

Summary Sheet

Rain Gardens, Green Roofs and Infiltration Systems

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Rain gardens, green roofs and infiltration systems are source control measures which intercept, treat and promote infiltration of runoff.

Rain gardens are shallow planted depressions designed to receive runoff and assist runoff to infiltrate the underlying soil, recharge the groundwater and reduce peak flows from the site.

Green roofs are a series of layers consisting of living vegetation growing in substrate over a drainage layer on top of built structures. There are four types: extensive, semi-intensive, intensive and elevated landscape. Each type is different in terms of depth of substrate, diversity of plantings, and access provisions.

Infiltration systems typically hold runoff within a subsurface trench prior to infiltrating into the surrounding soils. There are four basic types of infiltration systems: soakaways, infiltration trenches, infiltration basins and leaky wells.

What is Water Sensitive Urban Design?

Water Sensitive Urban Design (WSUD) is an approach to urban planning and design that integrates the management of the total water cycle into the urban development process.

WSUD incorporates all water resources, including surface water, groundwater, urban and roof runoff, drinking water and wastewater. It includes:

- Utilising water saving measures within and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non-drinking water supplies;
- Storage, treatment and beneficial use of runoff (at building and street level, including stormwater);
- Treatment and reuse of wastewater; and
- Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity and amenity.

There are many different WSUD measures which together form a 'tool kit' from which individual measures can be selected to form a specific response suiting the characteristics of each development (or redevelopment).

Those measures are described in detail in the WSUD Technical Manual, which can be found online at www.planning.sa.gov.au/go/wsud

Rain gardens, green roofs and infiltration systems are some such measures.

Purpose

- **Rain gardens** retain runoff for infiltration back into the soil. Some degree of pollutant removal occurs due to the water filtering through the plants and soil before it enters the groundwater. Rain gardens increase the proportion of pervious areas, increase habitat opportunities and biodiversity, and create visual interest through the introduction of water features into the garden;
- **Green roofs** reduce impervious area and runoff volume. Storage and detention of runoff also occurs as water is stored in the substrate and taken up by plants. Peak runoff rates from the roof are delayed before leaving the roof drainage system. Water quality and internal building temperature is improved through the infiltration and bioretention process in the substrate;
- **Infiltration systems** reduce runoff and therefore runoff pollution volumes, reduce peak flows and provide the opportunity for harvesting of runoff. Infiltration systems capture and infiltrate flows, and are generally not designed as a treatment measure (but can provide some level of treatment).

Application and Scale

- **Rain gardens** may be implemented at a variety of scales, from domestic through to commercial and industrial sites. They are an especially useful tool that can be implemented and managed by homeowners;
- **Green roofs** are appropriate for commercial and industrial structures as well as residential buildings. They can be installed on flat roofs but also can be built on slopes up to 30 degrees. They can be incorporated into new construction or retrofitted into existing buildings;
- **Infiltration systems** are limited to soils with good infiltrative capacity and should also be sited with adequate buffer distances from existing inground infrastructure. Infiltration trenches and basins are best suited to residential, commercial and industrial developments with high percentages of impervious areas. Infiltration basins are suited to medium to large (five to 50 hectare) catchments and infiltration trenches to small (less than two hectare) catchments.



Legislative Requirements and Approvals

A thorough investigation of required permits and approvals should be undertaken as part of the conceptual design and this should be discussed with your local council. A proposed system needs to meet the requirements of the following legislation:

- *Development Act 1993;*
- *Public and Environmental Health Act 1987;* and
- *Environment Protection Act 1993;*
- *Natural Resources Management Act 2004.*

Design Considerations

Rain Gardens

Plant selection is very important in the design of a rain garden and selected plants should be suitable for the long dry periods that occur in the Greater Adelaide Region. Perennial species with deep fibrous roots systems that naturally occur in wetlands and soaks should be used.

To prevent mosquitoes breeding, ponding should be limited to no longer than four days, by providing a suitable overflow path or ensuring adequate hydraulic conductivity. An overflow path is required to manage flow from major rain events.

Excessive wetting and drying can cause significant soil movement in some soils, causing damage to adjacent infrastructure. Rain gardens should be located away from infrastructure in heavy soils or installed with an impermeable liner to effectively create a bioretention system once connected to the stormwater chain.

Green Roofs

The factors that need to be taken into consideration for the design of the storage (i.e. detention/retention) component of green roofs include:

- Number and type of layers used in the system;
- Physical properties of the growing media;
- Depth of substrate;
- Type of plants incorporated in the roof; and
- Angle of slope of the roof;
- Intensity of rainfall.
- Local climate;

Structural considerations are critical and include the loads from the saturated growing medium, drainage system, plant mass and any point loads which should be placed over structural supports.

Plant selection is a critical element in green roof success. A wide spectrum of plants from coastal or arid areas of Australia may be suitable for use on green roofs having adapted to extreme environmental conditions, including temperature, high UV load, drought, salt laden winds and shallow nutrient depleted soils.

The most appropriate green roof for the Greater Adelaide Region is the intensive type, which performs better for runoff management given the increased depth of substrate and is better adapted to the dry humidity and heat experienced in summer in Adelaide.

Infiltration Systems

The *Development Act 1993* Ministers Specification SA 78AA (Planning SA 2003) contains a variety of considerations that must be adhered to in the design of infiltration systems. These include tables on the required size of infiltration systems and positioning of infiltration systems on a site.



Maintenance Requirements

Rain Gardens

- Rain gardens are a low maintenance, small scale WSUD measure when appropriate vegetation is planted. Under typical climate conditions, they should not need to be watered, mowed or fertilised. Regular weeding may be required once plants have matured;
- There are many species that do not tolerate waterlogging over an extended period of time. These species can be incorporated into the planting plan to identify when substrate infiltration rates change due to silt accumulation;
- Rain gardens should be covered with some form of mulch to retain moisture. Stone mulch varieties are recommended as they do not leach nutrients into ponded water and will not form a potential clogging layer at the surface of the rain garden; and
- Ensure no areas of extended ponding develop that will contribute to breeding of mosquitoes.

Green Roofs

- Initially the plants will need regular watering (in accordance with any water restrictions in place) until they are fully established (usually within six months). If extreme heat wave conditions occur then the use of subsoil dripper irrigation will be required over this period; and
- Regular fertilisation of the soil layer may be required. This can be achieved by applying a slow release fertiliser twice a year.

Infiltration Systems

- Infiltration system characteristics make them susceptible to clogging with sediments. Maintenance should be aimed at ensuring that the system does not clog. This is addressed by *Development Act 1993* Minister's Specification SA 78AA, including inspection and cleaning of retention system components on a regular basis.



Further Information

While there is a large range of useful resources and further information available on rain gardens, green roofs and infiltration systems, in the first instance it is suggested that people read Chapter 6 of the *Water Sensitive Urban Design in Greater Adelaide Technical Manual*. Further information is available at www.planning.sa.gov.au/go/wsud and the Minister's Specification SA 78AA can be found at <http://dataserver.planning.sa.gov.au/publications/948p.pdf>

Other Summary Sheets

Other Water Sensitive Urban Design Summary Sheets for the Greater Adelaide Region are available in this series. To download the summary sheets, visit www.planning.sa.gov.au/go/wsud

No. 1-3	Introduction to Water Sensitive Urban Design	No. 10	Bioretention Systems
No. 4	Demand Reduction	No. 11	Swales and Buffer Strips
No. 5	Rainwater Tanks	No. 12	Sedimentation Basins
No. 6	Rain Gardens, Green Roofs and Infiltration Systems	No. 13	Constructed Wetlands
No. 7	Pervious Pavements	No. 14	Wastewater Management
No. 8	Urban Water Harvesting and Reuse	No. 15	Modelling Process and Tools
No. 9	Gross Pollutant Traps	No. 16	Siphonic Roofwater Systems