

# GREEN INFRASTRUCTURE CASE STUDY: MEDIUM DENSITY RESIDENTIAL DEVELOPMENT CHRISTIE WALK, STURT STREET, ADELAIDE

*Green infrastructure is a green network - of green spaces, street trees and other vegetation (including wetlands, rain gardens, and green walls and roofs) - strategically planned, designed and managed to support the liveability, sustainability and resilience of an urban area. Green infrastructure is integrated, connected and multifunctional. It is integrated with development and other infrastructure, it links existing and new green assets across the public and private realms, and it provides multiple social, economic and environmental functions. Green infrastructure is essential infrastructure for our cities and towns.*

*This is one of a suite of case studies demonstrating how various types of green infrastructure were planned, designed and delivered, how they're maintained, and the challenges and lessons along the way.*

## PROJECT OVERVIEW

Initiated by Urban Ecology Australia (UEA) in 1999, Christie Walk is a 'nature and people-friendly' co-housing development in Sturt Street, Adelaide where residents share ownership and responsibility for the common areas. Built on a former recycling depot, the brownfield development comprises 27 dwellings, including four three-storey townhouses, a three-storey block of six apartments, four individual two to three storey cottages, a five-storey apartment block, and extensive communal open/green space.

Much has been written about Christie Walk, notably about its environmentally sustainable design and built features. Less has been written about its green, or living, infrastructure, which is the focus of this case study.

Christie Walk is distinctive for its high level of greenery. Landscaping weaves between the buildings, vines climb up the walls, hanging plants cascade down staircases and over balconies, and pot plants fill courtyard gardens. There is also a large vegetable garden between two of the townhouses and a roof garden on top of the central three-storey apartment block. In fact, almost every available piece of outdoor space (on both the horizontal and vertical planes) has been vegetated. Along with the lack of fences, the overall effect is of being enveloped in an urban forest.

## ABOUT THIS SITE

### ORGANISATION

Christie Walk Joint Venture

### FINANCIAL PARTNERS

Christie Walk Joint Venture (Wirranendi Inc in assoc. with EcoCity Pty Ltd); funded by the initial residents and investors, and building mortgage from Bendigo Bank

### SETTING

Medium density residential development

### GREEN INFRASTRUCTURE FEATURES

Extensive landscaping including 25+ fruit trees  
c. 55m<sup>2</sup> in-ground vegetable gardens  
50-100% vegetation cover on vertical planes  
c. 150m<sup>2</sup> roof garden



Green facade

Stormwater harvested from the roofs and hard surfaces supplies two thirds of the water for irrigating the gardens and toilet flushing.



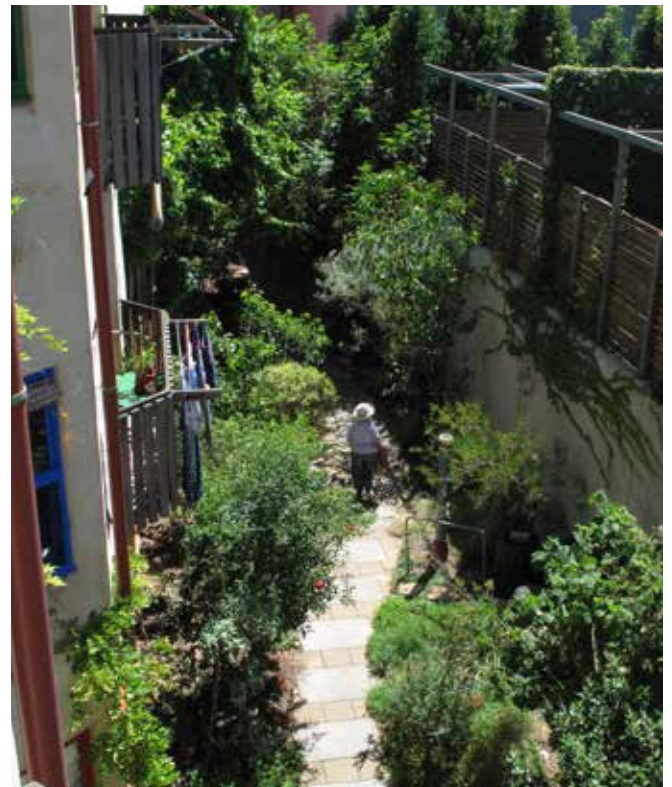


## PROJECT DESIGN

Architect, Paul Downton, planned green infrastructure as an integral part of the development right from the start - to assist with energy efficiency, liveability and biodiversity. A key way this was achieved was by minimising the space devoted to cars – driveways and car parks - which released a lot more ‘plantable space’ than a business-as-usual medium density development. There are only two short driveways, one on the northern and one on the southern side, and only 11 parks for the 27 dwellings. Where there would otherwise be a driveway in a conventional medium density development, there is instead a densely planted garden with a path weaving through it. Used thus, it makes a significant contribution to the development’s green cover and habitat value, and provides shade, privacy and pleasure for residents and visitor alike. Shrouded by trees and shrubs, walking along the path creates the impression of entering a ‘secret garden’.

The development’s green infrastructure evolved organically. The initial plantings consisted of fast-growing, short-lived pioneer species (e.g. wattles), along with plants transplanted from the first residents’ old gardens and their favourite plants. As new residents moved in, and through trial and error, the gardens changed over time. As a result, they feature an eclectic mix of native and exotic plants of all shapes and sizes; from ground covers to an unexpected (due to being incorrectly labelled) Tasmanian Blue Gum in the main car park, which is nearly as tall as the five-storey apartment block!

In addition to the aesthetic plants, there are over 25 productive trees – including five in the roof garden - a large communal vegetable garden (mainly leafy greens) and a smaller herb garden on the roof. Various herbs are also



*The path that meanders throughout the development. A number of ‘roundabouts’ with bench seats act as meeting points or places of quiet contemplation.*

scattered throughout the gardens, including parsley, thyme, marjoram, oregano, sage, rosemary, bay tree, lemon verbena, lemongrass, lemon myrtle, mountain pepper and perennial basil, and chervil, basil and coriander in season.

*“This is a very small site, but it’s got gardens running all the way through and over, onto the roofs, and up the walls, and I think that is the way cities should be. And when they are like that...the density... suddenly becomes acceptable because you are living in a walled garden.” Paul Downton, Architect*



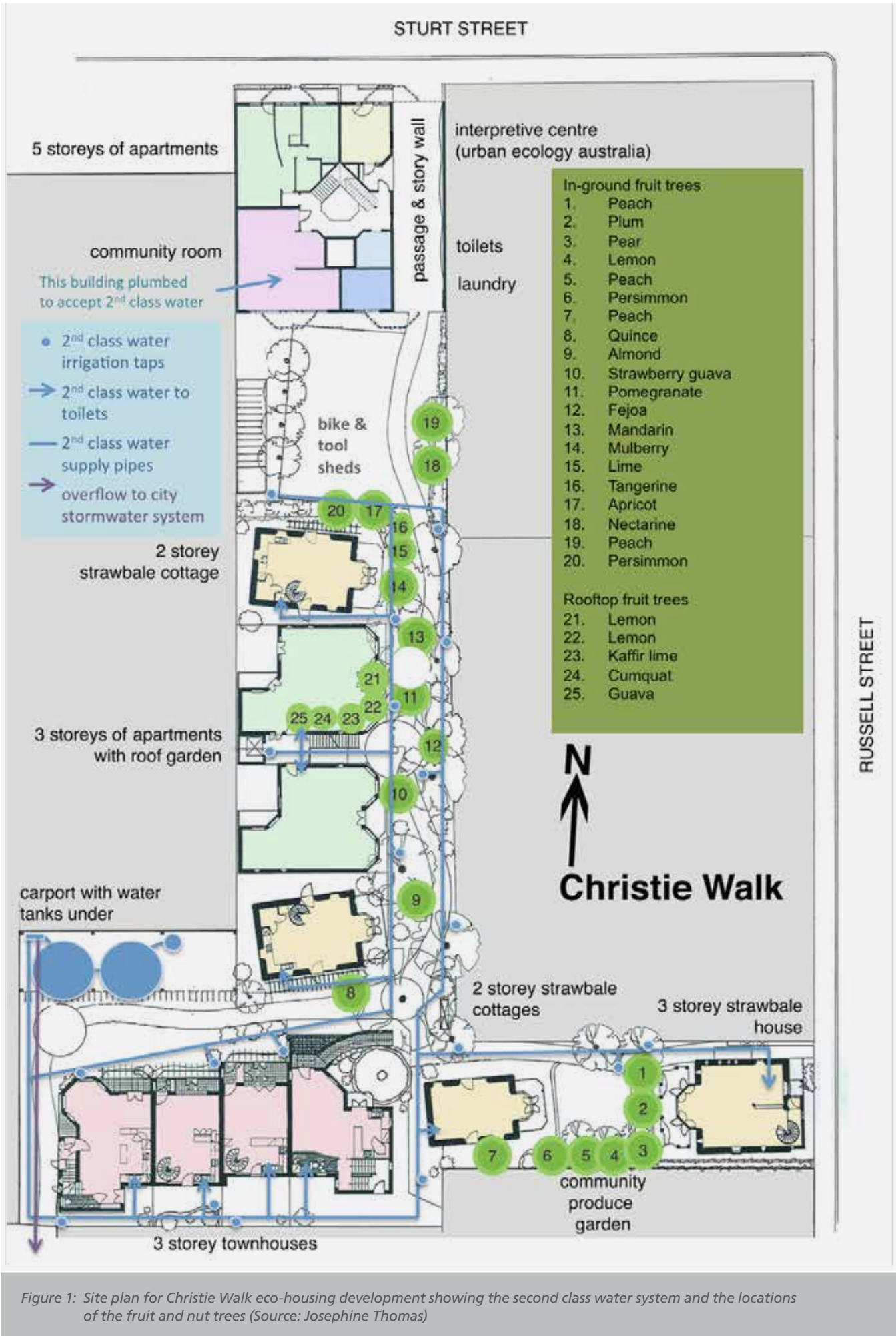


Figure 1: Site plan for Christie Walk eco-housing development showing the second class water system and the locations of the fruit and nut trees (Source: Josephine Thomas)

All the residents (and some neighbours as well) share in the harvest, regardless of whether it is the 'fruit of their labour' or not.

The courtyard and balcony gardens are cared for by the respective residents; ground level gardens are generally looked after by adjacent townhouse and apartment dwellers, while all the other gardens are tended communally. As a result all the residents are involved in gardening to some extent. There are just over 40 residents at Christie Walk, which has proved to be a critical mass to maintain the gardens.

Chemicals are avoided as much as possible other than sulphur spray to control mildew on the edible grapes, and baiting of snails. Rather, weeds are simply pulled out and pests are controlled by companion plants, lady birds or removing caterpillars and bugs by hand. Kitchen scraps are composted (in just 8 weeks, with regular turning) and used to feed the fruit and nut trees and vegetables and herbs.

The productive trees, along with a deliberate multi-tiered structure (i.e. upper, mid and under –storey) provide food and habitat for various native birds, including magpies, welcome swallows, New Holland honeyeaters and a pair of resident Eastern rosellas that have nested in one of the provided nesting boxes for several years. The residents have a 'compact' with the birds; they can eat the produce from the top third of the fruit and nut trees, and the birds generally keep their end of the bargain!

## ROOF GARDEN

The roof garden, on top of the central three-storey apartment block, not only insulates the building from direct sun but also provides a restful and productive green space within the building footprint.

Roof gardens are typically planted with low-growing hardy native grasses, sedges and herbs or tough exotic plants such as sedums, and managed by specialists. The Christie Walk roof garden, on the other hand, is managed entirely by the resident community and is remarkable for supporting a multi-tiered structure, including citrus trees, native trees, shrubs, herbs, grasses, including:

- Lemon and cumquat trees on dwarfing root stock; common guava, kaffir lime
- Native trees: silver princess (*Eucalyptus caesia*), golden wattle (*Acacia pycnantha*), silver cassia (*Senna artemesioides*).
- Native grasses and shrubs: native flax lily (*Dianella revoluta*), salt bush, grevillea, Geraldton wax, bottlebrush, kidney weed (*Dichondra repens*).
- Native climbers on the perimeter fences: coral vine (*Kennedia coccinea*), native lilac (*Hardenbergis violacea*), old man's beard (*Clematis microphylla*), climbing guinea flower (*Hibbertia scandent*).

## TECHNICAL FEATURES (See Figure 2)

- Load-bearing perimeter walls of 300mm aerated concrete blockwork and two internal columns running from ground to roof
- 2 x 200mm x 4m concrete slabs
- 400mm surrounding upstand with 7 drainage holes
- 2 layers bitumised waterproof membrane
- 19mm sand
- 30mm concrete edging pavers
- "Flownet" polyethylene mesh
- geotextile fabric
- 350mm growing medium (lightweight soil from Jeffries Soils)
- Mulch and compost to feed the soil and improve its moisture holding capacity.
- Clay paver paths to delineate pathways from gardens
- Microspray irrigation system
- Small pond
- Six photovoltaic (PV) panels (totalling 1.1 kW) on the pergola over the staircase

(Source: Paul Downton, Architect)



- Vegetables and herbs: warrigal greens, parsley, basil, rosemary, rocket, sage.
- An irrigation system utilising microsprays keeps the roof garden watered with recycled stormwater twice a week during summer.

There is also a beehive and a small pond that provides water for the birds and bees.

Roof gardens provide much needed green space in urban environs and good insulation – protecting the building from direct sun and stabilising the building's temperature.



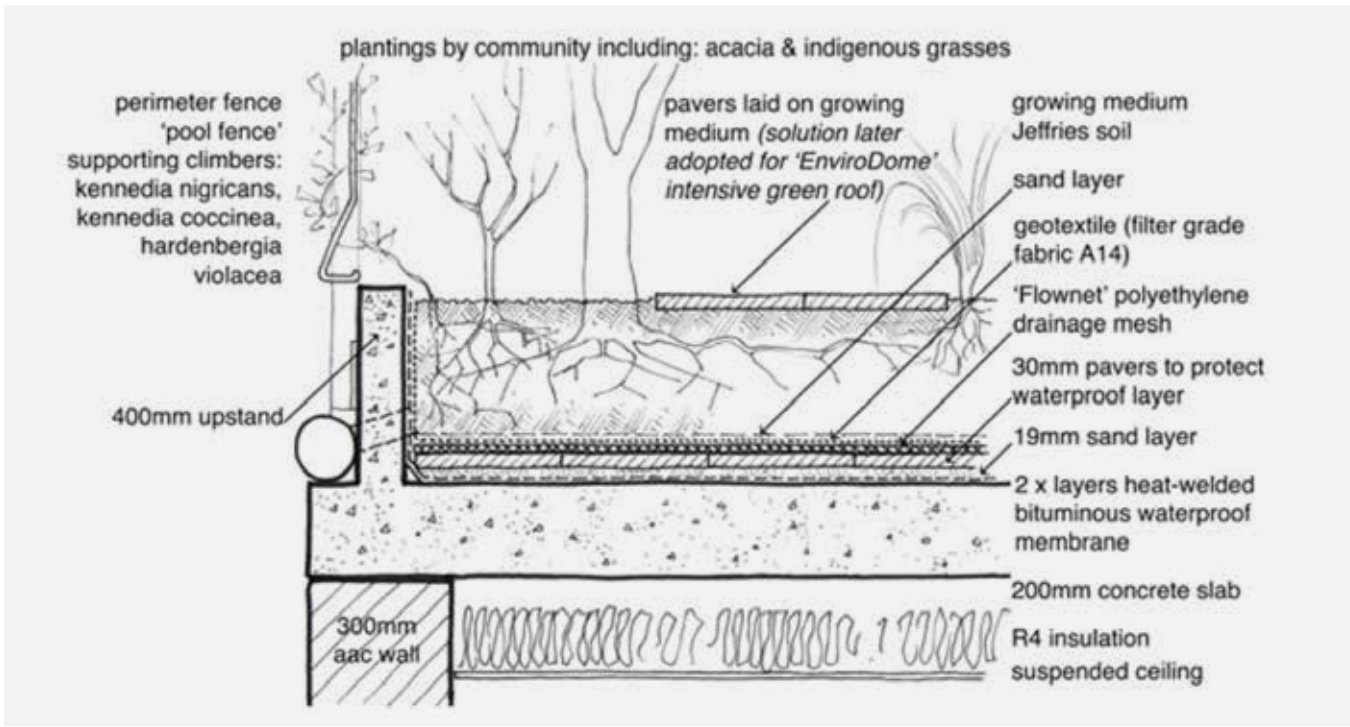


Figure 2: roof garden

## WATER COLLECTION AND DELIVERY SYSTEM

Surface runoff and roof water are harvested, filtered and stored in two linked concrete tanks (maximum storage capacity is c. 44,000L) located beneath the southern carpark.

Clean stormwater is pumped to more than 12 garden taps, as well as the rooftop garden and toilets in the straw-bale cottages, townhouses and three-storey apartments (see Figure 1).

The system has mains water back up. This minimises mains water use while ensuring that there is always water for the toilets. Three non-return valves, including one on the mains connection to the tank, prevent the clean stormwater entering the mains water system.

Solar panels on the pergola above the roof garden produce more than enough electricity to offset that used for pumping the stormwater around the site, and also generate income that goes into a community fund for 'green' projects such as extra PV panels.

Modelling by Goyder Institute estimated that the stormwater recycling scheme could meet 2/3rds of the water demand for toilet flushing and garden irrigation<sup>1</sup>.

<sup>1</sup>Tjandraatmadja, G., Cook, S., Sharma, A., Chacko, P., Myers, B. and Pezzaniti, D. 2014 Water Sensitive Urban Design Impediments and Potential: Contributions to the SA Urban Water Blueprint Goyder Institute for Water Research Technical Report Series No. 14/16, Adelaide, South Australia.

## WATER SYSTEM TECHNICAL FEATURES

- Wet drains that stay full of water, at the Sturt Street end of the development.
- Two submersible pumps and two level sensors in the western tank
- The delivery pump is set to 350kPa, which is sufficient to lift water to the rooftop garden
- A high level sensor activates the overflow pump to discharge excess water to the adjacent street spoon drain when the tanks are nearly full
- A low level sensor activates a valve to supply the tank with mains water if the water level drops to c. 30cm
- Once the level rises to 15-20cm above this minimum, the solenoid switches off the mains supply
- Six grates covered with fine mesh to screen debris, around the site allow access to the stormwater collection system

(Source: Christie Walk residents' guide to the stormwater system)

## CHALLENGES & LESSONS

- Christie Walk residents share common values and there is a strong sense of community. This manifests in the high level of stewardship of the green infrastructure and stormwater recycling system, and ensures they are kept in good condition.
- The residents' governance model, which includes the formal Strata bodies and office bearers and a series of working groups, enables residents to undertake structured and scheduled garden maintenance with minimal effort by any one person. Internal documents like the residents' guides, the to-do list in the common area, the "Christie Walk stormwater system: a user's guide", even a YouTube video on how to open the 'Gatic' covers to the system, provide detailed instructions that give confidence to residents to undertake maintenance and deal with emergencies. This also provides quality assurance maintenance activities are done to specifications every time regardless of who is responsible on any given day.
- The site and in particular the walkway is quite shaded by the adjacent apartments so it has taken a fair bit of trial-and-error to find plants that can tolerate the shade.
- Due to the confined space, frequent pruning and trimming of plants, both in the ground and in the roof garden, is necessary. The prunings are stockpiled and gradually fed into residents' green (waste) bins, or the green bin of a friendly neighbour.
- A number of plants have had to be removed because they grew too big, including a gum tree and native pine in the roof garden, and a White Cedar, which was replaced by a crab apple. On the other hand, a silver princess (*Eucalyptus caesia*) beside the central apartments was just pruned back so it could continue to provide a perch for resident and visiting birds.
- Climbers were originally planted on the pool fences surrounding the roof top garden to provide windbreaks for the citrus and other trees as they grew. Once the citrus established, most of the climbers were removed.
- The citrus trees provide fruit for much of year. The cumquat is productive enough to enable the residents to make marmalade. The keys to the success of these citrus are monthly feeds of fertiliser and compost (e.g. chicken manure) during the growing period and relatively constant soil moisture, akin to growing citrus in a pot.
- There is no lift in the building on which the roof garden is situated and as result all materials need to be carried up the stairs (including the PV panels installed after construction). For heavy or bulky items, Christie Walk residents form a human chain to haul them up the stairs.
- The soil structure for the roof garden is very light and therefore requires constant monitoring to avoid it drying out and becoming non-wetting, which can occur quite quickly. Regular checking of the plants' condition and soil moisture, and periodic inspections of the membrane for leaks, have been successful in maintaining healthy plants and discovering leaks in a timely manner. Experience has shown that some parts of the membrane suffer more stress than others and need to be monitored more closely.
- Water in excess of evapotranspiration and soil water holding capacity is discharged to a sub-surface soakage pit rather than contributing to the stormwater harvest. This is done because of uncertainty about the quality of the runoff given that the roof garden is irrigated with recycled stormwater. It may be that the quality of the runoff is suitable for returning to the stormwater recycling system but it is not known how many times it could be recycled without reaching critical water quality thresholds
- Plans for an on-site black water treatment did not come to fruition due to rapidly escalating costs. The intention was to treat black water on-site and use it to water nearby Whitmore Square in Adelaide CBD.







## MAINTENANCE

The green infrastructure is maintained by the Christie Walk residents under the guidance of a garden planning group and a maintenance group. Maintenance activities include:

- Regular planting, watering, pruning, pest removal, weeding, composting
- Monthly working bee
- Monthly visual inspection of rooftop membrane for leaks and plant condition as an indicator of soil moisture
- Reverse flushing of the filters every four weeks,
- Lifting, visual inspection and greasing the rim of the tank covers every two months
- Annual inspection of non-return valves
- Inspection of tanks bi-monthly and cleaned by contractors every two years.

Expenses such as plants, potting mix, tools etc. are budgeted and paid for out of the Strata fees.

## COMMUNITY OUTREACH

The purpose of the Christie Walk development was to push the boundaries of sustainable, high-density urban development. As such the residents openly share their experiences through internet articles, YouTube videos and regular tours that they have been hosting since February 2001. Tours can be booked through Urban Ecology Australia ([www.urbanecology.org.au](http://www.urbanecology.org.au)).

A resource pack containing two movies on a DVD and an e-book entitled '*Moving towards urban sustainability*' on CD-ROM, are also available.

The popular TV show *Gardening Australia* ran a story on the development in October 2009 presented by Sophie Thomson. The emphasis was on the gardens being an integral part of the community and providing amenity to inner city residents. More recently, in March 2017, Josh Byrne featured Christie Walk in his series '*Density by design*'.







## CHRISTIE WALK AWARDS

- Winner of **National Energy Globe Award**, Prague April 2009
- Finalist in the **UNAA World Environment Day Awards**, June 2009
- Finalist in the **World Habitat Award 2005** (Building & Social Housing Foundation/UN-HABITAT)
- Silver prize winner in the international **Ryutaro Hashimoto APFED Awards** for promotion and practical demonstration of socially-equitable and sustainable city living (Asia Pacific Forum for Environment and Development)
- **Winner of Civic Trust People's Choice Award** and certificate of commendation- "The jury commends Christie Walk as a working experiment in different technologies, building systems and modes of living, providing a test bed for ideas which will assist designers and developers of future housing projects



**Disclaimer:** While every effort has been made to verify the accuracy of items in the Department for Environment, Water and Natural Resources' case study fact sheets, independent advice should be sought on matters of specific interest.



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**Photos:** Paul Downton and Alex Ward

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