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Home Water Management: Summary Bulletin

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Background

With global warming and the current drought in Australia there is a growing recognition that water is becoming an increasingly scarce resource and therefore requires the implementation of water management practices to ensure the efficient usage of water in daily life. Water management at the household level does not only include compliance with water saving regulations but also concerns issues around the management of water drainage, water outlets and the appearance of moisture indoors as well as outdoors. Safety issues pertaining to domestic water usage and management should be a high priority for elderly and disabled populations. Although preserving our water supplies is important, especially during periods of drought it is also important to implement good water management practices to ensure the durability of the foundations and structure of the house which has significant implications for the safety of the occupants. The information presented in this bulletin therefore summarises both safety and water saving topics that may be relevant to, and useful for, improving the sustainability and management of water in the home environments of older and disabled people and their carers.

Water use by the household sector

According to a recent ABS report (2005) households are the second largest user of mains water¹ sources after agriculture, accounting for about 16% (2,181,447 ML) of the consumption of mains-supplied water in Australia and 8.8% of the *total* water consumption in Australia. The majority of household water consumption in Australia between the years 2000 and 2001 was used for indoor purposes (56%) and the rest was used for outdoor purposes (Table 1). An increase of 19% in the total household water used in Australia occurred between the years 1996-97 and 2000-01. The Northern Territory has been, by far, the largest household consumer of water per capita (212 kL/capita), followed by Queensland (137 kL/capita) and Western Australia (132 kL/capita). New South Wales had the lowest average domestic consumption of water per capita (101 kL/capita) and Victoria the second lowest (102 kL/capita).

While outdoor use of water (per capita) tends to vary among the Australian cities as a result of factors such as climate, size, style of gardens, pool ownership and the availability of alternative water sources, the trends of water use indoors is considerably less varied (GWA et al., 2003). Table 1 depicts the percentage of domestic water consumption by location of use. The table shows that water use in bathrooms and toilets alone accounted for 35% of the

¹ Main water sources refer to the sources of water supplied to a user via a non-natural network (e.g. a pipe) which requires an economic transaction for its deliverance.

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household water use in Australia. Water consumption in laundry and kitchen areas accounted for 13% and 8% respectively, of the total water used domestically.

Table 1. Location of Household Water use 2000-01

Location	% of water use
Bathroom	20
Toilet	15
Laundry	13
Kitchen	8
Outdoor	44

Source: Water Account Australia, ABS (2004).

These findings clearly present households as major wasters of water. This high consumption of water by the household sector and the ongoing water shortages Australia faces as a result of the drought and changing climate conditions highlights the need to find ways to reduce and regulate water consumption at the household level. There are currently a variety of practices being implemented in Australia to encourage efficient water use in households. The BASIX and the WELS schemes are examples of existing water saving programs that have been introduced to ensure households are limiting their water and energy usage so that overall urban water consumption in Australia is reduced. This means that there may be some specific water management regulations to adhere to with home modifications designed for the elderly and disabled populations. The information below first reviews existing water restriction schemes relevant to households in Australia and their implications on home designs for functionally impaired populations. It then continues with a discussion of safety issues pertaining to home water management of the aforementioned populations.

Current Water Restrictions and Efficiency Schemes

Water Efficiency Labelling and Standards Scheme (WELS)

The Water Efficiency Labelling and Standards scheme (WELS), introduced on 1 July 2006, is a national scheme requiring mandatory water efficiency labelling and minimum performance standards for all household apparatus that use water. The aim of the scheme is to ensure that consumers are presented with information on water use and efficiency in such a way that it will influence the selection and design of water-using devices as well as user behaviour for in long-term (GWA et al., 2003). The WELS scheme has replaced the voluntary water rating scheme and that was originally introduced in 1988 and managed by the Water Services Association of Australia (WSAA). Initially, the scheme covered only limited products (e.g. shower heads and dishwashers) and offered two levels of efficiency (A and AA). A third efficiency grade (AAA) was introduced a few years later (1992) and two higher ratings (AAAA and AAAAA) were added in 2001. Research (GWA et al., 2003)

found that the coverage of this early water regulation practice was limited as a result of it being voluntary; suppliers were in fact labelling only certain products available in the market (the best performing ones). Adding to this was the fact that the rising cost of water has made water-efficiency products more cost-effective for consumers. Thus, the new WELS scheme now requires that all water-using household products have minimum water efficiency standards and be labelled using star ratings (Figure 1). The star rating consists of one to six stars depending on the level of water efficiency; a rating of one star means the product has the lowest level of water efficiency whereas a rating of six stars means the product has the highest level of water efficiency. Furthermore, the labelling also requires the inclusion of an approximated amount of water use (litres per minute) used by each product, so that buyers are able to estimate the amount of water required during usage. The Australian and New Zealand Standard AS/NZS 6400, (*Water efficient products – Rating and labelling* published in February 2003) is the Standard that outlines the WELS requirements. The WELS Scheme covers toilet equipment, showers, tap equipment, flow controllers, dishwashers, clothes washing machines and urinal equipment. As WELS applies to all new products such as hand-held showers and taps, it is important to note the WELS rating of products before purchase. Below is information that summarises the reduction in water consumption of households that use water efficient products (Table 2). According to the Australian

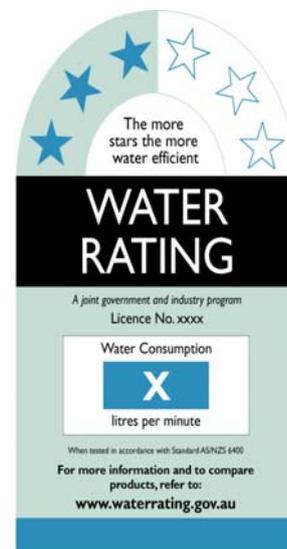


Figure 1: Example of a WELS Label

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 Government WELS site www.waterrating.gov.au by 2021 Australians could reduce domestic water use by up to five per cent (or 87,200 megalitres) each year if more water efficient products are used. Thus, any major building developments or residential home modifications should take into consideration the efficiency of washing machines, showers and toilets to reduce water consumption in homes as each of these account for 50%, 25% and 22% respectively of the total consumer water saving.

Table 2. Comparison between the use of water efficient and non-water efficient products on household water consumption.

Showerhead	15 - 25 (litres/1min)	6-7 (litres/1min)	up to 55%
Dishwater	29-25 (litres/cycle)	13-11 (litres/cycle)	up to 48%
Clothes washer (based on 5.5kg)	140 (liters top loading)	65 liters (four star front loading)	up to 54%
Urinal equipment	2.2 (litres/flesh)	1.5 (litres/flesh)	up to 30%
Taps	15 – 18 (litres/1min)	2 (litres/1min)	up to 67%
Lavatory equipment	12 (litres/1min)	4 (litres/1min)	up to 67%

Information sourced from WELS website <http://www.waterrating.gov.au/products/index.html#sanitary>, retrieved December, 2007 and *Water for today and tomorrow*, Brisbane City Council Information.

Other useful domestic water saving tips commonly mentioned by Australian local councils (e.g. *Water for today and tomorrow*, Brisbane City Council; *Do-It-Yourself (DIY) Water Saving Kit*, Sydney Water; *Water saving tips*, Stanthorpe Shire Council) are listed below:

- Take shorter showers (cutting each shower by 2 minutes can save 24 litres per day).
- Use washing machines and dishwashers only when full (can save 65 litres per day).
- Turn the tap off when you can (avoiding having running water when soaping hands, brushing teeth, washing fruits and vegetables can save 6, 8, 15, litres a day respectively).
- Repair any dripping taps and fixtures.
- Install water saving shower heads and low flow taps or tap aerators.
- Install dual flush toilets to reduce the flush volume.
- Install your hot water system as close as you can to the bathroom and kitchen so that you don't have to run the taps too long before hot water comes out.
- Insulate your hot water pipes and bath to keep your water hotter for longer.

The information provided so far mainly involves issues pertaining to efficient water consumption inside the home, however, water saving outside the home is no less significant in the discussion of water conservation. There are numerous water saving options to apply outside the home. For instance, installing automatic controllers, rain and soil sensors, rainwater tanks and tap timers and nozzles are some well-known useful techniques that certainly contribute to preserving water supplies. Other useful outdoor water saving tips commonly mentioned by Australian local councils (e.g. Water for today and tomorrow, Brisbane City Council; Do-It-Yourself (DIY) Water Saving Kit, Sydney Water; Water saving tips, Stanthorpe Shire Council) are listed below:

- Consider ways to re-use household water on the garden (greywater) – e.g. indoor wastewater from bath, washing machine etc. can be delivered to the garden using a hose.
- Do not store greywater for extended periods as it can contain pathogens.
- Mulch plants generously to reduce evaporation.
- Consider installing a rainwater tank which can be used to water the garden and flush the toilet.
- Water gardens appropriately – don't water lawns, don't water in the heat of the day, do use water efficient plants and do train plants to put down deep roots by watering less frequently.
- Install a pool cover to reduce evaporation (can save 100 litres a day).

The website www.sydneywater.com.au offers many more tips on how to save water inside or outside the home.

Some State Governments in Australia have legislated and set further specific standards to ensure new homes are designed and built with the latest water efficient designs and products.

The Building Sustainability Index is a New South Wales Government requirement for all new homes, villas, units and townhouses. This aims to reduce energy and water consumption by up to 40% compared with the average home. If home modifications require consent from council, such as a Development Approval or a Complying Development Certificate, then the 'BASIX Alterations and Additions' applies. From 1 October 2006, this requirement became mandatory for projects valued over \$100,000 and from 1 July 2007, it also applied to projects valued at, or more than, \$50,000 (NSW Department of Planning, 2006). BASIX therefore, does not apply to minor modifications such as installing new taps or hand showers, but it can be applied voluntarily if residents are concerned about conserving water and energy and want to reduce their water and energy bills.

The process of receiving a BASIX Certificate involves a free online assessment in which information on house location, size, design building materials and landscaped area is analysed and scored against the required water and energy saving targets (NSW Department of Planning, 2006). While the BASIX energy target varies according to building type and location, the BASIX water target incorporates district variables such as soil type, climate, rainfall and evaporation rates. In both cases the design must pass the required targets in order to get the BASIX Certificate.

Some basic requirements that go towards meeting BASIX water and energy targets necessitate that all new homes have:

- at least 40% of new lights as energy efficient.
- either gas, solar, heat pump or wood hot water systems.
- 3 star (WELS Scheme) rated toilets, showerheads and taps.
- a rainwater tank or alternative water supply for outdoor water use and toilet flushing and/or laundry.

Implementation of some of the water saving tips suggested above can further increase the chances of getting the BASIX targets as well as council approval. For more information on the BASIX scheme visit www.basix.nsw.gov.au

Although the BASIX is specific to the State of NSW, some water efficiency standards are also imposed in other states: in Victoria, new homes must meet the "5 star" standards of energy and water efficiency. Homes must also include either a solar hot water system or a rainwater tank. The State Government of Queensland has encouraged local councils to consider rainwater tanks to be required as part of the construction of new dwellings.

Water Rebate Schemes

Many Australian councils and government groups are currently offering rebates and other incentive schemes to encourage residents to conserve water. Before buying products such as water efficient showerheads or dual flush toilets, consumers should ensure that the products are eligible for a local rebate scheme, as criteria change from council to council. For example, in January 2003 the Victorian Government launched the Water Smart Gardens and Home Rebate Scheme which offers cash rebates (up to \$1500) for the purchase and installation of water-saving devices, permanent greywater systems and rainwater tanks (*Water Smart Gardens and Homes Rebate* brochure, 2007). The NSW Government offers a

Authored by N. Gohar, L. Oram & L. Millikan for the Home Modification Information Clearinghouse rebate ('Water for Life' program) for installing rainwater tanks but only in households (Sydney Water, 2007) whereas the Queensland Government's 'Water Wise' Scheme offers rebates for a wider range of water saving devices and technologies such as rainwater tanks, washing machines, dual flush toilets, greywater systems, showerheads and pool covers. The website <http://www.ata.org.au/green-living/renewable-energy-rebates/> provides specific details on the range of water rebates offered by the different state governments. Alternatively, you can contact your local council to get more information on the current rebate schemes proposed in your area.

Other Water restrictions imposed in Australia

Beside the national WELS scheme and the state-based water management schemes there are also current national permanent rules and guidelines to ensure sustainable water use practices in households and businesses around Australia (Water Restrictions, 2007). These water restrictions are currently in place in all major cities of Australia and include restrictions on watering lawns, using sprinkler systems, washing vehicles, hosing paved areas, refilling swimming pools and more. Depending on the available storage volumes, quality and supply constraints, these restrictions comprise seven levels (or stages). The lower the supply of water in a certain district, the stricter the restrictions. Basically, the Water Restriction Policy provides an operational and enforcement framework to manage the risk of water shortage in Australia. It aims to address concerns relating to demand management by ensuring that the time periods when watering is permitted do not overlap with the expected peak demand time for normal domestic use. It is also designed to give consumers an indication of permissible practices which are allowed during each level of restriction, thereby making compliance and enforcement easier. While all restriction policies are based on the uniform guidelines, there may be minor variations in the details to account for local conditions and some exemptions for the elderly and functionally impaired populations (see below). The specific restriction level and current exemptions are usually advertised and managed by local councils (newspapers and radio) or the local water corporation and applies to all residential, commercial and industrial properties connected to water supplies. Restrictions are only applicable to customers on a reticulated supply. These restrictions do not apply to customers using rainwater or bore water.

Information about the specifics of the level of water restrictions and what this means by region and state varies depending on conditions and can be checked by going online to http://en.wikipedia.org/wiki/Water_restrictions_in_Australia

Interactive House

Sydney Water's website (<http://www.sydneywater.com.au/>) has an interactive presentation of all household areas that make use of water. The software is designed to demonstrate the best possible ways to save water indoors as well as outdoors. By clicking on each area, the program presents viewers with information on the percentage of water consumption accounted for each area and a list of water saving tips that are known to increase efficiency of water usage in the selected areas.

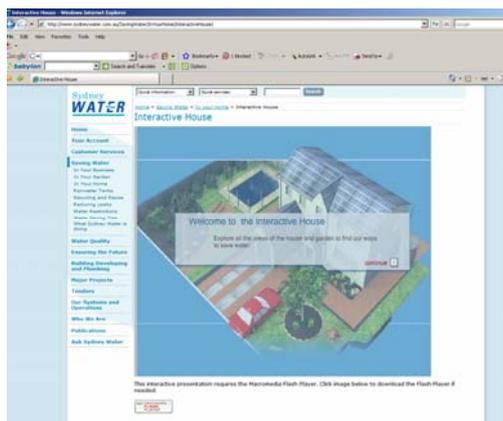


Figure 2. Sydney Water's Interactive House software for water saving tips

Exemptions for the elderly and disabled populations

Watering of gardens and lawns using hoses is banned in areas that are under Level 5 water restrictions or higher (e.g. Southeast Queensland, WA). Residents are therefore instructed to water their gardens using buckets or watering cans filled directly from a tap in specific times (*Water for today and tomorrow*, Brisbane City Council Fact sheet, retrieved in December 2007). In these cases concessions are available to residents who are either 70 years of age or over, entitled to a Disability Support Pension (regardless of age), hold a Transport Disabled Parking certificate, or suffer from a medical condition that prevents them from using a bucket or watering can to water their garden. By providing proof of eligibility, residents are eligible to water their garden using hand-held hoses for a total of 40 minutes per week in two separate 20 minutes periods. More information is available on the websites:

http://www.brisbane.qld.gov.au/bccwr/lib181/seniors_water_project_fact_sheet_1.pdf

http://www.gvwater.vic.gov.au/media_releases/2002/Water_Restrictions_Eased_Elderly_191102.asp

In WA specific exemptions may be also granted on application for the elderly or infirm. People with special needs are allowed an exemption to water between 9am and 6pm on their watering days subject to their application being endorsed by a medical practitioner. For more information on exemptions for the elderly and disabled populations in WA, go to:

<http://www.waterwisewaysforwa.com.au/go/secondary-navigation/faqs/exemptions>

Other recommended safety tips (Water for today and to tomorrow, Brisbane City Council Fact Sheet, retrieved in December 2007) for the back and body when using a bucket or watering include:

- Lift the bucket without using your back and with your knees bent.
- The bucket or watering can should have a wide grip to reduce hand and wrist pain.
- Do not overfill the bucket.
- Place the bucket on a raised platform to fill (e.g. stool or chair) to reduce the lifting distance.
- All pathways around the garden should be flat and free of trip hazards.
- Wear comfortable, supportive shoes with non-slip soles to avoid falls.

Water-Related Hazards

Back and body injuries resulting from the use of watering cans or buckets is only one example of a potential hazard linked to domestic use of water. In fact, home water management may involve many more risks beside these injuries including, falls or stumbling, scalds, hypothermia, growth of Legionella bacteria and electrical shocks. The most susceptible are children, the elderly and people with disabilities. For example, when considering the temperature for hot tap water delivery in a private dwelling, the Building Code of Australia (BCA) requires minimum water storage of 50°C. This is to ensure that water is not contaminated with organic matter (e.g. Legionella bacteria). On the other hand, warmer water temperatures are recommended for homes with ill, elderly persons or infants to reduce the risk of hypothermia. However, this population may be at serious risk of scalding (particularly in the bath and shower) since they tend to have thinner and more sensitive skin. For instance, water at 50°C can severely burn in 2-8 minutes whereas at 65°C it takes less than half a second (*Thermostatic Mixing Valves, Summary Bulletin*). It is therefore important to install and maintain commercially available solutions (such as tempering valves, thermostatic mixing valves) that can help protect against the many potential hazards around the home. More information on water safety issues such as regulation of water temperature,

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electrical safety and prevention of falls in the bathroom can be found in our previous publications (Home Modification Information Clearinghouse, 2004, 2005, 2006):

- Specific information on how to reduce risks of scalding or hypothermia as a result of inappropriate water temperature can be found in the article: *Thermostatic Mixing Valves*, Summary Bulletin (Bridge & Phibbs, 2004)
http://homemods.info/resource/occasional/summary_bulletin_thermostatic_mixing_valves
- Information on how to reduce the risk of electrical shocks resulting from the accidental spraying of water into power outlets can be found in the article: *Electrical Safety in Bathrooms*, Summary Bulletin (Oram, 2005).
http://homemods.info/resource/occasional/summary_bulletin_electrical_safety_in_the_bathroom
- Relevant information on prevention of falls and stumbles around the home can be found in the article: *Selecting Diameters for Grabrails*, Evidence Based Research Bulletin (Oram, Cameron & Bridge, 2006).
http://homemods.info/resource/evidence/diameter_evidence_based_research_selecting_diameters_for_grabrails

Environmental contamination of water

A secure and safe supply of drinking water is indeed fundamental to public health, however, contact with contaminated water can occur when drinking polluted water or swimming in polluted water. Although most drinking water is safe, incidents of contamination can occur when microbes and chemicals such as radon, lead or arsenic are present in the water. Bacteria and viruses are often present in drinking water but are not dangerous to the general population unless the human immune system is weak and is more susceptible to microbial illnesses. For this reason, older adults and persons living with HIV are considered particularly vulnerable as their immune system tends to be weaker than the average resident. In the US, for example, gastrointestinal illness was identified as one of the most common infectious diseases to occur each year as a result of exposure to polluted water or food (Mead et al, 1999).

The NSW Government endorsed the Australian Drinking Water Guidelines in 2004 (published by the National Health and Medical Research Council and the Natural Resource Management Ministerial Council). The guidelines provide a solid foundation for assessing drinking water quality by specifying health-based and aesthetic criteria to ensure safety of the

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water. It is available on The NSW Department of Health website at
<http://www.health.nsw.gov.au/public-health/ehb/water/drinkwater.html>

If your water comes from a public water system, it must meet the NSW standard (Australian Drinking Water Guidelines 2004), however if the water system comes from an independent private water supply (e.g. not urban water) consumers are recommended to regularly test the quality of the drinking water. Specific guidelines are available at

<http://www.health.nsw.gov.au/public-health/ehb/water/pdf/pwsgmay07.pdf>

More information on home water management specifically addressed to older and disabled populations and their family caregivers has been published by The Environmental Protection Agency in the US (*Water Works, Information for Older Adults and Family Caregivers, 2005*) and can be obtained at www.epa.gov/aging/resources/factsheets/ww_english_2006_01.pdf.

Some common tips often mentioned (NSW Department of Health, 2004; Better Health Channel, 2007) as useful to eliminate risks of contamination include:

- Test water quality on a regular basis (yearly) if your water supply is not public. Specifically test for the existence of bacteria, nitrates, radon, total dissolved solids and pH levels.
- Establish regular inspections for water leakage around your home.
- Fix plumbing leaks and other water problems to eliminate growth of mould.
- After flooding, clean and disinfect the damaged area. Remove or replace rugs, curtains and furniture that were exposed to sewage.
- If necessary, install filters, at the tap or at the connection between the water main and the connection to the house.
- Following a public notice on contaminated drinking water drink bottled water or use boiled water only.

Products

As mentioned before, given the increasing shortage of water in Australia, it is crucial for all residents to be aware of the current water saving practices applicable in their area and act according to their specific restrictions and suggestions on how to use water efficiently. Since the exemptions for elderly and disabled people mentioned above mostly refer to *outdoor* water consumption and apply in a few areas only, these populations should adhere to local *indoor* water restrictions and water management schemes just as any other resident. Committing to these water management practices may result in some home modifications such as replacement of taps, hand-held showers, thermostatic mixing valves and installation of rainwater tanks or greywater systems. However, there is evidence (Cumming et al., 2001;

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McCreadie & Tinker, 2005) that these populations specifically are highly resistant to home modifications even when these modifications are designed to improve their quality of life. Thus, in order to ensure a high level of compliance with current water management schemes, it is important to make the various water efficient products and techniques available and easy to access. In many cases, implementation of water efficient practices may also improve the functionality and safety of these residents (e.g. automatic tapware for people with arthritis, grate drain in a shower can prevent falls and stumbles in wet areas, etc.)

Home modifications pertaining to water management around the house are usually affected by the type of hot water system in the home. It is therefore important to first identify which type of hot water exists in the home before choosing compatible models of water outlet devices. The following information provides more details on the various types of hot water systems and the available commercial products that can be implemented and maintained to help increase the safety and efficiency of water consumption in private dwellings.

Hot Water Systems

Different types of hot water systems will create different water pressures at the various water outlets around the home. Some hot water systems will only work efficiently and safely with certain types of tapware. It is therefore, necessary to identify which type of hot water system a home has prior to any minor modifications taking place, such as replacement of tap heads or the installation of a hand-held shower.

Gravity Feed – A gravity fed system consists of a water tank in the roof cavity. Larger diameter pipes between the tank and water outlets are usually required (Commonwealth of Australia, 2004). The hot water pressure will depend on the height difference between the tank and the water outlet. If water outlets are a long way from the tank, then low pressure taps and hand-held showers are required to reduce the pressure and keep the temperature constant. The Building Code of Australia requires all new dwellings to install water efficient 3 star rated showerheads or showerheads with equivalent flow rates. Since some low pressure or gravity fed hot water systems would create a poor shower spray if fitted with a water-saving hand-held shower (3 stars) it may therefore be advisable to install a non water saving product to ensure shower comfort. In these cases the flow rate will still be equivalent to the 3 star showerheads with hot systems other than a gravity fed system, which complies with the NSW Government's sustainability requirements for water efficiency of showers.

Mains pressure – Mains pressure hot water storage tanks are usually stored at ground level and are delivered at a similar pressure to cold water (University of Technology Sydney Institute for Sustainable Futures, 2001). Most tapware and hand-held showers are suitable for this type of hot water system.

Solar – Solar hot water tanks are usually stored on the roof, but can also be installed on ground level or inside the roof cavity (University of Technology Sydney Institute for Sustainable Futures, 2001). If the solar panel is connected to a gravity fed hot water system, then hand-held showers and tapware that are suitable for low pressure systems are required. If however, the solar panel is connected to a mains pressure system then most water outlet devices should be compatible. Solar hot water systems do require temperature control devices such as tempering valves to control the very high temperatures the water can reach (W. Langham, personal communication, December 11, 2006).

Hand-held Showers

Tapware and hand-held showers are rated for water consumption and will also impact upon water delivery. When selecting a hand-held shower for the bathroom, it is crucial to consider the type of hot water system that is in place, as it will affect the temperature and pressure of the water flowing through the hand-held shower. With gravity fed tanks, the pressure can either reduce or increase with any upwards or downwards movement of the hand-held shower, which could risk temperature fluctuations and ultimately scalds.

The internal diameter of the hose is also dependent upon the type of hot water system. A hose with a wide internal diameter allows a large flow of water, so is suitable for gravity fed and mains pressure. Whereas, a smaller internal diameter hose will restrict the water flow and therefore is only suitable for mains pressure installations (W. Langham, personal communication, 18 October, 2006).

In addition to temperature drops and water flow rate interruptions, the spray pattern on the hand-held shower can impact upon the shower experience. Hand-held showers with multiple spray pattern adjustments are only suitable for mains pressure hot water systems because the mechanics of the spray adjustments inhibit the flow of water. Single spray hand-held showers on the other hand, are suitable for both gravity fed and mains pressure hot water systems. Most hand-held showers are imported from overseas so it is important to ensure that any model chosen is compatible with the hot water system of the home (M. Whipps, personal communication, 18 October, 2006).

Many new hand-held showers are water saving models which operate at even lower pressures, often making an uncomfortable shower experience. Purchasing a Zero WELS rated but Australian Standard approved hand-held shower will assist the water flow but with major modifications where the BASIX scheme may apply, 3 star rated shower heads are required (NSW Department of Planning, 2006).

Prior to prescribing or installing a hand-held shower it is important to check the packaging of the product to ensure that it is a suitable choice for the hot water system. According to Standards Australia (2005) the packaging should indicate the following:

- the minimum and maximum water supply pressure for the shower;
- the suitability with gravity-fed, low pressure or instantaneous hot water systems.

Lever Taps

Lever taps are the Standards approved style (Standards Australia, 2001) and enable many people access because of the ease of operating them. Quarter turn ceramic discs further reduce the movement required to turn the tap on and off; only requiring a 90 degree turn.

Lever taps can control hot and cold water separately or mix the water temperatures. Mixer taps in showers can help to reduce the risk of scalding because they directly mix hot and cold water, however, "...mixer taps may be incompatible with gravity fed hot water systems due to the difference in operating pressures of the hot and cold systems" (Atkins, 2000). It is therefore, advisable to identify what hot water system is in place prior to purchasing any tapware for the home.

The table below gives a few examples of lever tap styles.

Table 3. Lever tap styles

Tap	Image	Comments
Enware Expo Lever		The flat side design of this lever tap enables it to be operated with a wrist. A separate lever is required for hot and cold water.

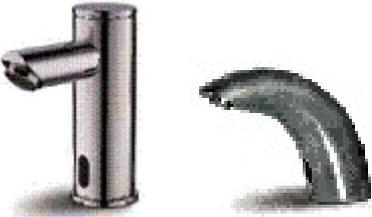
<p>Enware Basin Single Mixer Lever – Blade Handle</p>		<p>The open handle enables a user to hook a finger to operate the tap. As a lever it can also be operated with a wrist. Both temperature and water flow can be controlled with one hand.</p>
<p>Enware Basin Single Mixer Lever – Disabled Handle</p>		<p>A longer lever is more reachable and can be operated with a forearm. Both temperature and water flow can be controlled with one hand.</p>

Automatic Tapware

A new range of automatic touch-free taps is now available in the market. This electronic tapware incorporates a state-of-the-art design and technology to offer many functional advantages over traditional taps and is particularly suitable for the elderly or disabled. They are easy to use as they are set to automatically detect the presence of a hand/object, thus, providing an ideal solution for people with arthritis or disability who have restricted use of their hands. The faucet system is built with a sensor which, when triggered, activates a solenoid valve causing water to flow. The technology is highly hygienic as it minimizes the risk of cross contamination (thus is also highly preferable in a public setting). It also conserves energy (up to three taps can operate from a single power supply) since it usually operates on low voltage (24 volts) from a standard power-point. In most cases these taps can be operated on battery or mains power.

The table below presents examples of automatic taps available in the market.

Table 4. Automatic Tapware

Tap	Image	Comments
Autoflo Electronic Automatic Basin Tap (approved as a basin tap only by Sydney Water).		Consists of a faucet outlet and an infra-red light beam focused at a point below the outlet. Water automatically shuts off when hands are removed.
Enware Electronic Tapware		Electronic taps activated by an infra-red sensor for cold or premixed water. Available as basin, sink and wall taps.
Hansacobra Sensor Tap		An electronically operated tap for basins and urinals. Movement is detected by an electronic beam and causes water to flow at a predetermined temperature and pressure. Operated with by battery (6v) or mains supply (240v).

Some other specific suggestions for water wise products that are currently available on the market are listed on Sydney Water's website:

<http://www.sydneywater.com.au/SavingWater/WaterWiseProducts.cfm>

Other issues that may be important for the management of household water, and can contribute to the safety of residents and may reduce water consumption in households, are the management of water drainage, moisture problems and waterproofed bathrooms.

Water Temperature Control Devices

Hot water systems need to store hot water at a temperature of 60 degrees or more to prevent bacterial or viral growth (Atkins, 2000), but this temperature is too hot for bathing. Water

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temperature control devices such as thermostatic mixing valves combine hot and cold water and deliver it at a constant temperature. Most devices will work with lower water pressure but advice should be sought from suppliers to ensure the device is compatible with the home's mains powered hot water system. For more detailed information on thermostatic mixing valves see *Thermostatic Mixing Valves: Summary Bulletin* (Cameron & Bridge, 2004)

Grated Drains

Grated drains are also known as a threshold, trench, trough or channel drains. Some suppliers are promoting grated drains for more effective drainage for domestic shower recesses, however, these drains do not meet Australian access Standard requirements; AS 1428.1 Clause 10.5.2 which requires a central drain in the shower recess (Standards Australia, 2001). AS 3500.2 Plumbing and Drainage – Sanitary Plumbing and

Drainage (Standards Australia, 2003), Clause 11.18.1 and AS 4299 Adaptable Housing (Standards Australia, 1995), Clause 4.4.4 states that a minimum sized grate of 80mm diameter is required for shower recesses but does not specify the location of the drain. For domestic premises, therefore, which do not have to adhere to the access Standard, grated drains may be an option. It must be noted, however, that there are many considerations when installing these types of drains, for example, if a grated drain is installed on one side, the fall of the shower recess floor needs to run to that side instead of to the centre. This would require early planning as the shower floor needs to be restructured involving drainers, plumbers, concreters, waterproofers, tillers etc.

Waterproofing Bathrooms

Waterproofing the bathroom, particularly beneath the shower area is important for preserving the foundations of the building and promoting a healthy bathroom. Ideally, any excess water that escapes between the floor tiles will be caught by the seal or membrane and then redirected to the drainage holes in the shower area (Carter, 2003). Minor modifications, such as installing a reinforced section of wall for the installation of a grabrail could require additional waterproofing. AS 3740 Waterproofing of Wet Areas within Residential Buildings, Clause 5.11.2 requires waterproofing of shower recess walls only up to 150mm from the finished tile level (Standards Australia, 2004). The Building Code of Australia (BCA) on the other hand, states in section FP1.7 that water must not penetrate behind wall linings or fittings, such as grabrails, in wet areas (Australian Building Codes Board, 2006). It may, therefore, be advisable to waterproof the walls above the shower rose and beyond the



Figure 3. Grate drain in a shower recess (Stormtech, 2005)

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shower screen to exceed the standards and comply with the BCA (P. Lawrence, personal communication, 28 November, 2006).

The Master Builders Association of NSW has produced a guide titled *Guide to Internal Wet Area Waterproofing* (Master Builders Association of NSW Waterproofing Council, 2005), which discusses best practice techniques. To obtain a copy of this, contact the Master Builders Association (contact details below).

Moisture Resistance Practices for Homes

Managing moisture in and around the home is necessary for maintaining a structurally sound and healthy living environment. Water infiltration in the home is particularly common after floods or as a result of inadequate home maintenance. A potential hazardous outcome is an accumulation of moisture in the home that can result in mould growth and cause allergic reactions such as sneezing, a runny nose, red eyes and skin rashes (i. e. dermatitis) and, in some extreme cases, breathing problems. Individuals living with HIV or older persons with compromised immune systems are at greater risk. Builders can provide moisture barriers during the construction phase, but moisture management is a continual process. As a building ages, it is the responsibility of the home owner to identify and tackle the problems.

Some common signs of moisture problems (U.S Department of Housing and Urban Development, 2006) include:

- ▶ Dampness or musty odours
- ▶ Dripping taps or pipes
- ▶ Stained or soft areas on walls, ceilings or floors
- ▶ Cracked seals and grouting around sinks or tiles
- ▶ Sinks, showers, baths or toilets pooling water
- ▶ Mould growth
- ▶ Flaking of painted surfaces
- ▶ Rust around the hot water tank
- ▶ Water draining towards the external foundations of the house
- ▶ Condensation build up on windows and walls

These signs of moisture should not be taken lightly as water damage to the homes foundations may be occurring. The U.S Department of Housing and Urban Development has published a guide titled *Moisture-Resistant Homes* (U.S Department of Housing and Urban Development, 2006), which provides practical tips for home owners for regular check-ups of

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their property. This resource can be obtained from the US Department of Housing and Urban
Development web site at <http://www.huduser.org/publications/destech/moisturehomes.html>.

Greywater Systems

Greywater is domestic wastewater produced in bathroom and laundry basins, showers, bath tubs and washing machines for use in the garden. It does not include water from the kitchen, swimming pool or toilet, as this water may cause health and environmental risks. Saving water around the home by installing greywater systems to recycle wastewater has become very popular over the last few years (The Alternative Technology Association, 2008). Research shows that one Australian house can produce about 400 litres of greywater a day, which is equal to 40% of total house use of water (Byrne, 2005). Thus, if used effectively, greywater can lead to considerable savings at the household level.

Using greywater from the laundry and bathroom manually with a bucket, or connecting a flexible hose to divert it from the washing machine to the garden is often mentioned as a saving tip by local councils and do not require their approval. However, if householders are interested in installing permanent, more sophisticated greywater systems, specific local regulations should be adhered to as some properties may not be suitable for this type of irrigation. Furthermore, greywater systems need to be well set up and maintained (according to Australian standards) to ensure that they do not have any negative effects on the environment or human health. As it may often contain chemicals and bacteria which in the wrong place can cause health problems, all greywater systems require careful consideration before installation and a maintenance regime once it has been installed. There are a number of state and local laws and regulations that govern the installation of greywater systems. Before installing a system make sure that you comply with your state regulations and have the appropriate permits and approvals (Greywater Regulations, 2005).

There are three types of greywater systems (The Alternative Technology Association, 2008) that vary in their complexity and the type of regulations that the states and territories require to be adhered to.

Diversion-only systems - these are the least complex systems that generally require little maintenance, but on the other hand are potentially the most hazardous. They involve intercepting or diverting the water along a pipe pathway and directing it into the garden, generally by gravity. The big advantage with these systems is that they do not need approval in some states (check with your state and local authority) and they are cheap (approximately \$200) and easy to install. However they do require monitoring to ensure that untreated

wastewater is not going into other people's backyards. The main disadvantage of diversion-only systems is that even when people complement them with filter sieves, larger particles can still get through and over time, this can result in blocking up the irrigation system.

Diversion and filtration systems - diversion and filtration systems consist of a filter mechanism located outside the house. These filters strain out hair and anything else that goes down the drain. It is thus regarded as a better irrigation option than diversion-only systems, as they won't block the irrigation system as easily. However, they are usually more expensive than diversion-only systems (about \$1500) and require cleaning as well as council approval. In most states it is mandatory for diversion and filter systems to include a sewer overflow outlet for when the filter is too full to deal with the water flow.

Diversion and treatment systems - diversion and treatment systems are the most complex greywater systems that vary from highly mechanised systems, such as aerated wastewater treatment systems (AWTS), to sand filters. The benefit of installing a treatment system is that the water will have a far lower nutrient and solids content, as well as having a reduced pathogen load. This enables a wider and safer use of treated greywater in more direct irrigation systems, such as dripper lines, and even inside the house for toilet flushing and laundry washing. Treatment systems can be costly to install (about \$10,000) and may often require a lot more room than filter systems. Furthermore, they often involve varying degrees of ongoing maintenance and may even have running costs associated with the use of pumps, blowers etc.

The following list provides some tips for safe and appropriate use of grey water in households as proposed by the Victorian Government (Our Water, Our Future, 2008):

- Use the safest source of greywater wherever possible (e.g. the rinse and wash cycles in your washing machine is usually the safest, followed by bath or shower water).
- If somebody in the house is sick with a stomach bug, measles or flu, stop using greywater immediately to prevent the illness of other people in the house.
- Don't store greywater for more than 24 hours. The diversion of water to the garden should be whenever you shower or wash clothes.
- Keep water safely out of reach of children, dogs and people and preferably use underground pipes to divert the water.
- Avoid spraying or hosing with greywater – this just spreads the chemicals and bacteria around and can burn your plants.

- Food that is eaten raw should not be watered with greywater. Cooking helps protect against harmful bacteria that may end up on the surface of the plants.
- When watering plants with laundry wastewater there is a need to choose laundry detergents very carefully- laundry detergents should have low salt phosphorus levels (e.g. liquid detergents).
- Set up your irrigation system to cover as large an area as possible. The larger the area you can spread the water over the better – it dilutes any nutrients and salts in the water.
- Allow a strip of land between your irrigation system and the edge of your property so that greywater will not run off your property to the street or your neighbours' properties.

Rainwater Tanks

Rainwater tanks are one of the commonly recommended ways to save water within the home. The use of rainwater can reduce mains water demand by 54% and decrease stormwater volumetric discharges by 39% (Lucas, Coombes, Hardy, Geary, 2006). Nowadays, with increasing water restrictions around Australia, rainwater tanks have become a common sight not only in rural areas but also in urban landscapes. Many local councils encourage existing homes to install rainwater tanks by offering government rebates (see above). In other cases, they are being mandated by government - in the ACT, new home developments must include a rainwater tank; in NSW, new building regulations call for a 40% reduction in mains water usage (BASIX) which often necessitates the installation of rainwater tanks; in Victoria, new homes will have to be 5-star standard, and must install either a solar HWS or a water tank (Home Improvement Pages, 2008).

Rainwater is perfectly adequate for flushing toilets, in the washing machine, on the garden, and to wash your car. When storing water over 24 hours, the risk of water contamination should be considered. For this reason, it has been less advisable to use rainwater for drinking, particularly if town water is available. Nevertheless, recent research has revealed that when certain safety precautions are taken as part of the water capture, storage and distribution, rainwater is as safe as any other source of water and in some cases even safer, since it is not treated with chemicals such as chlorine to kill bacteria and it has no contact with soil which often contains harmful bacteria, dissolved salts, minerals or heavy metals (Heyworth, 2001). In South Australia, for example, 42% of residents mostly drink rainwater in preference to the ir mains water without any apparent effect on the incidence of gastrointestinal illness (Heyworth et al., 1998; Heyworth & McCaul, 2001). Thus, there is scientific support for the claim that roof-collected rainwater can be made safe and potable so that it complies with strict international (and Australasian) drinking water standards (Waller &

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Inman, 1982; Gould & McPherson, 1987). However, people with special health needs such as those who have a severely weakened immune system (e.g. cancer patients, transplant recipients, dialysis patients, HIV and AIDS patients) and the very young or very old should consult their doctor about the possible risks involved with drinking rainwater. In many cases these people may be instructed to take extra care by using only boiled, bottled or micro-filtered water and avoiding foods and beverages that may contain rain water. When boiling water, both the elderly and young population should be specifically aware of the dangers of scalding (Rainwater Tank Guidelines, 2004).

The following maintenance suggestions can ensure the safe use of rainwater for drinking, food preparation or bathing purposes (Rainwater Harvesting, 2008):

- Keep roof catchments clean and clear of moss, lichen, debris and leaves.
- Remove overhanging trees and branches that overhang roofs.
- Conduct regular inspections and, if necessary, cleaning of gutters.
- Clean gutter and tank inlets and screens every 3–4 months.
- Disinfect the supply, if tank contamination is apparent.
- Examine the accumulation of sludge in tanks annually and clean them out if necessary.
- If a breeding site for mosquitoes has been detected add a teaspoon of domestic kerosene (not powder kerosene), which will eventually evaporate.
- If a dead animal has been found in a tank, drain all the water from the tank, clean inside the tank with household bleach, refill it with good quality water and disinfect it with chlorine.
- Test the quality of the water periodically.

There are several types of water tanks that may suit a variety of home designs depending on your needs (Home Improvement Pages, 2008).

Polyethylene (poly) Tank- poly tanks can be used either above or below ground. They are very light weight and easy to carry around and install. They are also UV resistant and less expensive than other varieties. They are available in a wide range of shapes, sizes and colours, so will suit any home. The poly tanks are food grade (so are suitable for drinking water) and come with warranties of up to 25 years.

Metal Tanks - metal tanks are manufactured from copper, stainless or color polymer coated steel. These tanks are easy to transport, come in corrugated or flat designs and can be used above or below ground. Metal tanks are usually rust proof and long lasting thus

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ensuring a good quality of water. The main advantage that these types of rainwater storage tanks have is the fact that they can withstand extreme temperatures without showing any signs of wear and tear.

Concrete Tanks - concrete tanks can be installed above or below ground but are commonly used as below ground tanks. These tanks are usually made on site, but can also be delivered pre-cast. The main disadvantages of these rainwater storage tanks are that they usually crack over time and can attract algae growth where sunlight is present. However, they are very easy to repair and can keep water cooler than other above ground tanks that are exposed to sun and heat.

Fibreglass Tanks - fibreglass tanks are resistant to rust and chemical corrosion so are suitable for above ground installations and are lightweight and easy to transport. They can tolerate extreme temperatures and are available in a large range of colours and sizes. Although they tend to be the most expensive water tanks they are easy to transport and last for a long time which can explain their popularity in the market.

Summary

Australia's water is a highly valuable resource - its rainfall level is the lowest of all continents in the world (excluding Antarctica), nevertheless, its usage of water per capita is the highest in the world (Melbourne Water, 2008). For this reason, the management of water in all different sectors has become one of Australia's great challenges and concerns all residences including old and disabled populations. Since the household sector, in particular, is the second largest user of mains water sources after agriculture, home water management is essential in order to create sustainable water consumption.

There are many opportunities to make better use of water supplies around the house. In this summary bulletin we have highlighted some of the main technology, products and management practices that are currently in place in Australia, and which are all aimed at improving the sustainability of water consumption around the house. Water conservation schemes are currently imposed both at the state or territory level and at the national level. At the national level, all Australian householders are required to have water efficiency products which are designed to reduce the level of water consumption considerably (WELS scheme). At the state and territory level, different levels of water restrictions are imposed depending on the location, climate conditions and available water supply. Special populations, such as the elderly or functionally impaired people, have some special considerations particularly when

the level of water restrictions is higher than level 3. Nevertheless, in most cases these populations are required to comply with current restrictions and regulation guidelines that concern the consumption of water around the house. It is therefore important to provide these populations with appropriate education on as many ways as possible to reduce water use in the house.

The management of water at the household level concerns other issues besides water efficiency schemes and regulations, particularly when the populations involved are frail older people, people of all ages with disabilities and their carers. These issues mainly involve the safe usage of water around the house such that it will not impose any risk or reduce the quality of life of its occupants. Special consideration should be given to groups of people who have particular support needs that need to be acknowledged and responded to by HACC agencies. For example, exemption from having to use a bucket or watering can to water gardens or lawns is essential for those who suffer from medical conditions and can help in reducing the risks of back and body injuries. Other potential water-related hazards that need to be considered when discussing water management in the homes of the elderly and disabled populations include:

- Risks of scalding or hypothermia resulting from a failure to regulate water temperature. This hazard can be minimized if certain products such as tempering valves or thermostatic mixing valves are installed.
- Risks of electrocution in wet areas such as bathrooms and kitchens. This can be prevented by using products such as hand held shower hoses, weatherproof or safety power point switches or when installing a fixed partition that is able to provide effective protection against spraying water.
- Risks of falls and stumbling around wet areas in the home are common among old people especially, and can be reduced significantly when bathrooms are kept waterproofed and proper grabrails are installed. Creating effective water drainage in these areas may also protect the durability of the foundations and structure of the house.
- Risk of water contamination particularly if the water supply is not public (e.g. rainwater or bore water). People who have a vulnerable immune system (e.g. elderly, those diagnosed with HIV, children) tend to be at the highest risk of suffering from microbial illnesses. Regular inspections for water leakage and quality of water, as well as an installation of appropriate filters can ensure the safe use of water.

Conclusions

Water management plays a central role in the household sector. Home modifications now require a good general practice of water management to ensure both the safety of the residence as well as the sustainability of water use around the house. Although many types of water management practice, technology and products have been mentioned and discussed above, there is still a lack of knowledge around its level of implementation. Of specific concern are the elderly and disabled populations. Research has shown that these populations are the most likely to resist home modifications that may ease their functionality and improve their quality of life (e.g. Cumming et al., 2001; McCreadie & Tinker, 2005), thus it may also be reasonable to assume that specific modifications for better home water management will be also resisted at least at the same level. Research should then aim to explore the level of resistance among these populations and alternative ways to make home modifications in relation to water management easier and more attractive as it may have serious implications not only on their safety but also on their ability to adhere to the current compulsory water regulations.

Checklist for Water Management

The following brief checklist is a summary of this publication, designed to encourage homeowners, therapists and tradespersons to take the necessary steps toward effective home water management.

- The use of water is confined to local water restrictions and water saving tips are applied as often as possible.
- The type of hot water system in the home has been identified.
- Tapware, hand-held showers and water temperature control devices are compatible with the hot water system in the home.
- Home modifications and products comply with the water saving regulations such as WELS and BASIX, where appropriate.
- The design for shower drainage has been considered early in the planning process.
- Shower drainage is effective and adheres to standards where applicable.
- Waterproofing issues have been considered during the planning stage of any wet area modification.

- The home has been checked for any signs of moisture problems.
- Moisture barriers have been put in place and strategies for ongoing moisture management have been identified.
- If permanent grey water systems and rain water tanks are installed they should be well set up and maintained according to local council standards and regulations.

Useful Contacts

The following table provides useful contacts when considering water management practices in the home, however, this is not an exhaustive list.

Table 5. Useful Contacts

Aquadux	Manufacturer of grate drains Phone: 1300 132 352 (for nationwide distributors) Web: www.aquadux.com.au
Con-Serv Corporation Australia Pty Ltd	Manufacturer Phone: (07) 3630 5744 Email: mail@con-serv.com.au Web: www.con-serv.com.au
Dormic Pty Ltd	Supplier Phone: (02) 4388 9255 Email: dormic@bigpond.com
Enware (NSW) Pty Ltd	Supplier Phone: 1800 671 864 Email: enware@enware.com.au Web: www.enware.com.au
Greens Tapware	Manufacturer Phone: (03) 9460 1666 Web: www.greenstapware.com
Housing Industry Australia	For members: technical advice on all building regulations, legislation, construction techniques and OH&S compliance Phone: (02) 6245 1300 Email: enquiry@hia.com.au Web: www.hia.com.au

Master Builders Association of NSW Waterproofing Council	Waterproofing information/advice Phone: (02) 8586 3555 Email: housing@mbansw.asn.au
NSW Department of Planning - BASIX	Information on BASIX BASIX help line: 1300 650 908 Email: help@basix.nsw.gov.au Web: www.basix.nsw.gov.au
Stormtech	Supplier of grate drains Phone: (02) 4423 1989 Web: www.stormtech.com.au
Strip Grate	Manufacturer of grate drains Phone: (03) 5976 3073 Web: www.stripgrate.com
WELS Regulator, Department of the Environment and Heritage	Information on the WELS Scheme Phone: 1800 803 772 Email: wells@deh.gov.au Web: www.waterrating.gov.au
Your Home, Australian Greenhouse Office	Information for environmentally sustainable homes Email: buildings@deh.gov.au Web: www.yourhome.gov.au
Sydney Water, NSW Government	Information on Water Restrictions in NSW Phone: 132092/ 132090 Web: http://www.sydneywater.com.au/
Sydney Tap Center, Surry Hills, NSW	Electric Automatic Tapware Supplier Phone:(02)96982367 Email: sales@sydneytapcentre.com.au Web: www.sydneytapcentre.com.au
Rain Harvesting Pty Ltd, Brisbane, QLD	Rainwater goods and gutter mesh systems Supplier Phone:(07) 3248 9600 (TOLL FREE 1800 06 77 44) Email: info@rainharvesting.com.au Web: http://www.rainharvesting.com.au/

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