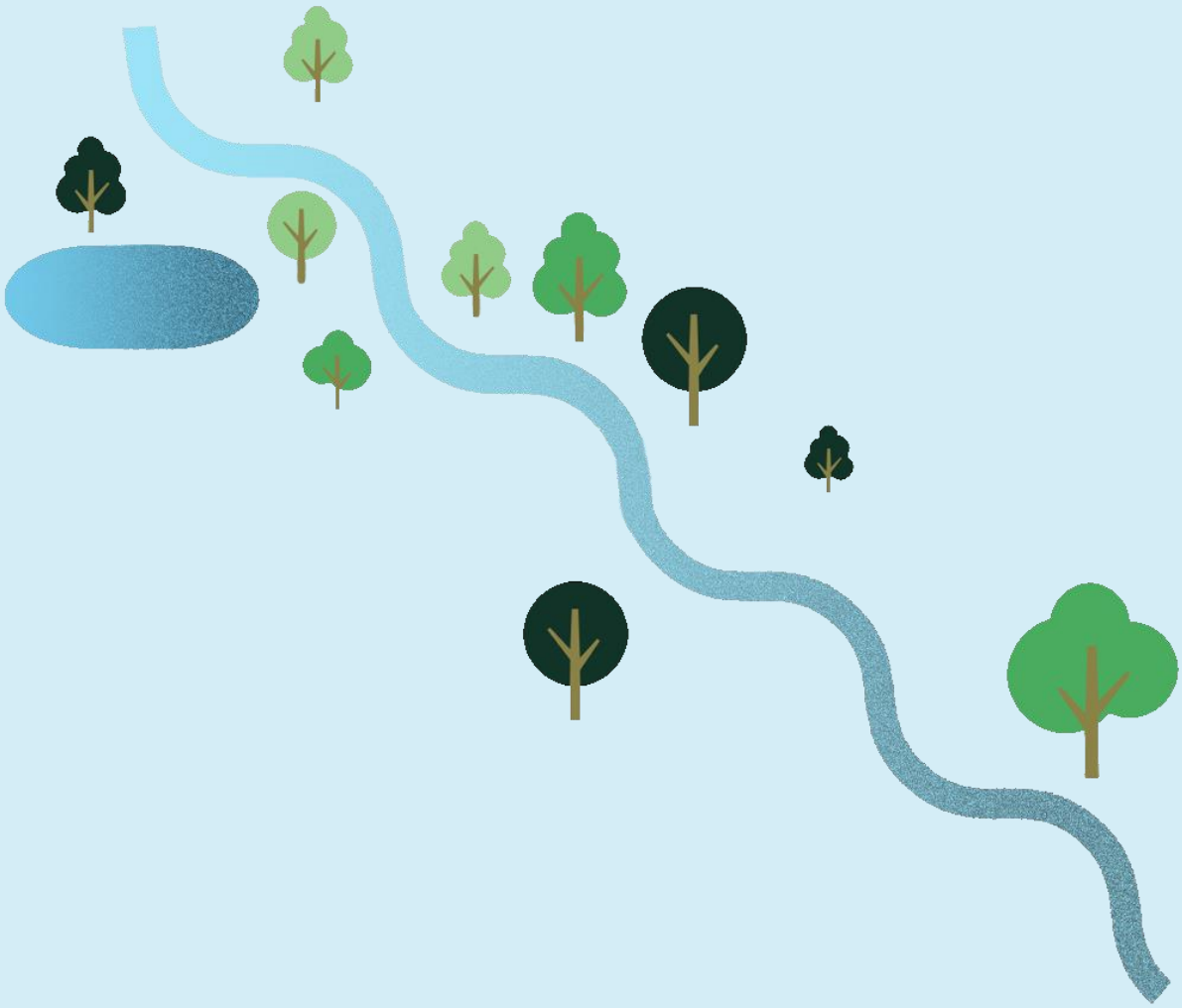
RESILIENT EAST

Climate Ready Eastern Adelaide

Water Sensitive Urban Design

For a Resilient East

June 2020



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Resilient East is a regional climate initiative between state and local government organisations in eastern Adelaide. It is about making sure the eastern region remains a vibrant, desirable and productive place to live, work and visit, and that our businesses, communities and environments can respond positively to the challenges and opportunities presented by a changing climate.

This partnership includes Campbelltown City Council, the Cities of Adelaide, Burnside, Norwood Payneham and St Peters, Prospect, Tea Tree Gully, Unley, the Town of Walkerville and the Government of South Australia.

Resilient East regularly works with agencies and organisations from all levels of government, NGOs, community groups, individuals and the private sector.

ACKNOWLEDGEMENT OF COUNTRY
Resilient East councils are located on the Adelaide Plains, the traditional lands for the Kaurna people. We acknowledge this land as the traditional lands for the Kaurna people and we respect their spiritual relationship with their country. We also acknowledge the Kaurna people as the custodians of the Adelaide region and their cultural and heritage beliefs are still as important to the living Kaurna people today. We also pay respects to the cultural authority of Aboriginal people visiting from other areas of South Australia and Australia.

Visit resilienteast.com for more information.

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The Extent and Performance of Water Sensitive Urban Design in the Resilient East Region

Executive Summary

There are over 1,000 working examples of Water Sensitive Urban Design (WSUD) across the Resilient East region. There are large-scale initiatives, including multiple Managed Aquifer Recharge (MAR) schemes and many small-scale installations capturing water from kerbsides and residential roofs. WSUD has become mainstream, although progress in this area has not always been well documented. This report captures the extent and performance of WSUD in the Resilient East region.

The performance of WSUD installations has been a recent focus, with positive results. Large-scale schemes are producing thousands of megalitres of fit-for-purpose water to maintain local parks and reserves. Small-scale installations are functioning well up to a decade after installation. Inspections of older kerbside inlet systems have found them functioning as designed, with sustained infiltration capacity.

A wide range of benefits flow from implementing WSUD. Utilising urban stormwater reduces reliance on mains water and reduces the cost and impact of stormwater management. WSUD also benefits urban vegetation management, supporting urban cooling, and assisting in the creation of attractive urban environments. The benefits of several WSUD projects in the region have been assessed in monetary terms, with results ranging from tens of thousands to millions of dollars per project.

There is great potential for WSUD in the Resilient East region. Collaborative work through the Resilient East project has improved the understanding of the extent and performance of local WSUD installations. Looking forward, the region will benefit through collaboration on design and development to optimise the performance of WSUD systems. There are abundant opportunities for small-scale WSUD installations on public and private land, and opportunities to expand large-scale systems. Understanding the benefits and performance of WSUD will support strategic investment in this area.

The ongoing utilisation of WSUD will assist local and state governments in meeting commitments to protect natural environments and develop a liveable and sustainable eastern region.

Introduction

Eastern Adelaide is changing. Increases to population, house sizes and housing densities are putting pressure on open space and water management. These changes present challenges in meeting resident needs and expectations for attractive and liveable suburbs. Water Sensitive Urban Design (WSUD) can play an important part in addressing these challenges. WSUD presents enormous opportunities to secure long-term local water resources, mitigate the effects of floods, protect natural waterways and support green infrastructure.

Traditionally, stormwater has been considered a nuisance in urban areas, directed quickly into drains and discharged into watercourses. This approach sees a costly loss of the valuable water resource and results in much drier soils. This loss will be exacerbated as the climate dries and more water is needed to maintain open space and green infrastructure. There are also downstream impacts, with organic debris, pollutants and litter entering creeks and marine environments. Further, with more intense and severe weather events predicted, the costs of managing a traditional stormwater network will increase. WSUD can assist in managing these issues.

WSUD utilises proven and emerging techniques and technologies to manage rainwater, stormwater, groundwater, wastewater and mains water. In practice, WSUD can be as simple as installing rainwater tanks to collect water or swales to slow water flow and allow it to infiltrate into the soil (Figure 1). At the other end of the spectrum, WSUD can be complex and involve multiple treatments, such as the construction of artificial wetlands to clean water for aquifer storage and subsequent use.

This report captures the extent and performance of WSUD in the Resilient East region.

Figure 1: Raingarden, Florence Street, Fullarton, City of Unley. One of three raingardens in this location that provide additional green space and have indigenous plants to attract wildlife. These raingardens reduce local flooding and improve water quality going into Parklands Creek. (credit: Environmental Protection Authority South Australia).

The Extent of WSUD in the Resilient East Region

There are over 1,000 working examples of Water Sensitive Urban Design (WSUD) across the Resilient East region.

For more than a decade, Resilient East councils have been developing and installing a range WSUD systems. This report captures the extent and performance of WSUD in the region. WSUD systems support urban greening and stormwater management at two scales:

1. **Large-scale WSUD systems: Managed Aquifer Recharge (MAR) and recycled water (see Table 1)**

   Where relatively large volumes of water are utilised, typically with storage, treatment and reticulation systems. These systems range in size from sports fields to regional networks. MAR schemes have been established to capture stormwater so that it can be used when needed to maintain urban parks and reserves. Recycled water is available from SA Water, through the Glenelg-Adelaide Pipeline (GAP).

2. **Small-scale WSUD systems (see Table 2)**

   Where local water flows are slowed, filtered and/or allowed to infiltrate. Examples include kerbside infiltration units, infiltration basins, permeable paving, rainwater tanks, detention basins and Gross Pollutant Traps (GPTs).

Collectively, the Resilient East partner councils have considerable design experience and operational knowledge in this area. The councils are working collaboratively through projects (e.g. the ERA Water and GAP schemes), sharing knowledge (e.g. design and performance data), and funding applications (e.g. greening grants) to further develop WSUD in the region.

While WSUD has become mainstream, the progress in this area has not always been well documented. The Resilient East Steering Group have been working to document the extent of WSUD and promote the work internally and externally. For example, many of the projects are now publicly promoted through resilienteast.com and the Water Sensitive SA Interactive Map, watersensitivesa.com/wsud-projects. This Interactive Map allows users to search for and find WSUD initiatives in the Resilient East region and click to see Images and find out more information (Figure 6).

WSUD Systems in the Resilient East Region

Table 1. Large-scale WSUD systems in the Resilient East region: Managed Aquifer Recharge (MAR) and recycled water

Council	Name	Date (operational)	Capacity
City of Adelaide	Adelaide Botanic Gardens, Adelaide	2014	100–200 ML
	GAP (see final row in this table)		
City of Burnside	ERA Water and GAP (see final row in this table)		
Campbelltown City Council	Lochiel Park, Campbelltown	2013	10–65 ML
	Max Amber Reserve	1997	30–50 ML
City of Norwood, Payneham & St Peters	Dunstone Grove–Linde Reserve	2012	5–20 ML
	ERA Water (see final rows in this table)		
City of Tea Tree Gully	Wynn Vale Dam Scheme, Wynn Vale (including Petaringa Oval and Tilley Reserve)	2010	10–100 ML
	Harpers Field, Golden Grove	2019/20	10–40 ML
	Aqueduct Way, Highbury	2010	10–25 ML
	Torrens Linear Parks, Dernancourt	2008	10–30 ML
	Kingfisher Reserve, Modbury Heights	2007	10–30 ML
	Tea Tree Gully Golf Club, Fairview Park	2001	10–50 ML
City of Unley	Ridge Park, Myrtle Bank (Figure 2)	2015	10–60 ML
	Heywood Park, Unley Park	2015	10–35 ML
	GAP (see final row in this table)		
Town of Walkerville	ERA Water (see final rows in this table)		
Collaborative projects	ERA Water (City of Burnside, City of Norwood, Payneham & St Peters, Town of Walkerville), including Felixstow Reserve and an extensive network of pipes.	2019/20	Up to 450 ML
	Glenelg–Adelaide Pipeline (GAP), a SA Water project delivering recycled water to City of Adelaide, City of Burnside and City of Unley (Figure 3, 4 and 5)	2010	3,800 ML for council and commercial use

Figure 2: Managed Aquifer Recharge (MAR), Ridge Park, City of Unley.

Figure 3: Glenelg-Adelaide Pipeline installation (GAP) (credit: Mark Dohring).

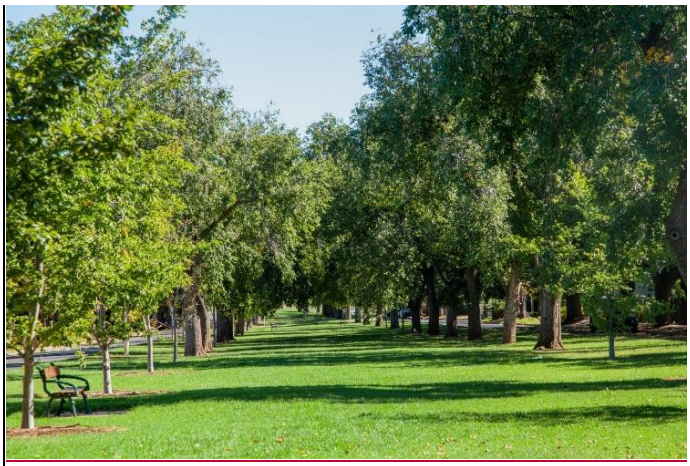


Figure 4: Memorial trees watered by the Glenelg-Adelaide Pipeline (GAP), Alexandra Avenue, City of Burnside.

Figure 5: Glenelg-Adelaide Pipeline Valve.

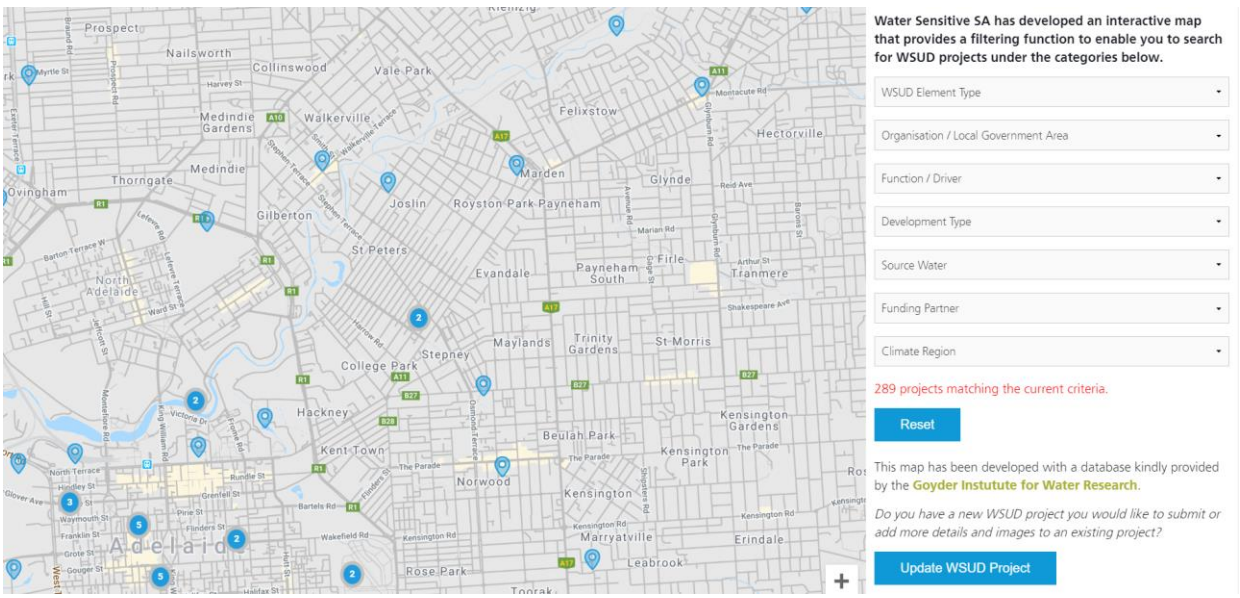


Figure 6: Water Sensitive SA Interactive Map

Table 2. Documented in 2019, small-scale WSUD systems in the Resilient East region (additional systems exist that have not yet been documented)

Council	Kerbside infiltration units (with sub-surface storage/infiltration)	Infiltration basins (swales, soakage pits and rain gardens)	Permeable paving (road, footpath and carpark surfaces)	Detention Basins and Rainwater tank systems	Other, including Gross Pollutant Traps (GPTs)
City of Adelaide		• 20 bioretention systems • 2 infiltration gardens • 7 swales • 4 wetlands	• 2 footpaths • 1 carpark	• 13 detention basins • 2 rainwater tanks	• 100+ passive tree watering systems • 17 GPTs
City of Burnside	• 213 residential inlets ('B-Pods') • 35 kerbside inlets	• 5 rain gardens • 6 swales • 34 soakage pits	• 4 carparks • 3+ footpaths • 1 road	• 3 detention basins • 6 public toilet rainwater tanks • 1 park rainwater tank	• 3 GPTs • 11 weirs • 16 rock ramps • 8 trash racks • 5 silt traps
Campbelltown City Council	• 8 kerbside inlets	• 11 swales • 19 biofiltration pits	• 2 car parks	• 1 detention basin • 4 public toilet rainwater tanks	• 1 GPT • 15 trash racks
City of Norwood, Payneham & St Peters		• 3 rain gardens • 1 bioretention system		• 2 rainwater tanks (park irrigation)	• 4 GPTs • 12 tree pits
City of Prospect	• 65 kerbside inlets	• 1 bioretention system • 3 rain gardens • 2 soakage pits	• 1 footpath and paved area in reserve	• 1 rainwater tank (civic centre)	
City of Tea Tree Gully	• 10 kerbside inlets	• 3 rain gardens • 5+ swales	• 5+ footpaths	• 5+ detention basins	• 10+ GPTs • 10+ trash racks
City of Unley	• 259 residential inlets ('water wells')	• 14 rain gardens • 1 swale	• 3+ footpaths • 1 roadway • 1 carpark	• 1 under road detention tank • 1 detention dam	• 2 GPTs
Town of Walkerville	• 11 kerbside inlets	• 10 rain gardens	• 1 intersection • 1 carpark • 1 reserve path		• 2 infiltration trenches
TOTALS	**601**	**151+**	**27+**	**40+**	**216+**

Figure 7: Kerbside infiltration – tree inlet, Glenunga, City of Burnside

Figure 8: Raingarden, Randolph Ave, Fullarton City of Unley (credit: Water Sensitive SA)**.**

Figure 9: Permeable paving, Tregenza Oval, City of Burnside.

Figure 10: Rainwater tanks, Glenunga Hub, City of Burnside.

Figure 11: Detention basin (credit: Water Sensitive SA)**.**

Figure 12: Gross Pollutant Trap (GPT), near Morphett St Bridge, City of Adelaide.

A Review of WSUD in Action

The performance of WSUD installations has been a recent focus, with positive results.

Large-scale WSUD project across the Resilient East region are delivering thousands of megalitres of fit-for-purpose water to maintain parks and reserves. Some concern has been raised about the performance of small-scale WSUD systems, which has been reviewed.

Review of Kerbside Infiltration Units

Over the past decade, over 600 kerbside infiltration units have been installed in the Resilient East region. Systems for directing roof stormwater into sub-surface infiltration pits in verges have been developed (B-Pods and Water Wells). Popular kerbside inlets (Figure 13) have also been installed to direct stormwater from the road into sub-surface infiltration pits in verges. Both systems divert stormwater to support public trees and urban cooling. A review of these units has found:

- **Blockage free**: 30 kerbside infiltration units that were 5-10 years old were inspected and found to be fully functional, with very little debris or intrusion by tree roots. Organic matter that had entered the units was breaking down naturally.

- **Maintaining infiltration capacity**: 5 kerbside infiltration units that were 5-10 years old were tested, with each allowing at least 200 litres of water to infiltrate within one hour of a simulated rainfall event. These tests were conducted to determine if the kerbside units maintain infiltration capacity in the medium term without maintenance, which they do. Further testing is required to determine maximum capacities.

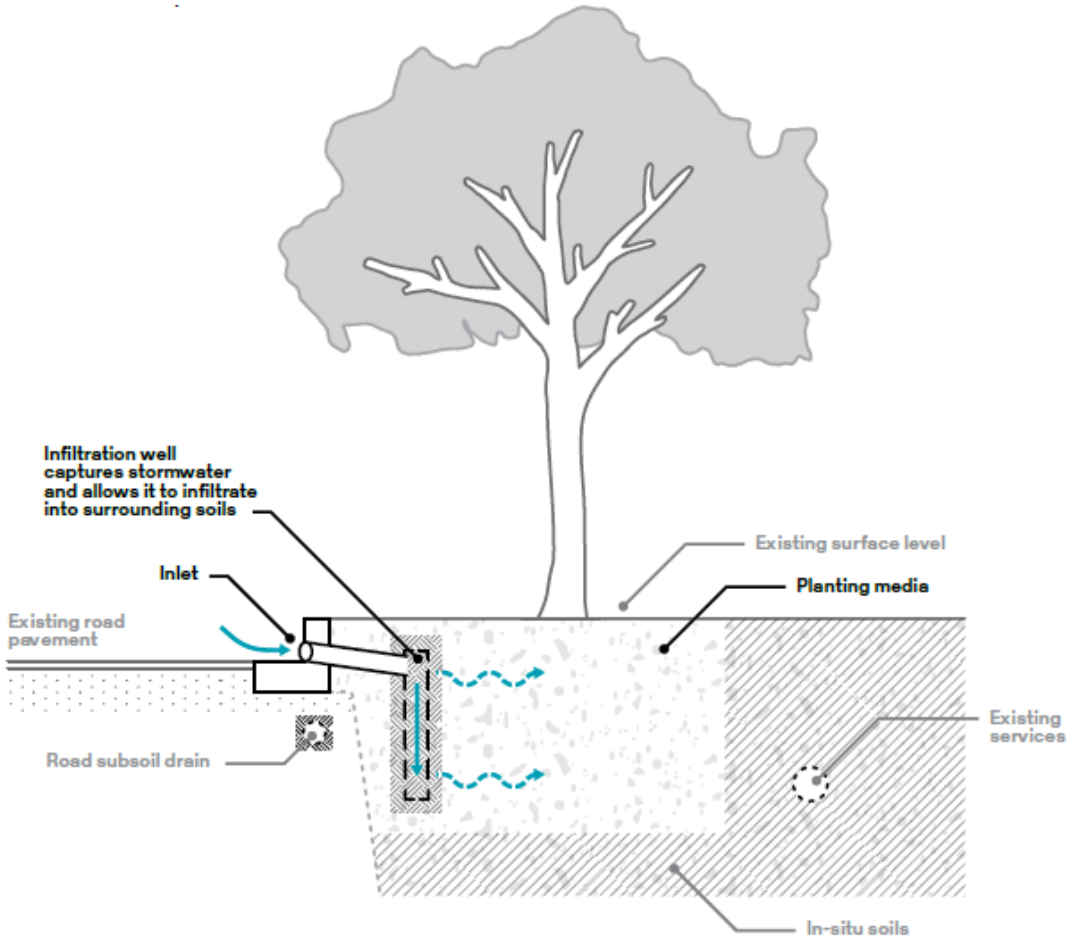


Figure 13. A kerbside Inlet, with a subsurface infiltration pit within a verge (source: Cooperative Research Centre for Water Sensitive Cities (2020). Designing for a cool city – Guidelines for passively irrigated landscapes).

The Outcomes of WSUD

The benefits of WSUD are being documented. There are a wide range of benefits that can flow from implementing WSUD. Utilising urban stormwater flows can reduce reliance on mains water. Reducing stormwater outflows can also reduce the cost and impact of stormwater management in local areas as well as on downstream aquatic, riparian and marine environments. WSUD can also benefit urban vegetation management and greening initiatives, maintaining natural and cultural heritage, supporting urban cooling, and assisting in the creation of attractive urban environments that encourage active and healthy lifestyles. The multiple benefits of WSUD are the focus of ongoing research, particularly around financial savings in the management of assets and green infrastructure, pollution control and public health. The utilisation of WSUD will assist local and state governments meet commitments to protect natural environments and develop a liveable and sustainable city.

Monetised Benefits of WSUD Project

Resilient East engaged a consultant to undertake an analysis of a sample of large and small WSUD projects across the Region. The Department for Environment and Water's WSUD Monetised Benefits tool was used to assess some of the benefits of WSUD, including water quality, runoff attenuation, neighbourhood character and health benefits. As the tool assessed only a limited range of benefits, the outcomes are likely to be underestimates of the value of WSUD projects.

Description of Benefits:

- Water quality: addresses the health of near shore sea grasses and reefs by modelling the benefits of suspended solid and nitrogen reductions.
- Runoff attenuation: assumes that runoff being directed through a WSUD feature reduces average annual flood damage costs within the project's catchment.
- Medical costs (health): links proximity to green infrastructure with rates of overweight and obesity within the adjacent resident population.
- Physical benefits (health): links proximity to green infrastructure with physical activity rates among adult residents.
- Neighbourhood character: relates to a 'willingness to pay' for living in a greener neighbourhood, using residential property values as a surrogate measure.

Table 3 presents a summary of the results of the projects assessed. The most significant monetised benefit calculated relates to neighbourhood character, demonstrating the importance to further investigate the link between neighbourhood greening and property values.

Based on extensive research, the tool enables the allocation of dollar values to some of the well documented social, environmental and economic benefits of WSUD and green infrastructure features. It can therefore assist state and local South Australian government bodies to assess potential benefits and present them to key stakeholders within the context of the broader costs and benefits of any proposed, ongoing or completed infrastructure project.

The full study can be found on the Resilient East website under 'Resources' – Monetising the Benefits of Water Sensitive Urban Design and Green Infrastructure Features – Resilient East Case Studies.

Table 3. Monetised benefits calculated in 2019 for five WSUD projects in the Resilient East region

WSUD System	WSUD Monetised Benefit Calculation (value over 30 years)	Benefit Categories
Gray Street (7 trees + 2 rain gardens; City of Adelaide)	$98,283	Water quality Runoff attenuation Neighbourhood character
Bell Yett Reserve car park and swale (City of Burnside)	$57,949	Water quality Runoff attenuation Neighbourhood character
Felixstow Wetlands (City of Norwood, Payneham & St Peters; ERA Water)	$5,269,736	Water quality Runoff attenuation Health - Medical costs Health - Physical benefits Neighbourhood character
Florence Street (3 rain gardens + 3 bioretention filters; City of Unley)	$64,100	Water quality Runoff attenuation Neighbourhood character
Way Avenue (water inlet wells for 31 trees; City of Unley - to be installed)	$300,520	Water quality Runoff attenuation Neighbourhood character
Smart Road (3 rain gardens and bioretention swales, City of Tea Tree Gully)	$108,050	Water quality Runoff attenuation Health - Medical costs Health - Physical benefits

Figure 14: Raingarden, Gray St, City of Adelaide

Figure 15: Permeable pavers at Bell Yett Reserve car park, City of Burnside

Figure 16: Raingardens & bioretention filters, Florence St, City of Unley (credit: Environmental Protection Authority South Australia).

Figure 17: Raingarden installation, Smart Road, City of Tea Tree Gully

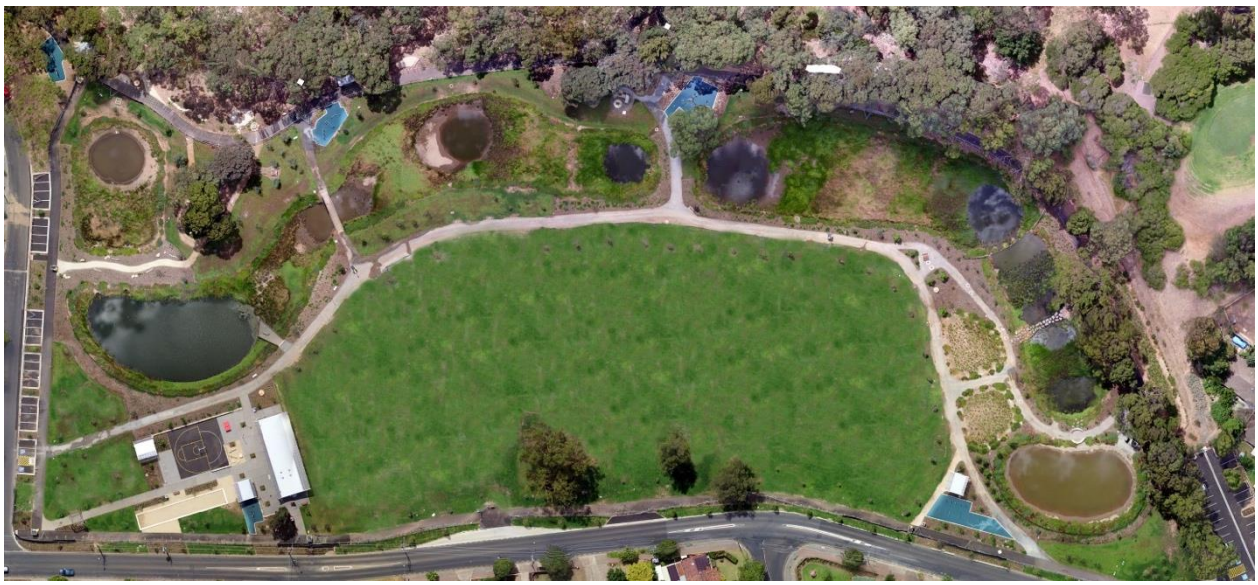


Figure 18: Felixstow Wetlands, Grey St, City of Norwood Payneham & St Peters.

Looking Forward

There continues to be great potential for WSUD in the Resilient East region. Collaborative work through the Resilient East project has improved the understanding of the extent and performance of local WSUD installations. Resilient East partner councils will benefit from continuing partnerships to further develop knowledge, skills and projects.

There are abundant opportunities for small-scale WSUD installations on public and private land. Some councils are now incorporating small-scale WSUD as business-as-usual, with kerbside infiltration units and passive infiltration commonly included in kerb replacement projects.

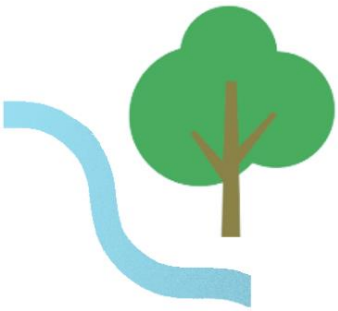
While there has been a focus on public WSUD, there is also a need to consider the potential for WSUD on private land. There has been limited attention to private work thus far, but there is growing community interest. Encouraging and documenting examples of private WSUD systems has been identified as an area for future work, engaging with residents and developers to expand the potential of WSUD.

There is also potential to develop new large-scale WSUD systems and expand existing ones. Aquifer storage of stormwater is working at numerous sites (Table 1) and could be developed at additional sites. New developments could be stand-alone or constructed to augment existing WSUD infrastructure, such as the ERA Water network.

Continuing work on the benefits and performance of WSUD will inform strategic investment. This work will ensure that the value of WSUD systems can be properly captured during the development of business cases for ongoing investment.

While further development is underway, it is also necessary to promote the extent and benefits of WSUD. Community support for public projects and implementation of private projects will depend on education and engagement in this area.

The ongoing utilisation of WSUD will assist local and state governments in meeting commitments to protect natural environments and develop a liveable, resilient and sustainable region.



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