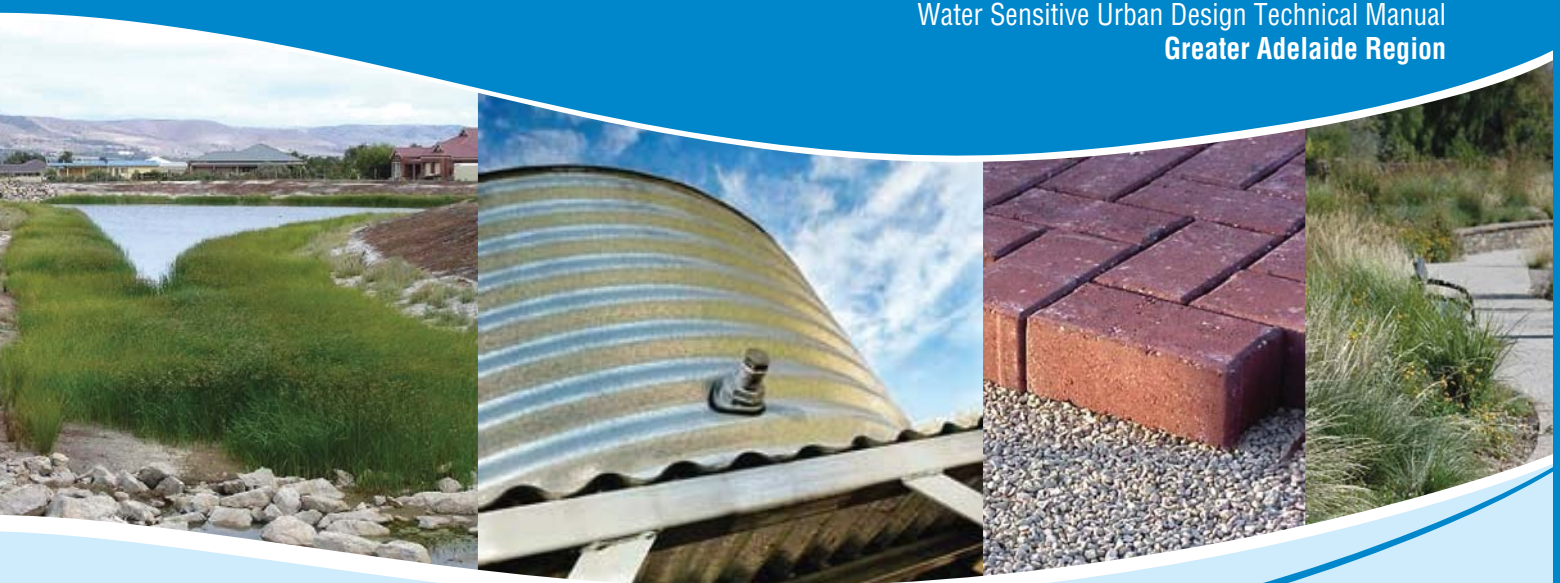


December 2010

Chapter 4

Demand Reduction

Water Sensitive Urban Design Technical Manual
Greater Adelaide Region



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The Water Sensitive Urban Design documents can be downloaded from the following website:

www.planning.sa.gov.au/go/wsud

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Disclaimer

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Appropriate design procedures and assessment must be applied to suit the particular circumstances under consideration.

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. It includes:

- Integrated management of groundwater, surface runoff (including stormwater), drinking water and wastewater to protect water related environmental, recreational and cultural values;
- Storage, treatment and beneficial use of runoff;
- Treatment and reuse of wastewater;
- Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity; and
- Utilising water saving measures within and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non drinking water supplies.

Therefore, WSUD incorporates all water resources, including surface water, groundwater, urban and roof runoff and wastewater.

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The project partners gratefully acknowledge all persons and organisations that provided comments, suggestions and photographic material.

In particular, it is acknowledged that material was sourced and adapted from existing documents locally and interstate.

Overall Project Management

Christine Lloyd (Department of Planning and Local Government)

Steering Committee

A group of local government, industry and agency representatives provided input and feedback during preparation of the Technical Manual. This group included representatives from:

- Adelaide and Mt Lofty Ranges Natural Resources Management Board;
- Australian Water Association (AWA);
- Department for Transport, Energy and Infrastructure (DTEI);
- Department of Water, Land and Biodiversity Conservation (DWLBC);
- Environment Protection Authority (EPA);
- Housing Industry Association (HIA);
- Local Government Association (LGA);
- Department of Planning and Local Government (DPLG);
- South Australian Murray-Darling Basin Natural Resources Management Board;
- South Australian Water Corporation;
- Stormwater Industry Association (SIA); and
- Urban Development Institute of Australia (UDIA).

Technical Sub Committee

A technical sub committee, chaired by Dr David Kemp (DTEI), reviewed the technical and scientific aspects of the Technical Manual during development. This group included representatives from:

- Adelaide and Mt Lofty Ranges Natural Resources Management Board;
- City of Salisbury;
- Department for Transport, Energy and Infrastructure (DTEI);
- Department of Health;
- Department of Water, Land and Biodiversity Conservation;
- Department of Planning and Local Government; and
- Urban Development Institute of Australia.

From July 2010, DWLBC was disbanded and its responsibilities allocated to the newly created Department For Water (DFW) and the Department of Environment and Natural Resources (DENR).

Specialist consultant team

Dr Kylie Hyde (Australian Water Environments) was the project manager for a consultant team engaged for its specialist expertise and experience in water resources management, to prepare the Technical Manual.

This team comprised Australian Water Environments, the University of South Australia, Wayne Phillips and Associates and QED Pty Ltd.

Beecham and Associates prepared Chapter 16 of the Technical Manual.

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Chapter 4

Demand Reduction

4.1 Overview

As detailed in [Chapter 1](#), there are many different WSUD measures which together form a 'tool kit' from which individual measures can be selected as part of a specific design response suiting the characteristics of any development (or redevelopment).

Demand reduction is one of those WSUD measures.

Water demand can be reduced through changing behaviour, through technology, and through design.

This chapter of the Technical Manual provides an overview of demand reduction measures. Other chapters to be read in conjunction with this chapter include:

- Introductory chapters ([Chapters 1-3](#))
- Rainwater Tanks ([Chapter 5](#))
- Rain Gardens, Green Roofs and Infiltration Systems ([Chapter 6](#))
- Urban Water Harvesting and Reuse ([Chapter 8](#)); and
- Wastewater Management ([Chapter 14](#))

Scale and Application

Demand reduction can be applied to all scales of development, including residential, commercial, industrial and open space.

Demand reduction measures are also appropriate for retrofitting existing residential, commercial (including retail, educational and institutional uses) and industrial development as well as parks and public open space.

4.2 Water Restrictions and Applicable Legislation

Water Restrictions

Water use restrictions apply in South Australia.

The level of water restrictions is regularly revised depending on water supply issues relating to the River Murray and Greater Adelaide Region catchments.

The level of water restrictions currently exceeds the permanent water conservation measures outlined below.

SA Water's website (www.sawater.com.au) is constantly updated with information relating to restrictions. It is recommended that the website is visited regularly to obtain the most current information.

Permanent Water Conservation Measures

Permanent water conservation measures are effectively the base level of 'water restrictions' South Australians are required to comply with on an ongoing basis. These were introduced in 2003.

(Note: as outlined above, temporary water restrictions in place at any time may exceed these permanent measures.)

Under the permanent water conservation measures, public or private gardens, recreational areas, sports grounds or nurseries can be watered:

- By hand (through a handheld hose, from a bucket or watering can); or
- Through a drip-feed irrigation system; or
- Where the watering takes place through a sprinkler – after 5pm and before 10am on any day (or, when daylight saving is in force, after 6pm and before 10am).

No hosing down of external paved areas with water at any time is permitted unless it is absolutely necessary to do so.

Water must not be used to clean a motor vehicle or boat unless the water is applied:

- From a bucket or watering can filled directly from a tap; or
- By a high pressure low volume water cleaner; or
- From a handheld hose that is fitted with a trigger nozzle.

Motor vehicles or boats can be cleaned at a commercial car wash or by means of an automatic washing system that recycles water. Boat motors may be flushed or rinsed after use.

Further details of the permanent water conservation measures and current water restrictions can be obtained from SA Water's website (www.sawater.com.au).

Anyone found in breach of the water conservation measures will, in the first instance, be issued with a warning notice reminding them of their responsibilities. If non-compliance continues, a \$315 expiation notice will be issued. Serious or ongoing breaches could result in court action and fines of up to \$5000 for individuals and \$10,000 for corporations are applicable.

Industrial Water Efficiency Plans

From 1 July 2007 there is a requirement (under the *Waterworks Act 1932*) for industrial users to prepare a water efficiency plan that identifies where they can make water savings in any area of their operations where water is used. Proformas for completing the plans are available on the SA Water website (www.sawater.com.au/SAWater/Environment/WaterRestrictionsConservationMeasures/water_efficiency_plans.htm).

Industrial use of water for the purposes of this provision means water used not only for conventional industrial purposes such as processing, production, manufacturing and smelting, but also for commercial and business purposes, institutions such as schools and hospitals, construction, mining, aquaculture and intensive animal farming. Government agencies also have to comply with these requirements.

All industrial users of water are treated the same way, regardless of whether they obtain the water via SA Water infrastructure or by pumping directly from the River Murray under a water licence.

Applicable Legislation

Various legislation relevant to water management in South Australia is outlined below. Further detail regarding each of these and its effect is provided in **Appendix A**:

- *Water Efficiency Labelling and Standards Act 2006*;
- *Water Conservation Act 2006*;
- *South Australian Water Corporation Act 1994*;
- *Waterworks Act 1932*;
- *Sewerage Act 1929*;
- *Natural Resources Management Act 2004*;
- *Public and Environmental Health Act 1987*;
- *Environment Protection Act 1993*; and
- *Local Government Act 1999*.

4.3 Where Do We Use Water?

A range of local and interstate material is available to provide general guidance on where water is used in different types of development.

Residential households are the largest group of users (45%) of Adelaide's water (from all sources), followed by primary production (28%), community purposes (17%) and commercial and industrial uses (10%). A total of 40% of this is used in gardens and the outdoors. (Government of South Australia Water Proofing Adelaide (2005), p27.)

The table below provides an indication of estimated household water demand for different types of residential development.

A range of tables is provided in **Appendix B** for other types of developments.

Table 4.1 Estimated Typical Household Water Demands (litres/day)

Water Use	Design Number of Occupants				
	1	2	3	4	5
Bathroom	65	107	145	189	223
Toilet	49	107	145	189	223
Laundry	38	54	100	137	174
Gardening	87	220	220	220	220
Kitchen	14	38	60	83	123
TOTAL	253	526	670	818	963

Source: Upper Parramatta River Catchment Trust (2004), Melbourne Water (2005)¹

¹ Data from Melbourne Water has been used for the one person scenario and the remainder of information in the table is sourced from Upper Parramatta River Catchment Trust

4.4 Demand Reduction Approach

Overview

There are a number of steps to be taken in determining the demand reduction measures which are most appropriate for a particular development or redevelopment. The steps include:

- Site analysis;
- Determining objectives and targets;
- Technique selection;
- Meeting with local council and other relevant authorities;
- Identifying funding opportunities; and
- Review of objectives.

These various elements are discussed in detail in the following sections. Reference should also be made to [Chapter 3](#) for a general discussion on the approach.

Site Analysis

WSUD responds to site conditions and land capability and cannot be applied in a standard way. Careful assessment and interpretation of site conditions is a fundamental part of designing a development that effectively incorporates WSUD.

Before being able to determine what demand reduction approaches are suitable for a new development or redevelopment it is important to understand, for each site:

- How much water is used (or intended to be used);
- Where water is used (or intended to be used);
- By whom water is used (or intended to be used);
- How water is used (or intended to be used); and
- When water is used (or intended to be used).

If the site is existing, an audit of the water usage should be conducted in the first instance to obtain the information listed above. An audit can range from a broad overview to a detailed study.

There are tools and services available to assist developers, existing businesses, industry, schools and householders to complete this process (see [Section 4.9](#) - Useful Resources and Further Information), but the following basic steps will help gain an understanding of water usage and costs for an existing development:

- Check water bills for the past two years (ideally five) to see how much water has been used. Sudden or gradual increases in water use may indicate leakage;
- Read water meters regularly to identify any unexpected increases in water use that may indicate leakage. To confirm if there are leaks, carry out a night flow test when water use is nil or at a minimum;
- Identify the water intensive areas of your business or home to target specific areas of high consumption. In particular, identify equipment and practices that utilise water and/or that potentially waste water;
- Investigate seasonal trends in water usage.

The information provided in **Appendix B** can be used to inform the auditing process, or can be used for new development sites where no historical data is available.

The outcomes of the site analysis should assist in setting objectives and targets for water use reduction.

Determining Objectives and Targets

To achieve reductions in water consumption, it is important to set realistic water conservation objectives and targets and track progress against any targets set. If the objectives for selecting a demand reduction approach (and measures) are clearly defined, the task is simplified.

For the commercial and industrial sector an option is to incorporate water efficiency and reduction targets into an environmental policy.

Targets should be:

- Specific - clearly state what you aim to achieve;
- Measurable - ensure that the data is available and that systems are in place to measure the data;
- Achievable - assess if it is possible to meet the goal with the available resources and timeframe;
- Realistic - set targets that are possible to achieve for the type of program you are implementing; and
- Timely - set a timeframe for achieving each target and goal, and monitor on a regular basis.

Further information on objectives and targets is contained in **Chapter 3** of the Technical Manual.

Technique Selection

The next stage of the process is to identify and prioritise water conservation and water reuse opportunities. Through the site analysis process a range of opportunities will have been identified.

There is a range of measures available that can be undertaken to meet the identified opportunities (see **Section 4.6**). Selection of measures will need to take into account factors such as:

- Site conditions;
- Effectiveness;
- Economics; and
- Energy consumption (or greenhouse gas emissions).

Opportunities should be categorised to assist in planning the implementation phase. For example:

- Quick wins that can be implemented immediately (i.e. installation of water efficient fittings, planting of more drought tolerant species);
- Opportunities requiring some capital outlay (i.e. installation of a rainwater tank or diversion of roof runoff or rainwater tank overflow to a rain garden);
- More capital outlay required, therefore could be considered to be lower priority initiatives (i.e. replacement of paving with pervious paving); and
- Initiatives requiring further investigation (i.e. installation of greywater treatment and reuse system).

It is important in the commercial and industrial sector to identify someone who will be responsible for water management within the business.

In relation to larger capital items, more opportunities will be available for a new development compared to an existing development where retrofitting is required.

Meeting with Council or Other Relevant Authority

Before designing or installing demand reduction measures, it is important to check whether there are any planning regulations, building regulations or local health requirements that apply to demand reduction measures in your council area. A discussion with your local development assessment officer at council is therefore recommended.

The council will also be able to advise whether:

- Development approval is required and, if so, what information should be provided with the development application;
- Any other approving authorities should be consulted; and

- Any specific council requirements need to be taken into consideration.

Further information can be obtained in **Section 4.2 - Water Restrictions and Applicable Legislation**.

Identify Funding Opportunities

Australian governments, at all levels, are actively encouraging demand reduction to help reduce the stress on the current water supply network.

Listed below are a number of rebate schemes currently available to South Australians. Funding opportunities should be investigated to see if they may be able to assist in undertaking the demand reduction measures which have been identified for the particular site.

It should be noted that the details provided below are correct as at May 2008. It is therefore important to check whether your local council or water provider is offering a rebate scheme.

Adelaide and Mt Lofty Ranges Natural Resources Management Board

The Adelaide and Mount Lofty Ranges Natural Resources Management (NRM) Board often releases community grants to assist the local community to take action to better understand and manage the region's natural resources.

Further information on community grants available from the Board can be found at www.amlrnrm.sa.gov.au/

Local Government

A number of local government bodies also have rebates available for their residents. Information can be obtained from the respective council or on their website.

For example, the Adelaide City Council's Water Conservation Incentive Scheme (as of May 2008) offers reimbursements on the purchase and installation of a range of water conservation devices in an effort to improve efficiency in the use of water. Items covered by the scheme include rainwater tanks, greywater reuse systems and water efficient showerheads, as well as the plumbing of rainwater tanks to household appliances.



Further information on the Adelaide City Council's grants can be obtained at www.adelaidecitycouncil.com

The City of Prospect also (as at December 2007) offers a range of financial incentives to encourage property owners and/or occupiers to implement various water conservation measures which aim to reduce usage of mains water. The incentives cover rainwater tanks, dual flush toilet cisterns and water efficient showerheads.

Further information on the City of Prospect's grants can be obtained at www.prospect.sa.gov.au

State Government

The home rebate scheme has been introduced by the South Australian Government to encourage South Australian households to achieve greater water savings inside and outside the home. Rebates are available for approved water efficient products purchased on or after 1 November 2007. Rebates towards home water audits are available from 1 January 2008.

The rebates available are:

- Up to \$30 for a low flow (3 stars or more) showerhead;
- \$150 for retrofitting a dual flush toilet suite;
- \$200 for the purchase of a new water efficient (4 stars or more) washing machine;
- \$50 rebate when you spend \$150 or more on specified water efficient garden goods;
- \$100 rebate for a home water audit plus the installation of up to two free low flow showerheads;
- Between \$200 and \$1000 towards the cost of purchasing and plumbing a rainwater tank to retrofit into your home; and
- \$200 rebate for the purchase of specific pool or spa goods that will help to conserve water.

More information on the particular rebates can be obtained from the SA Water website (www.sawater.com.au).

To help householders to better monitor and manage their water consumption, SA Water will bill residential customers on a quarterly basis, starting 1 July 2009.

4.5 Water Efficiency Labelling and Standards Scheme

There is a growing body of information for consumers on how to save water and money.

The Water Efficiency Labelling and Standards (WELS) Scheme was established as a cooperative Commonwealth/state and territory regulatory system to help reduce domestic water consumption.

It came into force in January 2006 and replaced the previous voluntary AAAAA water rating scheme.

Labelling under the WELS Scheme is compulsory and requires product suppliers to label clothes washers, dishwashers, showers, taps, toilets, urinals and flow controllers with water efficiency information and star-ratings to enable consumers to choose the most water efficient product for their needs.

The scheme is based on the existing successful energy efficiency labelling standards (which clothes washers and dishwashers must also carry) (see **Figure 4.1**).

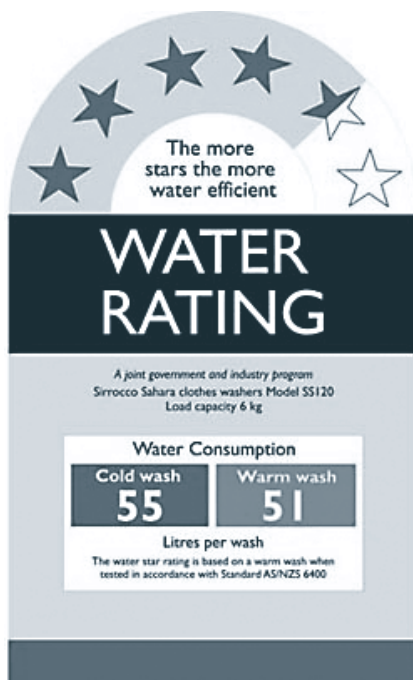


Figure 4.1 Water Rating Label Example

The label provides valuable information for consumers about

- a star rating for a quick assessment of the product's water efficiency and
- a figure showing water usage ie litres per kilogram of clothes washed.

Table 4.2 outlines what the labelling scheme generally means in terms of water efficiency.

Table 4.2 Water Efficiency Rating

Rating	Water Efficiency
★★★★★	Excellent
★★★★	Very high
★★★	High
★★	Good
★	Poor

For example, a showerhead that uses less than 9 litres/minute will be '★★★' rated. One that uses 9 to 12 litres/minute will receive '★★' rating. A 12-15 litre/minute showerhead will have an '★' rating. Those using more than 15 litres/minute do not comply with this scheme.

Products must conform to the appropriate Australian Standard for performance, such as Australian Standard AS/NZS 3662 for showerheads.

Additional consumer information is provided by WaterMark which is a product quality certification mark provided by independent certifying authorities. It confirms that the product complies with the requirements of the Plumbing Code of Australia and the specifications listed in relevant Australian Standards. These relate to the quality of the product, including aspects of health and safety, and warrant that it is fit for purpose.



WaterMark certification is mandatory for products to be legally installed in accordance with state and territory plumbing regulations. Those products required to be certified are listed in the Plumbing Code of Australia and AS5200.000.

The WaterMark logo, the relevant product Standard and the License Number are required to be marked on the product itself. However, WaterMark is not required for a product to be legally sold in Australia.

WELS products must carry a WELS label in order to be legally sold, but may not necessarily have the WaterMark. Consumers buying a WELS labelled product which does not carry the WaterMark should ask their local water authority or plumber if it can be legally installed.

4.6 Techniques

There is a range of measures which are available to assist in reducing the water demand for various types of developments which are summarised in Table 4.3 and discussed in more detail below.

Table 4.3 Demand Reduction Measures Applicable to a Range of Development Types

Measures	Development Type				
	Residential blocks	Multi-unit residential	Estate development works	Commercial, industrial and institutional developments	Capital works (roads, ponds, earthworks, public areas)
Water efficient fittings and fixtures	Yes	Yes	-	Yes	-
Water efficient mechanical plant	-	-	-	Yes	-
Water efficient landscaping	Yes	Yes	Yes	Yes	Yes
Rainwater storage and use	Yes	Yes	Yes	Yes	Yes
Stormwater storage and use	Yes	Yes	Yes	Yes	Yes
Use of greywater	Yes	Yes	Yes	Yes	-
Use of treated wastewater (if available)	Yes	Yes	Yes	Yes	-

Appliances and Fixtures

There are many, often inexpensive, ways to improve water efficiency including:

- Well maintained fixtures (i.e. no drips);
- Tap aerators;
- Efficient toilets;
- Water efficient shower roses;
- Washing machines; and
- Dishwashers.

Each of these measures is discussed briefly below.



Well Maintained Fixtures

The first step to achieving maximum water efficiency is to keep a well maintained plumbing system in all buildings. A dripping tap can waste up to 20,000 litres each year.

Other leaks that often go unnoticed are toilet cistern leaks. A toilet can run constantly from the cistern into the pan without being audible or visually noticeable. A slow, barely visible leak can waste more than 4000 litres per year. Visible leaks can waste more than 95,000 litres.

The best way to check if a toilet cistern is leaking is to put a few drops of food colouring into the cistern and watch to see if coloured water runs into the pan when the toilet has not been flushed.

Taps

Typical taps discharge 15 to 18 litres/minute. Low flow and aerating models may use as little as 2 litres/minute depending on the intended application.

Tap aerators are simple to install and cost very little (generally under \$5). They reduce the flow of water through the faucet while maintaining water pressure. Tap aerators should be installed on all sink faucets, kitchen, bathroom and laundry.

Taps with an aerator or flow restrictor may reduce flow to less than a third of standard taps. Examples of the different types of flow aerators available are illustrated in **Figure 4.2** and described below.



Figure 4.2 Types of Tap Flow Aerators

Source: www.sydneywater.com.au

Aerated Flow (picture 1)

Aerated flow types introduce air into the water stream. This softens the stream and reduces water splash when, for example, you are washing dishes.

Laminar Flow (picture 2)

Laminar flow types remove air to provide a clear water stream. They are commonly used in hospitals and medical clinics to prevent airborne bacteria from entering the water.

Spray Flow (picture 3)

In low flow conditions, where aerators and laminar devices would not function effectively, spray flows spread the tap's water stream over a wider area. This type of aerator ensures full coverage when washing your hands and is recommended for use in public toilets to reduce water consumption.

Other options for reducing water usage from taps include:

- Ensure that all new taps are water efficient. Look for the AAA rating as a minimum;
- Install mixer taps in showers. They can reduce the potential for scalding and save large quantities of water wasted through running the shower while trying to get a comfortable water temperature;
- Install separate hot and cold taps or mixer taps which provide cold water only in the middle position over basins and sinks. Mixer type taps are usually left in the middle position. This means that each time the tap is run for a glass of water or to rinse a toothbrush, hot water is drawn off just to cool in the pipe without ever being used.

Toilets

While dual flush toilets are mandatory for all new installations, flush volumes do vary significantly. Some older dual flush toilets have a full flush volume of about 9 litres while some newer models have reduced the full flush volume to as low as 4.5 litres. This represents significant additional savings when considered over the toilet's usage for a year.



Within the commercial/industrial sector, consideration should also be given to toilet fixtures. The use of waterless urinals or water efficient urinals with motion sensors should be considered. The average urinal uses approximately 2.2 litres per flush, while the most efficient urinals reduce flush volumes to 1.5 litres per flush – a reduction of more than 30%.

The most water efficient toilet is a waterless toilet, of which there is a range of models and types available. They work with no odour and little maintenance while providing excellent compost. The Department of Health should be contacted if a waterless toilet is to be considered.

Shower Roses



A water efficient shower rose will save a large volume of water, when considered over a year, and are easily installed. The technology has improved greatly and more recent water efficient shower roses can provide both good pressure and spread.

An inefficient showerhead can use more than 20 litres of water every minute while an efficient AAA rated one will provide a high quality shower using a maximum of 9 litres every minute.

AAA rated showerheads cost about the same as conventional ones (average price is around \$45) but can save around \$100 annually on household energy and water bills. This is because they use less water and less hot water, meaning less energy is used for water heating.

Washing Machines



In recent years there has been increasing focus on the development of appliances for water efficiency. Most front loading washing machines now use far less than older front loaders and top loaders (although there is a number of efficient top loading machines available).

In purchasing a washing machine, a consumer should look for the water efficiency labelling of the appliance (see **Section 4.5**).

Water efficient washing machines will save 50 L or more per load (or about one-third the water of an older model). Water efficient washing machines also use less detergent, which can be a big money saver.

Other ways to save water when using a washing machine include:

- Adjusting the water level on the machine so it is appropriate for the size of the load;
- Washing only full loads of laundry;
- Using the 'economy' cycle if the washing machine has one;
- Using the 'suds saver' function if the machine has one; and
- Diverting the treated wash water from your laundry to other uses, such as flushing your toilet or watering your garden (see **Chapter 14** – Wastewater Management).

Dishwashers

Water consumption in dishwashers varies greatly. There are many water efficient models available; however these units are often only efficient when run on a specific cycle. It is important to read the manufacturer's instructions carefully to ascertain how an appliance may be operated in the most efficient manner.



In purchasing a dishwasher, a consumer should look for the water efficiency labelling of the appliance (see **Section 4.5**).

Some newer model dishwashers are very water efficient, and can use less water than if you wash dishes by hand (depending on water use habits). The water use of dishwashers can range from 1.6 to 4.8 litres per place setting, with efficient machines using 18 litres of water or less per cycle. The most efficient dishwashers use half the water of average models.

It is important to always try to fully load the dishwasher before using it and use the 'economy' cycle if there is one.

Landscaping Practices

Overview

The application of WSUD principles to landscape design aims to achieve the following:

- Maximising the survival of plants during periods of low rainfall;
- Conserving an effective vegetation cover for WSUD measures that incorporate vegetation such as bioretention swales and rain gardens; and
- Enhancing biodiversity and habitat values by giving preference to locally indigenous plant species.



Landscaping practices:

- Can be applied to all scales of landscape development including residential, commercial, industrial and open space; and
- Are appropriate also for retrofitting existing landscape areas within existing residential, commercial and industrial development as well as parks and open space.

A variety of landscape measures can be used to reduce mains water use for irrigation including:

- Plant selection;
- Limiting the extent of lawn and the selection of the type of lawn (including artificial turf);
- Efficient irrigation;
- Choosing areas to receive less irrigation;
- Using surface mulches;
- Improving soil for plant growth;
- Wind and sun protection;
- Alternative sources of water; and
- Effective landscape maintenance.

For optimal results, these measures need to be undertaken in conjunction with careful site planning, drainage design and appropriate landscape practices.

Some of these measures are discussed below.

It should be noted that tree canopies intercept and detain a considerable amount of rainfall. This detention capacity has been equated with significant stormwater infrastructure cost savings.

Integrated Planning

The design and installation of water sensitive landscape measures needs to be undertaken as part of the planning for an integrated functional system for the whole site or area i.e. landscape measures should be designed in conjunction with other water management measures. For example, locating plants with similar water needs together is an aspect of efficient landscaping.

Plant Selection

Diversification

The aim of this approach is to create a diverse system within the landscape that is not reliant on a single device to manage water.

As an example, a gravel-lined basin (or infiltration basin) collects overflow from a water tank, spills over to a turfed filter strip, drains gently to a series of drainage swales spot planted with species that tolerate temporarily saturated soil, drains to a soak area ... and so on. This interconnecting system collects flow at a point source, reduces its speed and allows it to progressively infiltrate the soil, thereby reducing the risk of erosion, sedimentation and flooding, and use of reticulated water supply.

Species Diversity

Planting a variety of species will help ensure that there is not a complete loss of screen planting in the event of unfavourable circumstances such as prolonged drought, attack by a host specific pest, disease or unsuitable growing conditions. Unless a formal avenue of a single species is required for a landscape theme or style, choose hardy specimens from various genera, but with similar horticultural, watering and soil fertility requirements.



Suitable Plants

Select plants suited to the site's soil and microclimatic conditions. Some species are able to withstand low soil moisture or high wind exposure due to special adaptations such as hard leaf tissue, small leaves, deep root systems, deciduous leaves or silvery or furry leaves (or combinations of these). Local native plants have evolved to handle local conditions while other Australian natives also cope with very little water.

Some exotic plants from the Mediterranean region, California and Southern Africa are able to survive on limited water and a range of soil conditions. Some plants are so well adapted to severe conditions that they can colonise and dominate native bush areas.

When selecting low water demand plants, preference should be given to locally indigenous species that are adapted to the local soils and climate. However, the use of non-indigenous species may be appropriate in some situations to achieve a particular landscape outcome.

Check that plants chosen for the site (including native species from other parts of Australia) are not environmental weeds or declared noxious weeds with your:

- Relevant State Government agencies;
- Local council;
- Land care group(s);
- Regional botanical gardens; or
- Native plant nursery(s).

Explore the neighbourhood to determine which species grow well, including street trees and other rarely watered plantings.

Examples of different levels of water use include the following:

- Low use – most Australian natives including banksias, grevilleas, hakeas, wattles and eucalypts. Succulents and cacti and some exotic ornamentals such as bougainvillea also fall within this category.
- Medium use – hardy vegetables like pumpkins and potatoes, hardy fruit trees and vines like nut trees and grapes, many herbs, some exotic shrubs, most grey-leaved or tomentose (hairy) plants, roses and daisies.
- High use – lawns, leafy vegetables, soft fruit trees, exotic shrubs like azaleas and camellias, flowering herbaceous annuals and many bulbs.

Place plants in the areas of the garden that suit the conditions provided. For example, place moisture loving plants in protected spots with deeper soils, and hardy silvery-leaved plants in full sun, all with layers of mulch on the surface.

SA Water provide information on selecting plant species appropriate for Adelaide 'waterwise' and Mediterranean type gardens (see **Section 4.9** – Further Information and Useful Resources). The Department of Environment and Natural Resources (DENR) also provide information to assist the selection of species.

Minimising Lawn and Selection of Lawn Type

Lawns are shallow-rooted groundcovers that generally require regular watering to maintain a green leaf cover. Compared to garden beds, lawn areas require significantly more fertiliser, water and maintenance per unit area to maintain healthy growth. Lawn areas also require greater inputs of energy, time and money.

Rationalising the size and design of lawn areas can be easily undertaken, resulting in significant reductions in water use. There are many options including:

- Replace lawn areas with vegetable patches, garden beds, screen planting, or a shade tree and garden bench;
- Site turfed areas closer to the house for more efficient watering from rainwater tanks;

- Choose other groundcovers and low growing shrubs for a green outlook;
- Utilise artificial turf where possible;
- Use other pervious surfaces for trafficked areas, such as mulch, gravel or pervious paving units. This will avoid the need to repeatedly repair worn out tracks across the turf;
- Alter maintenance practices to encourage deeper root growth (reduced mowing frequency, higher blade height, less frequent but deeper watering);
- Replace with grass species that are slower growing and require less fertiliser and water to remain green.

Check with your local supplier for native and introduced grasses that suit local conditions.

Warm season grasses and cultivars have the lowest water demand and are drought tolerant including:

- Common or Bermuda Couch;
- Santa Anna Couch;
- Windsor Green;
- Greenless Park;
- Wintergreen; and
- Kikuya

Efficient Irrigation

Only install irrigation systems if needed. Landscape measures that collect and utilise runoff by slow infiltration can replace reliance on supplementary water.

Irrigation will generally not be required if plant species are carefully chosen to suit the soil, climate, aspect and microclimate, and appropriate planting and maintenance techniques are implemented. However, some gardeners have different preferences, such as for species that do not thrive with natural rainfall. The aim in this case is to apply water in the most efficient manner.

Points that should be considered regarding the choice of an irrigation system, its installation and use, are outlined below:

- Match the system's design and specifications to the conditions on your site, including water source and quality, soil types and depth, moisture infiltration rates, evapotranspiration rates, frequency and intensity of rainfall, slope, plant choice and layout. Consult an irrigation specialist for a tailor made efficient system;

- Refit an existing system with the most efficient lowflow fittings (jets, sprays and nozzles, etc.). Fix any leaks from joiners, hoses and pipes. Rationalise its layout. Adjust it to suit the changing requirements of plants as they mature (generally reduced water demand);
- Connect each garden area to separate valves to create 'hydrozones' where plants grouped with similar water needs can be precision watered to suit them. Lawn areas will require the most water;
- Water according to the weather and plant needs, not to a fixed time schedule. Install soil moisture indicators as a guide. Allow soils sensors to override an automated system;
- Reduce the frequency of watering so that plants become less reliant on irrigation. Monitor plants individually and replace systematic watering with manual watering of stressed plants;
- Install drip systems for sparsely distributed plants, and underground or surface leak systems for dense garden beds. As the most efficient form of irrigation, there is less vapour loss from spray or misdirected water;
- With spray systems, avoid overlapping areas or directing it onto paths and driveways.
- Ensure that the water is directed to the roots as much as possible;
- Set a timer to turn off watering systems if it is not automated. Adjust according to the season and plant needs; and
- Maintain the whole system routinely, inspect for blockages, repair leaks and replace worn parts.

Irrigation is best done in combination with mulching of garden beds to conserve applied water. Always avoid overwatering to the point where the soil is saturated and excess water flows away from where it is intended.

The costs and maintenance of an efficient irrigation system should be measured against the benefits.

The Code of Practice for Irrigated Public Open Space should be referred to for further information (www.sawater.com.au/SAWater/WhatsNew/Publications).

Mulching

Mulching can reduce irrigation water use by as much as 70%. A 50 millimetre layer of organic mulch spread over garden beds will break down slowly and feed plants, restrict weed growth, prevent wind and water erosion, and shade the ground.

However, if organic mulch is used, it should be ensured that it is placed such that it is not transported off site with resultant water quality issues.

Shading

Providing protection from harsh climatic forces makes garden areas more pleasant and reduces moisture loss from soil and plant tissue. Sun and wind exposure will strip moisture from leaves, requiring the plant to use greater levels of available soil moisture than in less exposed conditions.

Management

Correct management by properly trained and qualified staff for commercial and industrial sites and for State Government agencies and councils is essential for efficient irrigation. Training staff on irrigation systems auditing and scheduling is a key step.

Monitoring and Maintenance

For landscape areas, the following items should be inspected:

- Signs of plant moisture stress;
- Dead or damaged vegetation;
- Weed infestation; and
- Signs of surface erosion and scouring.

The following maintenance activities should be undertaken, with inspection frequencies shown in the example Inspection and Maintenance Checklist (**Appendix C**):

- Repair/replace any damaged vegetation;
- Reapply or apply mulch layer;
- Watering (in accordance with water restrictions); and
- Repair surface erosion and scouring.

Alternative Water Sources

Reducing potable (or mains) water demand also means finding alternative sources of water. How water is used can determine the appropriate quality – and source – of water. Most domestic, commercial and industrial water does not need to be of drinking standard, so it is possible to supply water from different sources.

Alternative water supply sources include:

- Runoff (including rainwater and stormwater);
- Groundwater;
- Treated greywater (i.e. from laundry and bathroom);
- Treated wastewater (i.e. from local wastewater treatment plants or sewer mining); and
- Treated plant water (i.e. at an industrial premise).

To determine an appropriate source of water for reuse, the following issues require consideration:

- Availability of the alternative source of water;
- Proximity to the use;
- Timing of the water requirements (i.e. constant or seasonal);
- Infrastructure requirements;
- Risk of cross connections (health impacts);
- Method of treatment required to achieve quality appropriate for reuse;
- Occupant behaviour and attitude; and
- Other environmental objectives such as energy efficiency and greenhouse gas emissions.

A hierarchy of options for water reuse, grading from the easiest to implement to the most extensive water reuse options, is presented below. Choosing the best option for a development will depend on:

- The scale of the development;
- The proximity to treatment facilities; and
- The importance of reducing water consumption.

The recommended hierarchy for household reuse options is:

- Rainwater reuse for toilet and garden;
- Household greywater for garden; and
- Treated wastewater to toilet and garden, rainwater for hot water.

The use of groundwater is becoming a critical issue as people respond to water restrictions and shortages by wanting increased access to groundwater supplies. Groundwater must be managed within sustainable limits.

The use of treated wastewater for irrigation by councils is quite common and presents an excellent opportunity to conserve mains water.

Further information on alternative water sources can be found in the following chapters of the Technical Manual:

- Rainwater Tanks (**Chapter 5**);
- Urban Water Harvesting and Reuse (**Chapter 8**);
- Wastewater Management (**Chapter 14**); and
- Siphonic Roofwater Systems (**Chapter 16**).

4.7 Education and Incentives

Overview

Raising awareness is one of the most cost effective and sustainable methods to save water. Education and incentive schemes can be used to encourage the uptake of water conservation practices and technologies.

There is already a number of community water conservation programs run by government agencies such as SA Water, the Environment Protection Agency (EPA), WaterWise, WaterCare and the Natural Resources Management Boards.



Incentives

Incentive programs generally provide a financial or service incentive for people to conserve water. They fall under the general categories of:

- Subsidised audits and advisory programs;
- Loan programs for the purchase of water conserving appliances, hardware or landscaping;
- Rebate programs which reduce the normal sale price of water saving fixtures;
- Give-away programs offering free water saving devices; and
- Subsidised retrofits.

In addition, for commercial and industrial operations, businesses and agencies can:

- Provide incentives for staff to save water by linking water conservation to staff performance reviews;
- Use visual tools like charts and graphs to highlight water savings to employees;
- Mention water conservation plans and progress in staff meetings;
- Use communication tools like bulletins, newsletters and emails to send staff water saving ideas, announcements, progress reports and news of special achievements;
- Include water conservation policies and procedures in staff training programs;
- Involve staff by seeking their ideas and rewarding those who make a positive contribution; and
- Reward achievements in water use reduction.

A number of these methods could also be considered as 'education' approaches.

Education

There are numerous methods to engage people through education and communication – from informal learning and engaging activities (often hands on) to professional development and continuing education, formal education, presentations, performances, information, artwork and media. Budget will often influence the methods that are used.

Generally, a series of coordinated activities will be required; building on existing activities and programs is one effective approach.

A range of examples of education and communication programs is summarised in **Table 4.4**.

Importantly, communication programs must be tailored to be relevant to the intended audience, with the best communication tending to involve participation.

For example, hosting workshops which invite participants to take action can build ownership and support in ways that simply sending out information will not do.



Table 4.4 Examples of Education and Communication Programs

Type of Program	Examples
Informal learning and engaging (often hands on)	<ul style="list-style-type: none"> ■ Demonstration sites and gardens ■ Launches ■ Festivals and fairs ■ Competitions and awards ■ Grant programs
Presentations and performances	<ul style="list-style-type: none"> ■ Talks, presentations, seminars ■ Demonstrations ■ Tours ■ Performances
Professional development / continuing education	<ul style="list-style-type: none"> ■ Workshops (e.g. workshops about rainwater tanks) ■ Courses ■ Study groups ■ Advisory services
Formal education	<ul style="list-style-type: none"> ■ School education ■ TAFE courses ■ University education ■ Training for teachers ■ Community college courses
Information	<ul style="list-style-type: none"> ■ Printed material ■ Display material ■ Electronic and audio visual material ■ Products

Type of Program	Examples
Demonstrations	<ul style="list-style-type: none">■ Implementation of water saving initiatives at community facilities
Signage and public art	<ul style="list-style-type: none">■ Signage at, for example, parks■ Community artworks and exhibitions
Media	<ul style="list-style-type: none">■ Media releases and articles■ Paid advertising

Source: Adapted from Department for Environment and Heritage (2005)

4.8 Case Studies

The Water Campaign

Australian councils taking part in the Water Campaign are conserving water and improving the water quality of local rivers, streams and groundwater through implementing on ground actions ranging from practical adjustments to innovative initiatives.

The Water Campaign is an international freshwater management program that motivates and empowers local government to work toward the sustainable management of water resources. The program builds the capacity of councils to take action to address water quality and water conservation within their own corporate operations, and influence their community through land use planning, education, regulation and various other incentives.

As part of the campaign, participating councils undertake an inventory of their water consumption and management practices that influence water quality. This provides baseline data, highlighting the current state of play. Based on the baseline data, councils then establish water reduction and water quality improvement goals. These water reduction goals outline the percentage of water the council wants to reduce, based on its baseline year by a specific target year.

There are currently 23 councils participating in the Water Campaign in South Australia. To date, four of these councils have set their corporate and community water reduction goals. Case studies below highlight actions undertaken by a number of Water Campaign participants from the Greater Adelaide Region. The actions are highly transferable and provide examples of how local government is approaching sustainable water management.

City of Mitcham

The City of Mitcham is located 6 kilometres south of the Adelaide Central Business District (CBD) and has a population of 61,900. The City of Mitcham has the following demand reduction targets:

- Corporate – 20% reduction in water use by 2013 (projected total savings = 49.8 megalitres); and
- Community – 20% reduction in water use by 2013 (projected total savings = 1670 megalitres).

The City of Mitcham has developed a Water Management Plan in order to provide the council with a strategic direction and an implementation schedule for water related activities over a five year period.



The City of Mitcham has made some innovative changes to its watering regimes in response to a detailed open space review. A key water saving component of this involves browning off in strategically identified low use open spaces. In high use areas and sporting fields, council is watering for longer periods, less frequently, to promote deep root growth and reduce water requirements.

The City of Mitcham is also saving water by replacing inefficient hose and

sprinkler systems with automatic irrigation systems, undertaking night watering and trialling soil additives to increase water retention. Drought tolerant native vegetation is being planted on council land and wood chips from council operations and tree trimming is being used to mulch council gardens. Stormwater diversion devices are being installed on Claremont Ave for street tree watering, in partnership with the Department for Transport, Energy and Infrastructure (DTEI), the University of South Australia and TREENET.

As a result of browning off and reduced watering, the council estimates it is achieving an annual saving of 29,900 kilolitres of mains water.

Browning -off has saved Council \$5000 per year through reduced water costs. Importantly, there was no financial cost to implement this action.

The City of Mitcham's action occupies the top of the water conservation hierarchy, as it avoids water use. This action is also carbon neutral; there is no water use, there is no pumping requirement and therefore no energy use.

Campbelltown City Council

The Campbelltown City Council is located 8 kilometres from the Adelaide CBD and has a population of approximately 47,000.

Council's main water usage in 2001-2002 was for open space (64%), playing fields (32%) and administration buildings and community centres (3% combined).

Playing fields are irrigated more intensively than other assets to maintain a suitable playing surface for active recreational purposes, such as soccer, football and cricket. Open space and playing fields are priority areas for action by council.

The Campbelltown City Council is predominantly residential land use with some retail, commercial and light industrial users. Water consumed by these sectors in 2001-02 was 5373 megalitres.

Households account for the majority of water consumed followed by the non-residential and commercial sectors. On average, non-residential users consume more water per property than other land uses.

Around 48% of all water is consumed by households. On average, each household uses about 280 kilolitres of water a year.

The Campbelltown City Council has the following demand reduction targets:

- Corporate – 25% reduction in water use by 2015 (projected total savings = 62.9 megalitres); and
- Community – 25% reduction in water use by 2015 (projected total savings = 1262 megalitres)

The Campbelltown City Council has developed a Water Management Plan in order to provide the council with a strategic direction and an implementation schedule for water related activities over a five year period.

Victoria Square 1 (VS1), City of Adelaide

SA Water's new headquarters under construction in Victoria Square in the City of Adelaide has been granted a 6 Green Star Rating – the first building in South Australia to gain such a ranking by the Green Building Council of Australia.

The building – Victoria Square 1 (VS1) – will house SA Water as the major tenant, and will deliver considerable savings in terms of energy and water conservation with its innovative design and construction.

The 10-storey building will use in excess of 70% less mains water compared with a conventional office building – saving 11 million litres of water a year.

The innovative features of the building include:

- Collection of rainwater and treatment of the building's wastewater for reuse in toilet flushing, irrigation and cooling towers; and
- Use of water efficient taps toilets and waterless urinals with AAAA rating.

Colliers International, City of Adelaide

Colliers International's Adelaide office at 10 Pulteney Street is leading the field in the implementation of water saving initiatives. The installation of waterless urinal cubes throughout the 18-floor complex has seen a reduction in water consumption in the building of about 4 million litres (Australian Government 2006).

The initiative cost \$2400 and delivered water cost savings and reduced plumbing costs of \$8200. Colliers International continues to implement this and other initiatives across a number of portfolios around the country (Australian Government 2006).

Commonwealth Law Courts, City of Adelaide

The Commonwealth Law Courts is a recently completed landmark building constructed to house cutting edge technology and ecologically sustainable design initiatives. The building accommodates 22 court rooms and support facilities for four federal jurisdictions.

It incorporates a number of water and energy saving features including:

- Collection and reuse of rainwater for irrigation, toilet flushing and make up to the evaporative pre-cooling systems in the plant room;
- Water conservation AAAA rating water conservation devices throughout the complex;
- Solar hot water generation with gas boost for times of peak demand.

The selection of locally based sanitary ware, tap ware and piping systems manufactured within South Australia offers greenhouse emissions benefits in terms of less transport energy used.

Schools

Like all government agencies, the Department of Education and Children's Services (DECS) is required to meet South Australia's Strategic Plan targets. These targets include a requirement to manage water use within sustainable limits. In line with this target, all DECS sites have been set a target to reduce water consumption by 10% from the 2000-01 base year.

In 2000-01 the total mains water usage of DECS was around 5 million kilolitres. A 10% saving on this amount would translate to a saving of 500,000 kilolitres. This is equivalent to a saving every year of 500 Olympic-sized swimming pools or a saving each year of the water consumed by around 1600 South Australian homes.

A number of steps have begun to be taken in the Central Office, which includes the installation of waterless urinals in March 2006 and the use of flow restrictors on taps. The waterless urinals are estimated to save between 4 and 5 million litres of mains water per year.

New measures applied for schools from the start of the 2008 school year, with the rolling average utility resource formula replaced in line with the water consumption targets.

Information and assistance is available to assist schools to meet their targets, including:

- Publishing water consumption data and water management information through the internet, available to schools;
- Distributing the Code of Practice for Irrigated Public Open Space;

- Developing a suite of policies to guide schools and pre-schools on water management;
- Providing grants to schools and other locations to undertake irrigation audits and irrigation management plans;
- Providing infrastructure grants to implement actions from detailed irrigation audits;
- Assisting suitable schools to use treated wastewater for irrigation;
- Seeking partnerships to encourage managed aquifer recharge (MAR) projects for turf irrigation; and
- Supporting schools to harvest rainwater or stormwater for toilet flushing and irrigation.

Green Schools Grants will be used to engage irrigation auditors to develop measures to assist schools to achieve at least a 10% reduction on 2000-01 consumption levels. By 2009-10 at least 200 schools and other DECS services will have been audited by an auditor accredited by the Irrigation Association of Australia.

4.9 Useful Resources and Further Information

General Information

www.yourhome.gov.au/technical/index.html

Environment Australia (2001). *Your Home: Technical Manual and Consumer Guide*

www.savewater.com.au

Australian website dedicated to promoting better water conservation

www.thegreendirectory.com.au

The Green Directory

www.greenplumbers.com.au

Green plumbers association

www.ata.org.au

Alternative Technology Association

www.waterrating.gov.au

Australian Government, Water Efficiency Labelling and Standards (WELS) Scheme

www.smartwater.com.au

Smart Water

www.iclei.org/index.php?id=water_home

ICLEI Local Government for Sustainability

www.sydneywater.com.au/Water4Life/SecuringOurWaterSupply.cfm

Sydney Water's water conservation and recycling site

www.smartwatermark.info

Smart Water Mark: Australia's outdoor water saving labelling program

www.waterforgood.sa.gov.au

Water For Good – the State Government's plan to provide for water security for South Australia

www.nabers.com.au

Office and home ratings advice including water conservation calculator

www.mitcamcouncil.sa.gov.au/site/page.cfm?u=1131

City of Mitcham water conservation tips

www.sawater.com.au/SAWater/YourBusiness/SaveWaterInYourBusiness/

SA Water – Business Water Saver Program

www.urbanforest.on.net

SA Urban Forest Biodiversity Program

www.mda.asn.au/download.cfm?DownloadFile=A4BBC949-E081-51EF-A74702E9E228C3B8

Water Conservation Handbook for Local Government

www.urbanwater.info/engineering/BuiltEnvironment/WaterSavingFixtures.cfm

Water Saving Fixtures

www.workgreen.com.au/

Work Green

www.waterforgood.sa.gov.au/using-and-saving-water/saving-water/

Best Practice Water Conservation Principles

www.watercare.net

Comprehensive schools education resource

www.ata.org.au/publications/water-not-down-the-drain/

Water Not Down the Drain

www.wsud.org

Water Sensitive Urban Design in the Sydney Region

www.yourhome.gov.au

Your Home

www.aila.org.au

Australian Institute of Landscape Architects

www.treenet.org

Treenet

www.sawater.com.au/interactivehouse

An interactive learning program including a home water use calculator

Education and Incentives

www.aeee.org.au/

Australian Association for Environmental Education

www.environment.gov.au/education/aussi/publications/aussi-factsheet.html

Sustainable Schools and Children's Services Initiative

www.captaingreen.com.au

Captain Green

communication.org.au/joinus/

Communication Research Institute of Australia

Irrigation and Plant Species Information

www.australianplantsa.asn.au

Australian Plant Society

www.southeastwater.com.au/SiteCollectionDocuments/Local%20Government/Attachment%206%20-%20Efficient%20Irrigation%20for%20Turf%20and%20Landscape.pdf

Efficient Irrigation: A Reference Manual for Turf and Landscape

www.sawater.com.au/SAWater/WhatsNew/Publications/

Code of Practice - Irrigated Public Open Space

www.irrigation.org.au

Irrigation Association of Australia

www.ngia.com.au

Nursery and Garden Industry Association

www.alma-lawn.com

Australian Lawn Mowers Association

www.stateflora.com.au/

State Flora, Belair National Park

www.sgaonline.org.au

Sustainable Gardening Australia

www.environment.sa.gov.au/botanicgardens/programs/landscapes-index.html

Native and exotic plants suitable for South Australian conditions

www.sawater.com.au/NR/rdonlyres/74E31A43-783D-458A-91ED-FEDC041EB858/0/beautiful_gardens.pdf

Waterwise garden

www.sawater.com.au/SAWater/AboutUs/InTheCommunity/Med_garden.htm

Mediterranean type garden

www.enduroturf.com.au

Endoturf - suppliers of synthetic surfacing

www.decorstone.com.au

Landscaping products

Water Audits

www.sawater.com.au/SAWater/YourHome/SaveWaterInYourHome/

SA Water – Home Water Audit

www.sawater.com.au/sawater/yourbusiness/savewaterinyourbusiness/

SA Water – Business Water Audit

www.murrayusers.sa.gov.au/water_audit_kit.php

Murray Care – Water Audit Kit

www.sawater.com.au/interactivehouse/

Ways to save water in the house and garden

Fact Sheets

www.decs.sa.gov.au/docs/documents/1/WaterSmartAuditingWater.pdf

Water Smart: Auditing Water Use in School Buildings

www.decs.sa.gov.au/docs/documents/1/BorewaterIrrigation.pdf

Water Smart: Bore Water for Irrigation in Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartIrrigationMgt.pdf

Water Smart: Irrigation Management and Auditing in Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartLandscapeDesign.pdf

Water Smart: Landscape Design and Management in Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartManagingLeakage.pdf

Water Smart: Managing Water Leakages in Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartMonitoringWater.pdf

Water Smart: Monitoring Water Use in Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartWaterEquipment.pdf

Water Smart: Water Saving Hardware and Equipment for Schools

www.decs.sa.gov.au/docs/documents/1/WaterSmartToiletsUrinals.pdf

Water Smart: Toilets and Urinals for Schools

www.lga.sa.gov.au/webdata/resources/files/FACTSHEET_IPOS.pdf

SA Water Information Sheet - Code of Practice: Irrigated Public Open Space (IPOS)

www.environment.gov.au/education/aussi/publications/pubs/aussi-factsheet-may07.pdf

Australian Sustainable Schools Initiative Fact Sheet

www.sawater.com.au/sawater/environment/waterrestrictionsconservationmeasures/water_efficiency_plans.htm

WaterWise in Industry Fact Sheet

www.adelaidecitycouncil.com/adccwr/publications/guides_factsheets/water_factsheet.pdf

Adelaide City Council Conserving Urban Water Fact Sheet

(Websites current at August 2010)

4.10 References

Australian Government (2006). *Water efficiency: office and public buildings*. Department of Environment and Heritage. Canberra.

www.environment.gov.au/settlements/publications/government/pubs/water-efficiency-guide.pdf.

Department for Environment and Heritage (2005). *Water Conservation Handbook for Local Government*. Government of South Australia. Adelaide.

Department of Natural Resources and Mines Queensland (2005). *Planning Guidelines for Water Supply and Sewerage - Chapter 5 - Demand / Flow and Projections*.

Government of South Australia (2005). *Water Proofing Adelaide: A Thirst for Change (2005 - 2025)*.

Melbourne Water (2005). *WSUD Engineering Procedures: Stormwater*. CSIRO Publishing.

Upper Parramatta River Catchment Trust (2004). *Water Sensitive Urban Design, Technical Guidelines for Western Sydney*. www.wsud.org/tools-resources/

Upper Parramatta River Catchment Trust, Sydney Coastal Councils Group, Western Sydney Regional Organisation of Councils, Lower Hunter Central Coast Regional Environmental Management Strategy (2003). *Water Sensitive Planning Guide for the Sydney Region*. Upper Parramatta River Catchment Trust. Sydney. May.
www.wsud.org/downloads/Planning%20Guide%20&%20PN's/WSPP%20Final.pdf.

(Websites current at August 2010)

Appendix A Legislation

National

The Commonwealth Government has a limited role in water conservation, as resource issues are generally the jurisdiction of state and local governments. However, the COAG water reform framework aims to improve water management and to ensure that extraction of water is sustainable. At its meeting in June 2004, COAG agreed to a National Water Initiative (NWI), covering a range of areas in which greater compatibility and the adoption of best practice approaches to water management nationally will bring substantial benefits. Key elements of the NWI include the return of over allocated systems to sustainable levels and actions to better manage demand in urban areas.

A potentially powerful regulatory role for the Commonwealth Government and its agencies is the Building Code of Australia (BCA), which can be used as a significant tool to ensure water efficient appliances are standard in new buildings. For example, under the BCA only dual flush cisterns can now be installed in Australia.

Water Efficiency Labelling and Standards Act 2006

The *Water Efficiency Labelling and Standards Act 2006* is an Act to provide for water efficiency labelling and standards as part of a cooperative scheme between the Commonwealth and the states and territories, as well as for other purposes. The Minister for Environment and Conservation has responsibility.

The objects of this Act are to:

- Conserve water supplies by reducing water consumption;
- Provide information for purchasers of water use and water saving products; and
- Promote the adoption of efficient and effective water use and water saving technologies.

Further information on the labelling scheme is contained in **Section 4.5**.

State

Water Conservation Act 1936

The *Water Conservation Act 1936* consolidates certain Acts relating to the conservation of water. The responsible minister is the Minister for Water Security.

South Australian Water Corporations Act 1994

The South Australian Water Corporation (the Corporation) was established on 1 July 1995 pursuant to the *South Australian Water Corporation Act 1994*.

The key objectives of the Corporation are to:

- Ensure South Australia's water and wastewater services are operated in a way which provides continuous, high quality supply, protects the health of the public, and minimises environmental impacts;
- Ensure South Australia's water and wastewater services are operated in a commercial manner, delivering high quality, value-for-money services to customers and adequate financial returns to the Government as owner within the context of government pricing decisions; and
- Facilitate the development of a viable, export-focused, vigorous water industry in South Australia.

The primary functions of the Corporation in accordance with the *South Australian Water Corporation Act 1994* are to provide services for the:

- Supply of water by means of reticulated systems;
- Storage, treatment and supply of bulk water; and
- Removal and treatment of wastewater by means of sewerage systems.

Additional functions of the Corporation, as set out in the Act, include researching and undertaking works to improve water quality and wastewater treatment; developing and marketing commercially viable products, processes and intellectual property; and encouraging and facilitating private or public sector investment and participation in the provision of water and wastewater services and facilities.

Waterworks Act 1932

SA Water administers the *Waterworks Act 1932*. The responsible minister is the Minister for Water Security.

SA Water may, with the approval of the Minister by notice published in the Gazette, do one or more of the following under the *Waterworks Act 1932* (Section 33A(1)):

- Prohibit the use of water for a specified purpose or purposes, or restrict or regulate the purposes for which water can be used;
- Prohibit the use of water in a specified manner or by specified means, or restrict or regulate the manner in which, or the means by which, water may be used; or
- Prohibit specified uses of water during specified periods, or restrict or regulate the times at which water may be used.

The *Waterworks Act 1932* contains the Waterworks Regulations 1996 and more recently the Waterworks Variation Regulations 2007. The variation regulations relate to the development of water efficiency plans (as discussed above). Part 6 of the Waterworks Regulations 1996 relates to water restrictions and permits.

Sewerage Act 1929

SA Water administers the South Australian *Sewerage Act 1929* which is applicable to areas where there is a government sewerage system available. These areas are known as proclaimed drainage areas. Areas where an SA Water sewerage system is not available are the responsibility of the local government authority and/or the Department of Health.

Section 36 of the *Sewerage Act 1929* provides for an exemption from the requirement to discharge to the sewerage system from a property. The Act allows for the exemption to be granted by SA Water and is used when application is made for the installation of a permanent greywater diversion system.

Exemption may be granted by SA Water in cases when SA Water is satisfied that the proposal does not compromise the sewerage or drinking water systems.

Natural Resources Management Act 2004

The *Natural Resources Management Act 2004* has integrated the management of land, water, plants and animals into one piece of legislation.

The Department of Water, Land and Biodiversity Conservation (DWLBC) is the principal department which assists the Minister responsible for the administration of the *Natural Resources Management Act 2004*. Through effective administration of the Act, the DWLBC seeks to encourage the use of water for its highest and best return within sustainable limits.

In addition to DWLBC, the Natural Resources Management Boards have three main legislative functions under the *Natural Resources Management Act 2004*:

- To prepare and implement Natural Resources Management Plans;
- To provide advice to the Minister and councils about water resource management; and
- To promote awareness and involvement in best practice water management.

Public and Environmental Health Act 1987

The Environmental Health Service of the Department of Health provides a range of scientific, engineering and technical services related to public and environmental health, specifically in the areas of drinking water (including rainwater), sanitation and wastewater management. This includes administration of the Waste Control Regulations, assessment and approvals of wastewater management systems and treated wastewater reuse systems, and support for local government in the administration of the *Public and Environmental Health Act 1987* and associated Regulations.

Permanent greywater systems such as diversion devices or treatment systems require installation approval from council or the Department of Health and all systems must be installed by a licensed plumber. Installation of greywater systems must take into

account the Department of Health requirements for setback distances outlined in South Australian Health Commission Code Waste Control Systems – Standard for Construction, Installation and Operation of Septic Tank Systems in South Australia and Supplement B – Aerobic Wastewater Treatment Systems.

Where it is intended to install a greywater treatment/diversion system in a sewerred (or other reticulated system) area, approval must be obtained from the owner/operator of the system.

Environment Protection Act 1993

The Environment Protection Authority (EPA) regulates and prosecutes for water pollution activities (under the *Environment Protection Act 1993*) and also runs water education programs for business and the community including Codes of Practice for Stormwater Pollution Prevention in South Australia.

The Environment Protection (Water Quality) Policy 2003 establishes thresholds above which it is an offence to discharge wastewaters to a water resource. This policy provides the legislative controls (*Environment Protection Act 1993*) to bring about improvements in the management to wastewaters, of which one method is the application of wastewater to a beneficial use.

The South Australian Reclaimed Water Guidelines [Environment Protection Authority South Australia, 1999 #68] describes methods by which treated wastewater can be used in a sustainable manner without imposing undue risks to public health or the environment.

The National Guidelines for Water Recycling [Environment Protection and Heritage Council, 2006 #67] are intended to replace the Reclaimed Water Guidelines and are now the primary reference for assessment of all treated wastewater reuse projects.

Local Government Act 1999

Local government approves the planning and development aspect of proposed developments.

The important role of local government in promoting sustainability initiatives is acknowledged through the Intergovernmental Agreement on the Environment, Local Agenda 21 and the following sections of the *Local Government Act 1999*:

- Section 6(b) outlines council's roles to provide and coordinate various public services and facilities, and to develop its community and resources in a socially just and ecologically sustainable manner;
- Section 7(e) outlines council's functions to manage, develop, protect, restore, enhance and conserve the environment in an ecologically sustainable manner;
- Section 8(f) outlines council's objectives to encourage sustainable development and the protection of the environment, and to ensure a proper balance within its community between economic, social, environmental and cultural considerations.

Appendix B

Water Usage Data

Water Usage Data

Water usage data is provided below from a range of local and interstate sources to assist with undertaking an audit of a site or determining what the water use reduction of a site might be. Local (and more recent) data should be utilised wherever possible.

Limited information on commercial, industrial and community uses is available. The information available has been included in this Appendix. Please note that these figures are from pre-drought water restrictions.

Table B1 Domestic Water Use in Adelaide

Use	Percentage	Volume (kL)
Garden and outdoor	40%	112
Bath and shower	20%	56
Laundry	16%	44.8
Kitchen	11%	30.8
Toilet	11%	30.8
Other	2%	5.6
Total	100%	280 kL

Source: Government of South Australia; Water Proofing Adelaide (2005)

Table B2 Indicative Water Usage Rates for a Range of Buildings

Development	Demand (L/day/unit)	Unit
Apartment/home unit	300-500	1 bed
	550-750	2 bed
	700-900	3 bed
Caravan park- van	550-750	Site
Caravan park - tent	150-250	Site
Central business	14,000- 20,000	Ha
Child care centre	40-70	Staff and pupils
Commercial premises	500-800	100 sqm GFA*
Convalescent home	600-1100	Bed
Crematorium	500-700	100 sqm GFA
Education- primary school	50-80	Staff and pupils
Education- secondary school	90-150	Staff and pupils
Education - tertiary institution	90-150	Staff and pupils
Fast food store	1400-4200	100 sqm GFA
Food services	1200-2000	100 sqm GFA
Heavy industry	10,000-35,000	Ha
Hospital	500-1800	Bed
Hostel accommodation	200-600	Bed
Hotel	700-1200	100 sqm GFA
Light industry	10,000-35,000	Ha
Major shopping development	300-800	100 sqm GFA
Medical centre	400-700	100 sqm GFA
Motel	300-600	Room
Multiple units	500-700	1 bed
	800-1000	2 bed
	1000-14,000	3 bed

Development	Demand (L/day/unit)	Unit
Place of worship	200-400	100 sqm GFA
Public building	500-600	100 sqm GFA
Restaurant	800-1800	100 sqm GFA
Retirement village	300-700	1 bed
	500-1000	2 bed
	700-1400	3 bed
Service station	500-700	100 sqm GFA
Shop	600-800	100 sqm GFA

* GFA - Gross Floor Area

These figures are for indicative and comparative purposes only. Caution should be exercised in the use of this data.

Source: Department of Natural Resources and Mines Queensland (2005)

Table B3 Estimated Typical Household Water Demands (litres/day)

Water Use	Design Number of Occupants				
	1	2	3	4	5
Bathroom	65	107	145	189	223
Toilet	49	107	145	189	223
Laundry	38	54	100	137	174
Gardening	87	220	220	220	220
Kitchen	14	38	60	83	123
TOTAL	253	526	670	818	963

Source: Upper Parramatta River Catchment Trust (2004), Melbourne Water (2005)²

² Data from Melbourne Water has been used for the one person scenario and the remainder of information in the table is sourced from Upper Parramatta River Catchment Trust

Table B4 Estimated Annual Water Use by Dwelling Type

Dwelling Type	Townhouse		Small Villa		Moderate Sized New Dwelling		Older 'Large Allotment' Dwelling	
	Without	With	Without	With	Without	With	Without	With
Allotment area (m ²)	240		300		650		800	
Roof area (m ²)	120		120		200		200	
Irrigated area, including trees and shrubs (m ²)	40		100		330		400	
Typical number of occupants	2		2		4		3	
Dual flush toilet	Yes		Yes		Yes		No	
With or without water conservation devices	Without	With	Without	With	Without	With	Without	With
Inhouse water use (L/day)	239	216	239	216	458	400	413	314
Outdoor water use (L/day)	72	72	162	147	519	470	618	558
Miscellaneous losses	47	47	60	60	147	147	155	155
Total indoor and outdoor (L/day)	358	335	461	423	1124	1017	1186	1027
Total (kL/year)	130	122	168	154	410	371	433	374
Reduction in water use (kL/year)	8		14		39		59	
Reduction in water use (%)	6		8		10		13	

Source: Department for Environment and Heritage (2005)

Table B5 Assessment Aid for Mains Water Conservation (Based on a Typical Three Person Household)

Appliance/Fixture	Typical Use (L/day)	Potential Reduction %		
		AAAA	AAA	AA
Shower	185	AAAA	AAA	AA
		50%	39%	22%
Toilet	177	2/4 litre flush	3/6 litre flush	Flush arrester
		55%	35%	42%
Washing machine	135	AAAA	AAA	AA
		61%	40%	19%
Kitchen sink	37	Flow regulator		
		50%		
Bathroom basin	21	Flow regulator		
		50%		
Other	58			

Typical irrigation water demand = 1.0 L/day/m² of irrigable landscaped area. Demand is estimated based on information provide for the BASIX project by Sydney Water. It assumes an occupancy rate of three persons per dwelling.

Saving in mains water due to use of rainwater or stormwater tanks for internal/external uses are estimated by calculating the percentage harvest runoff and then multiplying it by the stormwater volume flowing into the tanks (change units to L/day).

Total savings in the site's mains water demand is the sum of saving from using water efficient fixtures/appliances and the use of rainwater/stormwater tanks.

Total unmanaged water demand is the sum of the total unmanaged indoor water demand and the irrigation water demand.

Percentage reduction in the site's mains water = total site saving /total unmanaged site water demand x 100.

Source: Upper Parramatta River Catchment Trust (2003)

Table B6 Indicative Savings for Using Water Conservation Methods or Devices

Use	% of Water Use in Typical Home [^]	Typical Water Use Per Year (kL)	Water Conserving Method	Approximate Cost for Water Conserving Device	Typical Water Saving Per Year (kL)
Garden	50%	180	More careful garden watering, planting of water efficient species	\$20	45
Bathroom	20%	75	Install a water efficient shower head or flow control device	Typically, no more than an equivalent inefficient showerhead, about \$20-\$60	25
Laundry	15%	55	Replace with a water efficient washing machine	About \$70 per kg dry clothes capacity more than a water inefficient machine	25
Toilet	10%	35	Replace with a water efficient 6/3 litre dual flush toilet	\$200	15
Other	5%	20	Flow control devices on taps etc	Variable	Variable

[^] Water use assumes a three or four bedroom home, large garden and three occupants

Source: Department for Environment and Heritage (2005)

Table B7 Water Efficiency Opportunities in Office and Public Buildings

	Heating, Ventilation and Air Conditioning (HVAC)	Amenities	Leakage
Design	Investigate site water collection and reuse options. Investigate wastewater treatment options. Specify use of water wise landscaping. Negotiate water reuse, discharge and pricing options with utilities.	Specify minimum 4 star WELS rated fittings. Consider waterless urinals. Set a water intensity target for the building against benchmarks.	Design to include submetering of tenancies, plant and landscape uses.
Construction	Ensure runoff is contained and sediment removed prior to leaving site. Consider setting goals for drinking and non- drinking water use on site.		
Fit out and commissioning	Ensure that water saving and water treatment technologies are installed and commissioned as designed.	Ensure that WELS ratings are specified for water using fittings and appliances installed in any fit out.	Ensure sub-metering of tenancies occurs and is supported by appropriate leak detection and reporting signage.
Occupancy	Ensure that responsibilities for water efficiency are clearly stated in leases and contract for facilities management. Ensure that cooling towers are monitored and that risks of excessive water consumption (such as from blowdown) are managed proactively.	Provide information and training to building managers and users on efficiency measures and opportunities. Ensure cleaning staff are aware of water issues, including issues specific to waterless urinals. Cover amenities use in a water management plan. Be proactive about maintenance of valves etc.	Audit building water use periodically to identify base flows and unaccounted for water. Develop and implement a water management plan for the site (possibly as part of an EMS). Take a proactive approach to maintenance for leak prevention and remediation. Task cleaners and staff to report leaks promptly.

	Heating, Ventilation and Air Conditioning (HVAC)	Amenities	Leakage
Refurbishment	Investigate opportunities to upgrade cooling towers to improve efficiency. Consider installation of water storage and opportunities to install grey water 'third pipe' plumbing. Consider including water intensity target in any new lease.	Benchmark building water performance before commencing refurbishment and set an intensity target for the refurbishment building. Specify higher WELS rated appliances and fittings. Upgrade toilets and urinals to newest efficiencies.	Benchmark base flows before the refurbishment (including when building is empty). Identify leaks and correct while doing building works. Identify any overpressure problems that may require altering mains supply pressures. Improve submetering of tenancy spaces and specific uses.
Re-occupancy	Ensure building management information and training takes advantage of new water efficiencies in the refurbished building. Ensure that responsibilities for water efficiency are clearly stated in lease and contracts for facilities management.	Provide information and training to building managers and users on efficiency measure and opportunities. Ensure cleaning staff are aware of water issues. Cover amenities use in water management plan. Be proactive about maintenance of valves etc.	Audit building water use periodically to identify base flows and unaccounted for water. Develop and implement a water management plan for the site (possibly as part of an EMA). Take a proactive approach to maintenance for leak prevention and remediation.
End of life	Ensure stormwater runoff is contained and sediment removed prior to leaving site. Consider setting goals for potable and non-potable water use on site during demolitions. Consider reuse of water storage, transport and treatment technologies from the old building if appropriate.		

Source: Australian Government (2006)

Appendix C

Checklists

The *Inspection and Maintenance Checklist* was modified for South Australian designs and conditions from checklists and forms provided in Upper Parramatta River Catchment Trust (2004).

All parts of all checklists should be completed. Even if design checks or field inspections were not performed, it is important to record the reasons for this in the relevant checklists.

Landscape Development

Inspection and Maintenance Checklist

Items Inspected	Checked Y/N	Maintenance Needed Y/N	Inspection Frequency
Plant Survival			3 months
1. Dead plants identified and replaced			
2. Alternative plants used if heat stress is evident or long interevent dry periods cause regular moisture stress.			
Irrigation System Check			3 months
3. Plants show no evidence of moisture stress			
4. Repair / replace any damaged components			
5. Adjust irrigation program if necessary			
Drainage Pattern			3 months
6. Subsurface drainage required to prevent water logging			
7. Modification of surface drainage required to direct runoff to planted areas			