the costs would have been unfeasible at this scale, however there are still ongoing operational costs. While there was initially some reluctance from council officers to take on service provision that was traditionally outside their remit, support from council leadership encouraged take-up of the idea. Through discussion, a rate model has been developed whereby the council can recoup operational costs through a special

“There’s still a challenge in Perth in terms of who’s prepared to take on recycled water systems, whether in smaller communal developments like WGV or larger, precinct developments” — Greg Claydon, Department of Water

BACK TO MENU

area rate amounting to $300/year instead of directly charging residents for water use. At the moment LandCorp are setting up and operating the scheme, and will handover to council once the development is complete. Efforts are being made to make sure the system's operational requirements are well-documented and that there is an official handover and training of council staff. It has also been highlighted that the management could be outsourced in the future and still funded by council rate contributions, providing flexibility in governance.

The water licensing exemption for WGV sets a precedent, and it is likely that community bores managed by local councils would be awarded a similar exemption under the Act in the future. Usually this is done case-by-case, but if multiple applications are received by DoW there is potential for a class exemption for community bore schemes run by local councils. However, it should be noted that groundwater use isn't suitable everywhere and needs to be considered within a framework of sustainable groundwater use.



Visualisation of community bore network (credit: LandCorp)

→

Community bore controls (credit: Josh Byrne & Associates)

→

3. Managing loss of tree canopy on site

Before development, the site benefitted from substantial tree cover, which was important to the local community and the council. Efforts were made to retain as many mature trees as possible, with 37 out 155 trees retained on-site, including the best specimens. Using the OPL sustainability framework enabled a clear communication of ideas, and helped to ease community concerns and provide assurance to the local authority that all was well-thought through and helped with planning approval. Extensive community engagement and a sensitive approach to design and planning was needed to address concerns of the local community on this issue. Initiatives like the creation of the landscaped infiltration basin and the trial of passively irrigated trees helped to show the development could give back greenery and open space, resulting in a mature tree canopy which will match pre-development coverage.

The lessons

This project demonstrates...

- **A 60-70% reduction in potable water use is possible**: Through a combination of water efficiency measures and alternative water source supply (rainwater and groundwater), substantial changes in potable water demand are expected for the site, and this will be measured through metering.
- **Infiltration basins can be transformed into valuable public landscapes**: A precedent for the retrofitting of infiltration basins has been made, creating a valued public landscape while minimising risk through design.
- **Councils can provide water supply services to support communities**: A governance model has been developed for the site, whereby the council will own and operate a community bore supply which provides groundwater for irrigation of private gardens. A special area rate will be used to fund the scheme.
- **A new model for development can be delivered through collaboration**: By aligning the interests of the developer, consultants, water utilities and regulators, a new benchmark in development has been developed in Western Australia.
- **Sustainability frameworks provide a platform for recognition**: An important communication and benchmarking device was the use of the One Planet Living framework and the Waterwise programme. These facilitated buy-in from stakeholders and provided a unique marketing angle for the development.
- **Buyer education is essential to adoption of initiatives**: Design guidelines played a key role in communicating sustainability initiatives and creating an expectation of a two-way commitment between buyers and LandCorp.

Reflections and what to work on next time...

- **The presence of persistent and passionate champions is important to drive change**: Many of the initiatives in WGV were driven through the actions of individuals and their persistence.
- **Leadership is important**: Leaders within LandCorp, City of Fremantle, Department of Water and Josh Byrne & Associates played a key role in highlighting this project as a showcase and in giving others confidence in taking initiatives forward.
- **Engaging the community in a meaningful way will ensure long-term support**: While there were initial concerns from the community over the type of development and loss of tree cover, by engaging the community in the vision for the site, WGV is now an exemplar that the local community takes pride in.
- **Ongoing learning and data collection is important**: The site has currently secured support for ongoing monitoring of key sustainability initiatives. The creation of data and feedback to industry is important to validate initiatives and transfer lessons to others.

"Don't be afraid of having the conversation and exploring the options, and trying new things out. Also, don't be afraid to learn, use, and adapt what others have done. A lot of others have gone down this route and we've certainly learnt from what didn't work - that's just as important" — Mayor Brad Pettitt, City of Fremantle

"It's important to get the proponent and various decision-making agencies together sooner rather than later and to try and do that in a collaborative way" — Greg Claydon, Department of Water

For infill developments, “we need to expect more, and always question business-as-usual …“If we are going to create more liveable, healthier environments within infill areas, then we have a responsibility to be very careful with public realm design and work to create spaces of better quality”

— Josh Byrne, Josh Byrne & Associates

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: July, 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