Review of National & State Plumbing Codes to facilitate Domestic Water Reuse

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EXECUTIVE SUMMARY

Over the past 12 months the Master Plumbers and Mechanical Services Association of Australia (MPMSAA) with research partner RMIT University – Faculty of Engineering, reviewed the National Plumbing and Drainage Codes and State plumbing regulations. The aim of the research is to investigate possible changes that would be required to better facilitate rainwater harvesting and domestic scale water reuse to assist Water authorities and other stakeholders. This research forms part of the CSIRO / AWA Australian Water Conservation and Reuse Research Program which is due to be released in early 2004.

During the research it was important to first recognize the current technologies available in Australia and overseas, and the current and possible future uses for rainwater and recycled water within a domestic (urban) site. Therefore before we could investigate any possible omissions or impediments within the current plumbing and drainage regulations, we made some decisions as to the possible future directions for the use of urban recycled water.

The report investigates the current National Plumbing and Drainage Code AS/NZS 3500 and other state based regulations as at July 2003, with regard to the following urban applications:

1. Domestic stormwater/ rainwater harvesting
   - Rainwater applications
     - garden / outdoor use
     - toilet flushing
     - clothes washing
     - hot water heating
   - Above ground tanks
   - Underground tanks (one collection point)

2. Domestic scale sewage treatment

3. Domestic scale greywater reuse
   - Public and environmental health and safety
   - Garden irrigation & toilet flushing
   Combined stormwater and sewerage water treatment on site for domestic reuse.

4. Large scale domestic off site sewerage treatment and reuse
   - Large scale sewerage treatment off site and returned onsite for domestic use.
     (3rd pipe examples) water class/ quality and possible use – garden irrigation and toilet flushing

The report aims to highlight the over regulation and complexity of the plumbing industry to government authorities and other stakeholders who are currently investigating the urban water cycle to reduce potable water demand and increase possible reuse options.

Currently there is no national regulatory body, and at a State level there are a large number of regulatory stakeholders such as water authorities, water retailers, local government municipalities, environmental protection authorities and health departments. All of which generally have mixed views on domestic water harvesting, water recycling and re-use.

Many regions around Australia are experiencing drastic water storage shortages combined with forecast population growth over the next 20 - 50 years. In response many state and local governments have implemented their own water efficient initiatives that recommend local
technical solutions for building/plumbing practitioners, sometimes outside the guidelines / regulations of the National Plumbing and Drainage Code of Australia AS/NZS 3500.

Some of the issues arising from differences between the National Plumbing and Drainage Code and state based regulations are:

- Class A quality recycled water and domestic use.
- The inconsistent definition of rainwater when there is a potable supply available.
- Treatment of sewage water and rainwater and how the two systems are managed.
- Marking of pipes containing waters of different quality.
- Provision in new construction to separate wastewater and sewage drainage within the house to at least an outside access point, to facilitate selective reuse.
- Harnessing of rainwater tank supplies for household applications.
- Consideration for provision of multiple sources of water to the same use, and how these could be interchanged (eg supply of washing machine m/c from tank with mains as a backup) - automated/ manual.
- Non return values where multiple sources of water are used (backflow prevention).

In concluding, the report highlights changes that need to be considered in order to expedite some best practice options, and where current codes are barriers to good practice or have failings by omission.

This report is intended for use by

Government Authorities
Local Government
Plumbing and Building industry groups.

As changes to plumbing codes and standards are constantly being reviewed and updated, this report will be updated on a regular basis to inform the CSIRO research group of important changes that will impact on water conservation and reuse within an urban environment.

Appendix H of this report has been updated to reflect the changes recently made to AS/NZS3500 series – April 2004.
INTRODUCTION

Currently, per person, Australians use more water per person than other developed countries while we also live on the driest habitable continent on earth. How long then can we sustain our current water practices, especially when we irrigate our domestic gardens with potable water (30-35%) and flush 19% of our potable water down the toilet annually?

The Master Plumbers and Mechanical Services Association of Australia (MPMSAA) in conjunction with research partners RMIT University – Faculty of Engineering have undertaken a review of national and state plumbing codes (as of June 2003) and the possible changes required to facilitate rainwater harvesting and domestic scale reuse of rainwater (stormwater) and in-situ treated sewage and greywater. Concurrently, many regulatory bodies within the water and building sectors are investigating and in some cases implementing a variety of options which may have implications for current plumbing practice.

This report covers all Australian states and territories, and also references relevant standards and codes used internationally, and highlights models of good practice. Issues to be addressed include:

- Non return values where multiple sources of water are used (backflow prevention).
- Identification marking of pipes containing alternative water supplies of different quality.
- Provision in new house construction or extensions to separate water supply and sewage pipes from water uses within the house at least to the outside of the house, to facilitate selective reuse of greywater or selective supply from rainwater.
- Harnessing of rainwater tank supplies to houses.
- Consideration for provision of multiple sources of water to the same use, and how these will be interchanged (eg supply of washing m/c from tank with mains as a backup) – automated / manual.
- Any other issues found to be important barriers to domestic scale water conservation and reuse.

This report will review the current Australian Standards in place for plumbing and make reference to individual State practices. This report concentrates on the current AS/NZS 3500 National Plumbing and Drainage Code and relevant standards as highlighted in Table 1–page 17 – existing structure for relevant Australian Standards and use within the Australian plumbing industry).

Appendix D lists the clauses discussed throughout the paper from AS/NZS3500. (This paper specifically discusses AS/NZS 3500 unless otherwise stated and referenced).

All recommendations made in this report are based on current practices and Australian Standards as of July 2003. This report does not take into consideration the impending changes to the Building Code of Australia or the proposed new Plumbing Code of Australia. (to come into effect June 2004)

The conclusion of this report considers changes that are needed in order to expedite best practice, and identifies where current codes constitute barriers to good practice or have failings by omission.
DOMESTIC SCALE –
RAINWATER HARVESTING & USE

Stormwater
Domestic scale stormwater reuse (rainwater harvesting)

For rural areas of Australia rainwater harvesting and reuse for all activities within a domestic home have been common practice for over 200 years, as this in many cases has been the only supply of water available. However in larger cities and towns this has predominately been the responsibility of the water authorities which could monitor the quality of water being supplied.

Currently the National Plumbing and Drainage Code AS/NZS 3500 obliges all domestic homes that have the potable water supply available to connect and use this water source. Compliance with the Code is enforced by local water authorities. However the Code does allow for a possible alternative water supply to be used for garden use, toilet flushing, washing machine and outdoor use as long as it meets the performance requirements of the standard and is marked with identification labels. Until recently, not all local water authorities have publicly supported or promoted this alternate use.

Uptake of rainwater tanks for urban cities with a potable water system available has been minimal, and only became an option during the past 10 – 15 years as some metropolitan water authorities relaxed restrictions on the domestic collection and use of rainwater. This has limited the ability of the manufacturing and plumbing industry to produce an economically viable alternative for many domestic households to retrofit. This has been addressed by many State governments during the past 5 years through the introduction of water rebate schemes to simulate the market and introduce new technology and more competition.

Many water authorities still do not promote the full potential of rainwater use and local councils have differing requirements for tank installations – such as size, height colour and distance from the boundary etc..

Many local councils in metropolitan areas currently restrict the maximum size of a rainwater tank allowable without a planning permit (usually 4500 L). Many metropolitan water authorities also recommend that the collected rainwater should not be used for drinking purposes because of increased health risks due to possible contamination from atmospheric pollution. As populations increase over the next 20 - 50 years many water authorities have identified rainwater harvesting at a domestic level as an opportunity to achieve substantial potable water savings.

The Victorian Government has identified these issues and recently regulated the compulsory installation of rainwater tanks into all new homes as part of the 5 Star energy requirements (to come into effect 1st July 2004).

The current AS/NZS 3500 does not impede the installation and use of rainwater tanks for domestic use. Possible urban rainwater applications in no particular order could be:

- Toilet flushing (year round use) (average Australian household use of potable water 19%)
- Garden irrigation (35%)
- Other outdoor use (car washing, window washing, ponds, swimming pools etc.)
- Laundry washing (hot/cold water wash) (year round use) (15%)
- Hot water heating (between 15% - 30% depending on laundry washing)
Further investigation needs to be undertaken to determine the best use of rainwater in an urban environment with other sources of water available.

If households were to harvest rainwater for the activities listed above, this could represent at least 60% of current potable water use for the average urban family household (on average 140,000 litres of water). This raises the question of how urban homes can collect and store sufficient water to meet year round needs. If you could install a large tank of 10,000 litres on a domestic site, it would need to be emptied and refilled 14 times a year to satisfy the above uses.

Above-ground rainwater storage tanks
Possibilities for existing households and new homes to integrate above ground rainwater storage tanks include:

1. Installing a “pressurised” system at one collection point. Many rural properties currently have this system which requires the tank to be positioned where all the stormwater drainage pipes merge together; the inlet point on the rainwater tank must be below the level of the household guttering system to enable the tank to fill under gravity pressure. It must be noted that this system leaves water in the downpipes and stormwater drainage pipes permanently and AS/NZS 3500 requires an overflow from the tank back into the stormwater drainage system. Most urban stormwater roof drainage systems have not been installed for a “pressurised” system and therefore would require replacement or at the least testing for suitability. With a pressurised system there is no potential to harvest rainwater from other surfaces such as pavements, gassed areas, or driveways.

2. Installing a rainwater storage tank directly connected to one or more downpipes with stormwater overflow. This is by far the cheapest option available for retro fitting to existing urban households, however it is limited to the design of the guttering system and will not collect any other stormwater runoff or surface water.

The current AS/NZS 3500 outlines the requirement for the design of the domestic roof guttering and downpipe system. The Code provides annual expected rainfall intensity figures for different regions within Australia (SAA HB39-1997 Appendix C – refer below) that are to be taken into consideration when designing the roof guttering, downpipe and underground stormwater drainage system. For example the standard defines the size of guttering and number and size of downpipes required for a particular roof catchment area in square meters based on annual rainfall figures provided for each region.

In many cases the householder would only like one above ground rainwater tank connected to an existing home which may have up to 6 downpipes. Depending on the size and shape of the home, this would also decrease the cost burden of installing more than one rainwater tank. However, this may limit the volume of water harvested as many urban homes may not have the space available for a single large tank.

If we wish to keep the existing standard guttering size for aesthetic and economical purposes on existing and new homes to enable us to capture more roof run off (rainwater) to a single downpipe, AS/NZS 3500 would need to address existing guttering overflow requirements.

In ground tanks (one collection point)
Larger in ground rainwater collection tanks are now available within the plumbing industry. Large tanks could be designed to be installed underneath the driveway of a typical domestic home and have the ability to harvest all the rainwater from the main dwelling, other buildings and the driveway itself. This would result in a large catchment area of between 200 – 400m² for the average household.
Submersible pumps could then redirect the captured rainwater for internal and external uses. Tanks would need to be large enough to hold the rainwater and be designed to withstand external load and soil bearing from buildings, and enable water quality monitoring and control.

**Rainwater tanks**

AS/NZS3500.1:2:1998 is very clear on requirements for rainwater storage tank materials (Section 2.5 storage tank materials). Materials shall comply with the Australian or New Zealand standard and be suitable for storing potable water (food grade quality) and comply with AS3855.

Further clarification may need to be documented for in ground rainwater tanks especially in higher density areas where the tanks may have to be designed with additional load bearing capabilities to cater for soil / building loads and driveways/ vehicles/ other structures and vegetation etc.

Noise requirements may have to be regulated for any pumps used, especially for larger homes (2/3 storey etc.) when installed in higher density areas. These additional considerations are currently outside the plumbing regulation AS/NZS 3500.

**Rainwater for toilet flushing**

AS/NZS3500 does not limit the use of rainwater within a home in any way, providing that appropriate backflow prevention is installed if there is a separate potable water supply available to the household that so that there is no possible cross contamination with the potable supply.

From our investigations there are a number of rainwater tanks and products designed purely for toilet flushing for a domestic household. Many rainwater tanks designed for toilet flushing avoid backflow/cross contamination by providing an air break, however, this design usually has potable water refilling the tank when the water level reaches a certain low point. This type of system also limits the storage capacity when it does rain again.

Our research uncovered two manufacturers that have designed a rainwater toilet flushing system that if and when the tank is empty of rainwater, the system automatically diverts to the potable water supply available without refilling the tank with potable water. Subsequent flushing leaves the tank empty ready to be filled with rainwater. Both of these systems have been very popular with builders and some local councils not only for the water saving potential but also for the stormwater retention capabilities. These systems meet the current AS/NZS 3500 requirements for cross contamination and backflow, however some State / local council authorities have requested additional requirements such as testable check valves and ongoing monitoring of water quality at considerable additional expense. This seems contradictory to the requirements for other appliances such as clothes washing machines and dishwashers, which work on similar technology.

The Plumbing Industry Commission (PIC) of Victoria have released a “technical solution” for plumbing practitioners on rainwater toilet flushing systems (Refer Appendix C - Victorian PIC technical solution rainwater for flush toilet cisterns)

**Roof harvesting area and guttering and downpipe calculations.**

AS/NZS 3500 clearly outlines the design criteria for domestic and commercial stormwater roof guttering and downpipe drainage systems.
The criteria prescribe the maximum allowable roof catchment area for each downpipe and roof guttering profile. In brief larger cross sectional guttering and downpipe will allow for more roof area to drain to that point.

The AS/NZS3500 clearly defines design criteria for different regions of Australia depending on the meteorological rainfall data contained within the standard. The rainfall data is divided into Average Rainfall Intensities (ARI) of 20 years for exposed guttering systems and 100 year ARI for internal guttering systems.

In summary the current standard does not allow for increased rainwater to converge to one downpipe for greater harvesting potential unless the guttering and downpipes are adequately sized to reduce the potential of overflow/ flooding.

With the existence of guttering systems with overflow slots built into the gutter itself, the standard AS/NZS 3500 could review the current requirements for retrofitting a rainwater tank to existing households with limited space available for tank(s). This could increase the potential roof catchment area available to one location (downpipe), therefore increasing the potential rainwater collected.

The standard AS/NZS 3500 does not limit the number of downpipes that can be connected to a rainwater storage tank.

**Summary of National Plumbing and Drainage Code AS/NZS 3500**

The standard clearly identifies the opportunity for rainwater or an alternative water supply for the use of toilet flushing, washing machine use, garden use, outdoor use, provided that the water supply meets the performance requirements (AS/NZS 3500 1.1 clauses 5, 6 and 7). The standard also indicates that any alternative water supply must be clearly marked for ease of identification and suitable backflow devices must be installed to avoid cross contamination with the potable supply if more than one water supply is connected to a fixture or appliance.

Rainwater for hot water heating for domestic use is not discussed in the national plumbing standard. However, rainwater is widely used throughout rural Australia for domestic hot water heating within the household as there is no reticulated potable water supply available in many cases. The standard would need to address hot water installation requirements, as some domestic households may be able to harvest enough rainwater to service all their requirements.

The standard AS/NZS 3500.1.2 – 1998 covers in great detail the cross connection and backflow requirements to safe guard the potable water supply. We feel the information stated in the acceptable solutions for backflow prevention would be adequate for any water pressure and water quality issues that may arise in a domestic situation; the standard is currently used to prevent cross contamination for industrial and commercial applications as well as domestic fixtures and appliances.

The standard states quite clearly the current limitations for a rainwater tank when the water is used for toilet flushing. We believe the intention of the standard when developed was to separate tank water for fire fighting and toilet flushing to ensure these systems had adequate water supply to meet expected demands and to ensure water used for sanitary purposes could not contaminate the water (potable) supply.

The standard could be reviewed to accommodate a single rainwater tank for multiple uses in a domestic situation. Currently there are systems available which can supply water safely to
more than one fixture or appliance, while also meeting the cross contamination / backflow requirements (Refer to Appendix H – AS/NZS updated in December 2003).

In ground capture of stormwater (roof run off) with a current design for downpipes could be a preferred method (therefore capturing all rainwater at 1 location of storage for later use). This method would also assist in meeting the design criteria for limiting the rainwater overflow on eaves and box gutters which otherwise would require very large guttering systems once you increase the roof area to one downpipe.

Currently there is no monitoring or quality control in place for rainwater collection and storage in plumbing Standards or Legislation, however many local government and water retail businesses identify rainwater quality as an issue in urban areas.

(Refer to Appendix H – non potable water supplies pipe identification marking system including rainwater pipes. AS/NZS updated in December 2003)

Source:
This standard sets out the objectives for water supply in its functional and performance requirements – This standards refers to AS/NZS 3500.1.2 National plumbing and drainage water supply – acceptable solutions

National Plumbing and Drainage Part 1.1: Water supply – performance requirements
AS /NZS 3500.1.1 – 1998

National Plumbing and Drainage Part 1.2 water supply – acceptable solutions
AS/NZS 3500.1.2 – 1998

National Plumbing and Drainage Code Part 3.1
Stormwater Drainage - Performance Requirements AS/NZS 3500.3.1-1998

National Plumbing and Drainage Part 3.2 stormwater drainage acceptable solutions
AS/NZS 3500.3.1-1998

Summary National Plumbing and Drainage Part 4 - Hot water supply systems

Non-potable water such as rainwater could be used for hot water heating. Currently there is very little information on rainwater for hot water heating in either the AS/NZS3500 or at a State regulatory level.

One new urban residential development (Aurora – northern suburbs of Melbourne – developer Urban and Regional Land Authority) is currently investigating the viability of using rainwater for hot water for buildings on the site.

Further investigation is required.

Source:
National Plumbing and Drainage Part 4.1 Hot Water supply systems performance requirements AS/NZS 3500.4.1-1997

National Plumbing and Drainage Part 4.2 Hot Water supply systems acceptable solutions
AS/NZS 3500.4.1-1997
2. DOMESTIC SCALE: SEWAGE TREATMENT

Many areas in metropolitan and rural Australia currently do not have a reticulated sewage disposal system available and therefore have an on-site sewage treatment system. The in ground septic tank with sand filtration lines has been the most common on-site domestic sewage treatment system for many years.

In situ treated sewerage systems

Septic Tanks
Unfortunately the majority of householders are not aware that septic tanks require regular maintenance and servicing, and only have a serviceable life of 20 – 30 years. Many municipalities throughout Australia have currently indicated that septic tanks are a major environmental concern with many councils estimating the failure rate of existing septic tanks to be as high as 60%.

Septic Tank Code of Practice

The current practice for septic tank installations is that the plumbing contractor needs a permit from the local municipal/council authority. Most states in Australia have a septic tank code of practice which outlines the design principles for the sand filtration lines and the installation of the septic tank itself. In many cases this takes into account the local soil and geographical site conditions. One consistent requirement is that the treated wastewater must be totally contained within the site boundaries.

Aerated wastewater treatment systems (AWTS)

Currently the AS/NZS 3500 states that any on-site waste water treatment system requires ongoing monitoring and maintenance, however the standard does not prescribe the level or timeframe for this monitoring. In many cases State EPA’s and local councils have regulated the monitoring requirements in conjunction with manufacturers’ recommendations; in some cases the frequency is every 3 months which is financially limiting and complex to administer as the onus to comply is placed on the householder.

Summary of National Plumbing and Drainage Code AS/NZS 3500

Sanitary plumbing and drainage AS/ NZS 3500 Part 2

Currently the standard prohibits stormwater and wastewater converging to a possible (or future) combined on-site domestic treatment plant for reuse. (This practice is currently used in other countries and could be a viable option for some domestic areas. – Refer Appendix F) The standard does not mention the separation of sewage and sullage waste water for possible future reuse. Opportunities for at least the sullage water (the separation of waste disposal pipes for sewage waste and sullage waste) should be a requirement for new construction until the drainage pipes reach an external wall of a dwelling. Therefore in the future the cost and accessibility of possibly reusing sullage water (greywater) would be greatly reduced – identification marks would also need to be enforced. Further investigation is required.

With the advent of new dual flush toilet systems being able to reduce the amount of water needed to flush a toilet down to 4.5 / 3ltr, dual flush consideration for lower water flows needs to be catered for. Currently standards only indicate minimum gradient levels for drainage systems, however these could be better linked to installed / expected flow rates from internal
fixtures. Toilets, hand basins, showers are all reducing the volume of water being used which could in turn create drain blockage issues.

Currently the standard indicates that all sanitary drainage systems need to be approved by a regulatory body. In many cases when there is a sewer main to connect into, the process is relatively simple by contacting the local water authority for a permit. However when a sewage treatment plant needs to be installed on the domestic site (totally self contained within the property boundaries), the plumbing practitioner needs to design a system and attain approval from a local authority, usually with the aid of a State based septic tank code of practice, manufacturers guidelines or local council guidelines. Local councils differ on their requirements for on-site domestic sewerage treatment due to the varying climatic and soil conditions around Australia.

Source:
National Plumbing and Drainage Part 2.1 Sanitary plumbing and drainage – performance requirements
AS/ NZS 3500.2.1-1996
National Plumbing and Drainage Part 2.2 Sanitary plumbing and drainage – acceptable solutions AS/ NZS 3500.2.2-1996

3. DOMESTIC SCALE: GREYWATER REUSE

Greywater (sullage)
Greywater, sometimes referred to as sullage, is used water from a household that does not include water from the toilet or bidet (blackwater). From the general public’s viewpoint Greywater recycling/reuse is perceived to be less complex than recycling sewage as it is perceived that there are fewer health issues (less pathogens) and less treatment (if any) required. However government groups and water authorities have clearly recognised the potential hazards associated with greywater and are treating the issue of use very cautiously.

Greywater is usually discharged from the bathroom, laundry and kitchen to the sewer but, especially in times of drought, some households intercept it for garden watering. Little is known about how widespread this practice is. More could be done to encourage the use of this under utilised water resource both in the garden and for toilet flushing once the potential hazards and plumbing standards become clear. Widespread greywater reuse could have implications for operating the sewage system, which relies on greywater to keep sewage flowing. Any major reduction of greywater flow into sewers could lead to blockages and reduce the effectiveness of the system. Significant reductions in greywater flow would also increase concentrations of waste matter in the sewage which could have a detrimental effect on existing treatment plants.\(^1\) There also needs to be further study on the long term impacts of greywater use on plants and soil, as greywater could also contain large amounts of detergents / bacteria etc.

(There are ways around these difficulties. In Lubeck, Germany, they have developed a process that separates blackwater and greywater, treating the latter in wetlands and using it for non potable purposes, and using vacuum sewers over short distances (comprising about 300 – 400 houses) to minimise the problems of reduced flows).

Sullage (greywater) use and regulation

Health and water quality concerns lie behind the mixed responses from many regulatory authorities for the use of greywater.

\(^1\) Water corporation of Western Australia
The current regulations relating to greywater use vary across states and even local governments, and authoritative advice about greywater use is generally difficult to source. Often councils are not sure whether we can or we cannot establish domestic greywater reuse systems. There are many DIY greywater diverters on the market that are very popular during water restrictions and drought throughout metropolitan areas. Many of these products do not meet current Australian Standards (MP52) product approvals such as a watermark, with many products on the market designed to block the drainage line so it can be diverted for reuse. There is a high potential for these products to malfunction and block the drainage system which may not always be apparent to the householder.

Public and environmental health issues are the biggest concern relating to greywater use. People should not be allowed to reuse greywater without some sort of regulation and understanding of the potential risks. At the moment local councils are dealing with permanent greywater systems on a case-by-case basis, with a number of councils adopting the current State EPA and Department of Health guidelines, but are unaware of the level of use and environmental impacts within the community for the DIY greywater diverters.

(Appendix G – Victorian EPA information bulletin - Reuse options for household wastewater publication 812 Nov 2001 & DHS SA reclaimed water guidelines)

Because the quality of greywater varies, authorities are reluctant to recognise the water savings that can be made from it’s reuse and generally prefer for it to remain a part of sewage stream and undergo treatment with the resultant effluent made available for use. However, the CSIRO suggests that using greywater for garden watering will probably be more economic when performed at the household rather than at regional scale and conservation-minded households may question the benefits of repurchasing water that has already passed through their property and been sent to the sewage treatment plant.

It is difficult for authorities to provide comprehensive advice on greywater reuse because its quality varies between households as does the volume, frequency, soil type, topography, climate and discharge area/size, and local government planning requirements.

However, the environmental and health issues can be avoided if onsite greywater reuse systems (subsurface garden irrigation) are carefully designed, installed and managed. Sufficient land needs to be available so that the water can be absorbed on site and it is prevented from flowing to neighbouring land. It must not be allowed to form puddles or be sprayed because of the potential risks with human contact.

Despite the fact that many people use greywater to water lawns, untreated greywater is generally only suitable for subsurface irrigation where organisms in healthy soils can break down contaminants. Underground systems also remove the risks associated with human contact and the CSIRO suggests that legislation is required to ensure that this occurs. Additionally, long term watering with greywater needs to be assessed for it’s environmental sustainability (for example, salt loads and nutrient levels).

Greywater for domestic toilet flushing

One current internal use for untreated greywater use is a closed system that uses greywater for toilet flushing. Lower risk sources such as bath and shower water is diverted to a holding tank and sent to cisterns. This minimises the risk of human contact with the water and can achieve considerable savings of potable water. On average there are two to three times as much greywater generated per day per household than is required for toilet flushing.
However in relation to the holding tank for the greywater, good greywater management practice prevents untreated greywater from being stored for longer than 24 hours. This appears to be enforced by most local councils and state environmental authorities. Greywater can quickly become septic when stored as pathogens multiply and unpleasant smells can be emitted. This problem has been overcome in relation to toilet flushing by a couple of manufacturers who install a timing device on the holding tank that automatically sends unused greywater through an overflow pipe back to the sewer every 24 hours.

Currently any greywater that is stored for longer than 24 hours is considered by environmental authorities as sewage and the holding tank and monitoring requirements need to be inline with current septic tank and onsite wastewater treatment systems (AWTS) regulations.

The current monitoring requirements by some Government Environmental Authorities and Local Governments are cost prohibitive for any proposed long term greywater treatment and/or storage system, however these requirements could be looked at if the greywater system was limited to lower risk greywater sources such as bath, shower, laundry rinse water and hand basin water only.

Further investigation is required if greywater use is considered a viable option, with many issues raised during this section including Plumbing standards/codes are still not clear.

Summary: On Site Domestic –Wastewater Management AS/NZS 1547:2000

The code for on site domestic wastewater management AS/NZS 1547 is very clear. The standard only provides basic performance provisions for septic tanks and introduces performance requirements to cover other types of wastewater treatment units. The standard clearly avoids issues of sustainable reuse of water.

As discussed earlier, current greywater regulations are enforced by State authorities and local government municipalities, which in many cases treat greywater exactly the same as sewage and therefore have strict reuse and monitoring requirements which limit the viability.
Off-site sewage treatment - recycled water for domestic reuse.

Recycled water treated off site and returned for domestic use (3rd pipe)

There are a number of new residential developments that are currently looking at the viability of treating the sewerage from domestic households close by and returning the treated water for domestic reuse. There are many examples across Australia of current residential developments currently using this technique with varying success and plumbing issues.

Currently AS/NZS 3500 caters for an alternative supply to enter a domestic building and could easily be used for toilet flushing and garden irrigation as long as the plumbing system meets the current back flow and cross contamination requirements and that the plumbing system is marked with identification (lilac coloured) with signage in place and child proof tapware etc.

However some health and environmental authorities are currently restricting the possible use.

Refer to Appendix E – PIC Recycled water – plumbing guide April 2003.

Rouse Hill NSW

Integrated water cycle management is managing water, wastewater and stormwater together with monitoring the impacts of all three on the quality of water in local rivers. These three parts of the water cycle are all managed separately throughout most of Sydney. In Rouse Hill, Sydney Water manages all the elements of the system together. This helps to decrease the environmental impact of urban development on the Hawkesbury Nepean River. Sydney Water tested water quality in the river prior to the recent housing developments to set water quality targets. The aim is to ensure that water quality does not deteriorate as more homes are built.

Stormwater management

Stormwater in Rouse Hill is collected in grass-lined channels which feed the storm water system through a series of rubbish traps and wetlands in order to reduce the pollutants entering the river system. Wherever possible these channels follow the natural watercourse through the area. In areas where floodwaters may cause erosion some concrete channels have been used.

Stormwater is not used in the production of recycled water because the volume changes dramatically with weather conditions.

The drainage system has been designed to protect the area from floods and can carry a one in one hundred year storm without disrupting the community. A recycling system designed to cope with this storm flow would be wasted when the area has average or low rainfall.

Wastewater and recycled water

Wastewater in Rouse Hill is treated to a very high standard (Class A). This wastewater has an extra treatment known as ozonation and microfiltration. This allows it to be recycled and fed back to homes in the area in a separate pipeline for outdoor use and toilet flushing.
Any wastewater that is not recycled is released into artificial wetlands in Second Ponds Creek. When treated wastewater is discharged to the river, the advanced treatment ensures that the impact on water quality is minimised.

By managing these elements together we can consider the water cycle as a whole unit. This allows us to make better use of a valuable resource by imitating and speeding up the natural processes of the water cycle.


Sandhurst Club (Melbourne – Victoria)

A new residential development currently under construction in Melbourne is the Sandhurst Club which is located 2km from the Currum Downs treatment plant in the south east of Melbourne. The proposal is for a 3rd pipe line system to be installed at every household for garden irrigation and toilet flushing. The recycled water is also used for the 2 golf courses on the site.

The researchers of this paper believe this should be a requirement for all new urban residential developments.

No changes would be required to AS/NZS 3500 Plumbing Codes - as the Code allows for alternative water supply for domestic use; i.e it could be used for domestic Garden use and toilet flushing. However conflicting requirements by some State EPA’s require a minimum of class A water quality to be achievable for internal domestic reuse. Many water authorities currently implementing 3rd pipe systems can achieve class A quality water, however the treatment costs are significantly higher than current potable water costs. Therefore many new residential developments are currently only using class B water for domestic and public space garden irrigation.

Many agricultural activities can also access this water depending on the quality of water achieved.

(Refer Appendix A – current regulatory uses for classes of treated water for reuse). The installation costs of the infrastructure may also be prohibitive to pipe the new system into existing areas.

Refer to Appendix A: for a reference of possible uses for the different levels of water quality.

There are many other examples across Australia of 3rd pipe systems currently in development/construction. This report was only intended to research the plumbing issues encountered by using current information (standards/codes) available.
Melbourne Water on site water recycling (sewer mining)

Melbourne Water have developed an on-site water recycling treatment plant that can treat raw sewage and produce up to 30,000 litres of class A water per day which meets EPA Victoria guidelines and Department of Human Services health requirements.

The technology involves sewage being pumped from an existing sewer main nearby and treated in a small treatment plant on site. A trial was conducted at Melbourne’s Kings Domain Park (next to the Royal Botanical Gardens) to monitor the water quality. Currently the recycled water is being used for the irrigation of parklands, golf courses, with Melbourne water identifying over 45 possible locations in metropolitan Melbourne to be implemented over the next 7 years.

International Example: Combined stormwater and sewerage water treatment on site for domestic reuse.

In Europe some cities domestic wastewater recycling and reuse projects combine stormwater, sullage water and sometimes even sewage waste into a single treatment and holding tank system. In most cases this provides sufficient quality and quantity of water for toilet flushing and garden irrigation. The treatment process can achieve varying levels of treatment resulting in water quality for many purposes.

This option requires further investigation, as the initial costs could be substantial. Currently all plumbing codes including Australian Plumbing Code AS/NZS 3500 would need to be revised to allow stormwater and wastewater to converge together.

This example was included in the report to demonstrate that our current regulatory structure and plumbing standards/codes have been upgraded over the years from a historical view of plumbing practices. Nether-the-less, the structure has difficulty accepting new options or environmental requirements without being amended.

(Refer Appendix F – Australian Plumbing Industry Journal – Winter 1999 Rainwater tanks for the 21st Century)
Summary of National Plumbing and Drainage Code AS/NZS 3500

The researchers of this paper believe all new urban residential developments could currently utilise a dual reticulation system that delivered potable and class A water when the new development was in close proximity to the sewage treatment plant.

No changes would be required to AS/NZS 3500 Plumbing Codes - as the code allows for alternative water supply for domestic use (i.e. it could be used for domestic Garden use and toilet flushing).

However conflicting requirements by some State EPAs require that a minimum of class A water quality must be achievable for internal domestic reuse. Many water authorities currently implementing 3rd pipe systems can achieve class A quality water, however the treatment costs are significantly higher than current potable water costs. Therefore, many new residential developments are currently only using class B water for domestic and public space garden irrigation.

Many agricultural activities can also access this water depending on the quality of water achieved (Refer Appendix A – current regulatory uses for classes of treated water for reuse) The installation costs of the infrastructure may also be prohibitive to pipe in the new system into existing areas.

Refer to Appendix A: for a reference of possible uses for the different levels of water quality.
4. EXISTING STRUCTURE FOR RELEVANT AUSTRALIAN STANDARDS AND USE WITHIN THE AUSTRALIAN PLUMBING INDUSTRY

Existing Building Control Act

Existing Building Code of Australia (June 2004 BCA will refer to PCA)

NEW Plumbing Code of Australia — Expected Release Date June 2004 (This report does not discuss the proposed Plumbing Code of Australia) Refer to appendix

Existing Additional AS/NZS codes (referred to by AS/NZS 3500) Please Note: Only an example of AS/NZS codes relevant to this report have been shown below.

On Site domestic – wastewater management AS/NZS 1547.2000

Materials for Water storage tanks AS3855.

Backflow prevention devices shall comply with AS 2845.1

State Based Regulations & Technical Solutions

NSW  Victoria  Queensland  Sth Australia  Western Australia  Tasmania  ACT  NT
5. STATE BASED REGULATIONS:
TECHNICAL SOLUTIONS & CODES OF PRACTICE

From our investigation, it appears many states and regions throughout Australia do not currently enforce the use of the performance standards and technical solutions available in AS/NZS 3500. Some authorities use older versions of AS/NZS 3500 and produce their own technical solutions and performance requirements for plumbing.

One of the main issues impeding a consistent approach to water efficiency and reuse regulations is that each State and territory in Australia has their own regulatory structure in place for plumbing.

1. Each State individually regulates the onsite installations (including auditing and compliance).
2. Each State has an examination and licensing board for plumbing practitioners (Refer to Table 2: State Based Regulatory Structures for Plumbing (Technical Solutions)).
3. There is a national regulation for plumbing products approval / compliance MP52, however many states do not enforce this at installation or point of sale.

The table below (Table 2: State Based Regulatory Structures for Plumbing) highlights the complexity of the existing State regulatory system. For example – in Victoria there is one authority that regulates plumbing, however when water reuse is proposed for a domestic site (ie- greywater, domestic sewerage treatment plants and rainwater) the Environmental Protection Authority (EPA), the Department of Human Services and local government also become involved.

The situation becomes more complex in NSW where there are at least 10 different authorities that regulate plumbing (including local councils and water authorities) which reference different versions of AS/NZS3500. When domestic scale water reuse is involved, other groups have jurisdiction such as NSW EPA and Sydney Health.

In many cases the State authorities develop their own interpretation of AS/NZS 3500. An example of this is the ruling for backflow prevention devices to stop cross contamination with the potable water supply. The standard states that potential risks for non potable water entering the potable water supply is separated into 3 categories depending on the risk to human health. Low hazard, medium hazard and high hazard.

For example, clothes washing machines and outdoor irrigation systems generally have a low level of hazard attached to the backflow prevention devices required. In the case of outdoor irrigation systems, no backflow devices are installed. In contrast, rainwater tank systems in some cases are treated as high level risk hazards, increasing the backflow device requirement and costs.

Further investigation is required into how each of the States and Territories in Australia can streamline their plumbing legislative requirements and the possibility of each State adopting the proposed new National Plumbing Code of Australia (to be released in July 2004).

The proposed new plumbing code is being driven by the Plumbing Industry Commission of Victoria, which have also indicated that they will be the first State to adopt the new National plumbing code from July 2004.
Table 2: State Based Regulatory Structures for Plumbing (Technical Solutions)

<table>
<thead>
<tr>
<th>State</th>
<th>On site regulation</th>
<th>Wastewater (additional regulatory groups include)</th>
<th>Occupation Licensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>On site regulation Building Codes of Queensland Local Government Councils regulate plumbing works</td>
<td>Wastewater (additional regulatory groups include Victorian EPA Dept. Health / human services, local government)</td>
<td>PIC with processes supported by the Australian and New Zealand Reciprocity Association agreement.</td>
</tr>
<tr>
<td>Queensland</td>
<td>On site regulation Building Codes of Queensland Local Government Councils regulate plumbing works</td>
<td>Wastewater (additional regulatory groups include Qld EPA, ecoaccess, local government)</td>
<td>Plumbers and Drainers examination Licensing Board</td>
</tr>
<tr>
<td>Sth Australia</td>
<td>On site regulation South Aust. Water corporation administered by Development Services Branch</td>
<td>Wastewater (additional regulatory groups include Department of Human Services, local government, EPA)</td>
<td>Water corporation will transfer to the plumbing licensing board</td>
</tr>
<tr>
<td>Western Aust.</td>
<td>On site regulation Water Corporation of WA. Technical regulatory role with transfer to plumbing licensing Board and the office of Water Regulation</td>
<td>Wastewater (additional regulatory groups include, local government)</td>
<td>Commissioner for consumer affairs</td>
</tr>
<tr>
<td>Tasmania</td>
<td>On site regulation Dept. of Infrastructure, Energy and Resources (legislation &amp; regulations) Local Government councils (issues permits and certification of completion of plumbing works)</td>
<td>Wastewater (additional regulatory groups include, local government)</td>
<td>Plumbers and gasfitters registration board</td>
</tr>
<tr>
<td>ACT</td>
<td>On site regulation Building, Electrical &amp; Plumbing Control (BEPCON), ACT Department of Urban Services Wastewater (additional regulatory groups include Environment ACT, Urban services)</td>
<td>Occupation Licensing</td>
<td>Administrated by Dept. of Industries and Business</td>
</tr>
<tr>
<td>NT</td>
<td>On site regulation The Building Advisory services branch of lands, Planning and environment Wastewater (additional regulatory groups include, local government)</td>
<td>Occupation Licensing</td>
<td>Plumbers and Drainers Licensing Board – Administrated by Dept. of Industries and Business</td>
</tr>
</tbody>
</table>

Source: Commonwealth Department of Industry Science and resources 2000 (Future Options for Plumbing and Drainage Regulation in NSW February 2002 – NSW Interagency committee on plumbing regulation reform.)

MPMSAA (Green Plumbers™) & RMIT University
Review of National & State Plumbing Codes to facilitate domestic water reuse
6. CONCLUSION

In concluding, it is hoped that this report increases the level of awareness and support for a Nationally consistent approach when dealing with water conservation and water reuse for urban plumbing standards and legislation. Currently many States and plumbing regulatory bodies work to differing performance standards and there are a large number of stakeholders involved at an individual state and National level.

This report has attempted to give an independent view on some of the current and future possibilities for urban water reuse and the issues relating to existing Plumbing codes/standards (snapshot June 2003). This report has not discussed viability with regard to environmental or climatic conditions of particular areas across Australia or the financial costs/ benefits of the options discussed.

The current National Plumbing and Drainage Code AS/NZS 3500 series covers in great detail the performance standards and acceptable solutions for current plumbing installations. However it does not cover water sustainability measures, or acceptable alternative water supplies.

The existing AS/NZS 3500 covers plumbing installation requirements in detail and in general does not impede the current activities of stakeholders currently implementing water reuse initiatives such as class A and B 3rd pipe systems, aquifer recharge, small or large scale stormwater storage and use or greywater reuse etc. However the researchers of this paper believe that the current National Plumbing and Drainage Code AS/NZS 3500 should be revised to include provisions for greater alternative /reuse water options and water sustainability measures.

The AS/NZS 3500 has adequate provision for the regulation of backflow prevention to eliminate cross contamination with other potable (and non potable) water supplies, the National Standards also cater for alternative (potable) water supplies taking into consideration, low and high pressure, gravity and pressure supply.

At a national level our research also reviewed the Australian Building Code and possible changes to BCA21. Unfortunately the BCA21 review committee is undecided as to whether it should include water sustainability measures within the revised Building Code. However, the review did conclude that if it was to include water sustainability performance it should be at a national level.

At the very least the BCA or the soon to be released Plumbing Code of Australia (June 2004) should make provision for greater access of wastewater within a home, for example mandating that wastewater drainage pipes remain separated until they reach an external wall, therefore reducing costs for future possible reuse technology. The Victorian Government recently (24th July 2003) made amendments at a State level to the Building Code. Amendments include compulsory rainwater tanks, water efficient appliances/ fixtures (and internal flow rates) and/or solar hot water for all new homes and will come into effect from 1st July 2004. However, once again NSW is looking at adopting a different approach for new homes in regard to water saving measures and other environmental benefits.

The current impediments for domestic water reuse are at a local government, State environmental and water authority level.

A consistent approach to domestic water reuse fit for purpose needs to be achieved at a national level, with provision for local geological and climatic differences, and the flexibility for multiple solutions for existing homes and new construction.

One thing we can all agree on is that domestic water reuse needs to be installed with human and environmental health in mind.

A number of amendments have been made recently to AS/NZS 3500 series (December 2003) to include alternative water supply identification markings, new provisions for non drinking water service and rainwater tanks and plumbing materials. The soon to be released Plumbing Code of Australia (July 2004) will provide a platform for each State and territory to work to nationally consistent plumbing outcomes which hopefully will be adopted by all states and territories by the end of 2004.
Reclaimed water is divided into several classes in state guidelines, on the basis of the treatment level applied to the effluent and the uses to which it can be put. For example, Victoria specifies four classes of reclaimed water. Secondary treatment produces Class D reclaimed water, and pathogen reduction and further treatment (tertiary) can be applied to produce Classes C to Class A as shown in the following table.

<table>
<thead>
<tr>
<th>Class</th>
<th>Water quality objectives medians unless specified</th>
<th>Treatment processes</th>
<th>Range of uses – uses include all lower class uses.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Indicative objectives</td>
<td>Tertiary and pathogen reduction with sufficient log reductions to achieve &lt;10 E.coli per 100mL; and &lt;1 helminth per 50 liters; and &lt; 1 virus per 50 litres</td>
<td>Urban (non profitable): with uncontrolled public access Agricultural: eg human food crops consumed raw Industrial: Open systems with worker exposure and potential</td>
</tr>
<tr>
<td></td>
<td>• &lt; 10 E.coli org/100ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Turbidity &lt; 2 NTU</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• pH 6 – 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 mg/L C12 residual (or equivalent disinfection)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>• &lt;100 E.coli org/100mL</td>
<td>Secondary and pathogen reduction (including helminth reduction for cattle grazing)</td>
<td>Agricultural: eg dairy cattle grazing Industrial: washdown water</td>
</tr>
<tr>
<td></td>
<td>• pH 6 – 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• &lt;20 / 30 mg/L BOD / SS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>• &lt;100 E.coli org/100 mL</td>
<td>Secondary and pathogen reduction (including helminth reduction for cattle grazing use schemes)</td>
<td>Urban (non profitable): with controlled public access Agricultural: eg human food crops cooked/processed, grazing/fodder for livestock Industrial: systems with no potential exposure</td>
</tr>
<tr>
<td></td>
<td>• pH 6 – 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• &lt;20 / 30 mg/L BOD / SS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>• &lt;10000 E.coli org/100 mL</td>
<td>Secondary</td>
<td>Agricultural: non-food crops including instant turf, wood lots, flowers</td>
</tr>
<tr>
<td></td>
<td>• pH 6 – 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• &lt;20 / 30 mg/L BOD / SS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

APPENDIX B
DOMESTIC POTABLE WATER USE & POTENTIAL SAVINGS

Average of domestic water use by the household. Melbourne metropolitan households.

It is estimated that less than 1% of potable water is currently used for drinking and cooking within the average household.

Hot water use – approximately 24 – 35%
Toilet flushing – 19%
Outdoor / garden use – 35%

Source:
21st Century Melbourne: a water smart city
Planning for the future of our water resources – Strategy Directions Report.
Water resources strategy for the Melbourne area committee. May 2002

Domestic toilet flushing

The average family household in Australia uses 19% of their total water consumption for toilet flushing. The table below demonstrates that a large volume of potable water is used for toilet flushing.

<table>
<thead>
<tr>
<th>Toilet system</th>
<th>Number of people in house</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>6/3 dual flush compulsory in new homes 1993-</td>
<td>10 000</td>
</tr>
<tr>
<td>9 / 4.5 flush 1989 - 1993</td>
<td>15 000</td>
</tr>
<tr>
<td>11/5 dual flush 1982 - 1989</td>
<td>18 000</td>
</tr>
<tr>
<td>11 Litre single Flush 1960 - 1982</td>
<td>24 000</td>
</tr>
<tr>
<td>13 litre single flush up to 1960</td>
<td>28 300</td>
</tr>
</tbody>
</table>

(figures supplied by Caroma)

Estimated water use for toilet flushing
Based on 7.1 million households in Australia (ABS 2002)
It is estimated there are 3 million single flush toilets (pre 1960) still in use throughout Australia.
APPENDIX C

1. THE PLUMBING INDUSTRY COMMISSION (PIC) OF VICTORIA “TECHNICAL SOLUTION” FOR PLUMBING PRACTITIONERS ON RAINWATER TANK TOILET FLUSHING SYSTEMS

2. RAINFALL DATA AND ROOF STORMWATER DRAINAGE INFORMATION SAA HB39-1997
APPENDIX D
NATIONAL PLUMBING & DRAINAGE CODE: AS/NZS 3500

National Plumbing and Drainage
Part 0 : Glossary of terms
AS/NZS 3500.0:1 1995

Stormwater
The runoff due to rainfall from roofed areas, termed roofwater, from paved and unpaved areas, termed as surface water and from water bearing ground, termed subsoil water.

Rainwater
Stormwater

Sullage
Domestic wastes from baths, basins, showers, laundries, and kitchens, including floor wastes from these sources

Greywater
Sullage water

Groundwater
Water occurring naturally in the subsoil.

Potable water
Water which is suitable for human consumption.

Sanitary plumbing system
An assembly of pipes, fittings, fixtures and appliances which is used to collect and convey sewage to the sanitary drainage system.

Sanitary appliance
An appliance which is intended to be used for sanitation and which is not a sanitary fixture. Included are machines for washing dishes and clothes.

Please note:
This report is consistent with the glossary of terms used in AS/NZS 3500 Parts 1,2,3,4.

Please find above the applicable descriptions currently used in the glossary of terms used AS/NZS 3500.0.1

Particular clauses of the current National Plumbing Codes AS/NZS 3500 have been highlighted below as to possible impediments to facilitate domestic scale rainwater harvesting and water reuse. Each Australian Standard has been evaluated with direct clauses referenced in (italics font).
PREFACE
The performance requirements of this standard have been published without a ‘durability’ clause. This course of action was found necessary owing to a division existing among the committee members responsible for the document.

5. Objectives – The objectives of this standard are as follows:
   (a) Safeguard people from illness due to consumption of, or contact with contaminated water.
   (b) Safeguard people from injury or loss of amenity due to a failure of the water supply installation.
   (c) Safeguard people from a water supply that is offensive in appearance, taste or odour.
   (d) Ensure that suitable water facilities are provided for people with disabilities.
   (e) Ensure that the cold water supply installation throughout its design life will continue to satisfy the objectives of items (a), (b), (c) and (d).

6. FUNCTIONAL REQUIREMENT – FIXTURES AND APPLIANCES Fixtures, appliances and drinking water outlets shall have a safe and adequate piped water supply suitable for the intended purpose.

7. PERFORMANCE REQUIREMENTS
7.1 Water supplies- Installations intended to supply water for human consumption, food preparation, utensil washing or oral hygiene shall be connected to a potable water supply.
7.2 Non-potable water supplies – Pipes outlets and fittings supplying non potable water shall be clearly identified.
7.3 Water supply installations- water supply installations shall be designed and constructed as follows:
   (a) Avoid the likelihood of contamination of potable water within both the system and the water main by means which are appropriate to the hazard.
   (b) Provide water to fixtures and appliances at flow rates and pressures which are adequate for the correct functioning of those fixtures, appliances and fire services under normal conditions and in a manner that does not create undue noise.
   (c) Avoid the likelihood of leakage or failure
   (d) Allow the system, appliances and backflow prevention devices to be isolated for testing and maintenance”.

“10. AUTHORIZATION Products used in water supply systems shall be of an approved type as specified in SAA MP52”.

National Plumbing and Drainage
Part 1.1 : Water Supply- performance requirements
AS /NZS 3500.1.1 – 1998
National Plumbing and Drainage
Part 1.2 : Water supply – acceptable solutions
AS/NZS 3500.1.2 – 1998

Forward

Regulatory Requirements - Attention is drawn to the relevant regulatory requirements with respect to:

(c) The authorization for certain materials, products, fittings and other components to be connected to water supply systems in accordance with National Certification of Plumbing and Drainage Products scheme (NCPDP) in Australia and the Building Industry Authority (BIA) in New Zealand.

Section 2 MATERIALS & PRODUCTS

2.3 Selection and use of materials The materials and products used shall be selected to ensure satisfactory service for the life of the installation within the property (see figure 2.1). Factors to be taken into account include

(a) the type of usage likely to occur and the nature of the water to be conveyed;
(b) the nature of the ground and the possibility of chemical attack therefrom;
(c) the physical and chemical characteristics of the materials and products;
(d) frost protection in accordance with clause 5.19; and
(e) other environmental factors

2.5 STORAGE TANK MATERIALS. Materials shall comply to a relevant Australian or New Zealand standard and be suitable for storing potable water and comply with AS3855.

Section 4 CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

4.2.2 Quality of water supply
Only potable water shall be supplied to plumbing fixtures or outlets for human consumption, bathing, food preparation, utensil washings or clothes washing.

Section 4.2.3 Introduction of contaminants
No device or system that may permit the introduction of any foreign substance into the water service, shall be connected directly or indirectly to any part of the water supply system (including fire protection, garden watering and irrigation systems) or to any temporary attachment to the water service without cross connection or backflow prevention control authorized by the regulatory authority.

Section 4.2.5 Alternative water supplies – Alternative water supplies shall conform with the following:

(a) Where water supplied from one source is connected to another water source:
   (i) an appropriate backflow prevention device shall be fitted; and
   (ii) the installation shall be authorized by the responsible regulatory authority.

(b) Where the alternative supply is non-potable water supply, it shall be clearly and permanently labelled ‘CAUTION NOT FOR DRINKING’ at every outlet.

(c) Where the alternative supply is a non potable water supply, clear and permanent labels in accordance with AS1345 for the distribution pipes and AS1319 for the outlets are required. Where the non potable alternative supply is installed below ground the service shall have a continuous marker tape, stating the pipe below is non potable, installed in the trench above the service.
(d) Piping conveying water downstream of a high or medium hazard backflow prevention device other than which is used for containment shall be clearly and permanently labeled ‘CAUTION NOT FOR DRINKING’ at every outlet. The caution sign shall comply with AS1319 and the distribution pipes shall be clearly marked in accordance with AS1345.

Section 4.4 PROVISION OF BACKFLOW PREVENTION DEVICES

4.4.1 The backflow protection required shall be determined by first identifying the individual hazard(s) within the premises. Then working upstream from each hazard, the water shall be regarded as non-potable until a backflow prevention device is provided suitable to the degree of hazard. Backflow prevention devices shall comply with AS 2845.1

4.4.6 Inspection and maintenance - Testable backflow prevention devices shall be inspected and tested after installation and prior to service. They shall be maintained in working order and inspected for operational function at intervals not exceeding 12 months. Reduced pressure zone devices, double check valves, pressure type vacuum breakers, registered break tanks and registered air gaps shall only be used with a maintenance program for device registration and test certification. Where there is no such program, these devices shall not be fitted and the standard air gap requirements shall apply.

4.4.7 Hot water systems - Backflow prevention devices shall be installed in hot water supply in the same way as cold water supply systems. The backflow prevention device used shall be suitable for the specific hot water installation.

SECTION 8 WATER STORAGE TANKS

8.2 PURPOSE OF TANKS

8.2.1 General – Tanks shall be provided as necessary for the storage of water to cater for the following purposes:

(a) Sanitary flushing
(b) Potable supply
(c) Fire fighting
(d) Air conditioning
(e) Refrigeration
(f) Ablutions
(g) Prevention of cross connection
(h) Make up water
(i) Contingency reserve

8.2.2 Limitations on use – A tank intended for the storage of potable water or water for fire services or fire sprinkler systems shall not be used to supply directly any water closet, pan, bidet, flush valve, slop hopper pan or other similar fixture or fitting used, or intended to be used for sanitary flushing except as provided for in clause 9.9.

8.3 TANK MATERIALS

8.3.1 Permitted materials - All materials used to construct tanks shall comply with section 2.

8.3.2 Prohibited materials – Materials in contact with water for potable purposes, which impart to the water any taste, odour or constituent known to be hazardous to health, shall not be permitted to be used (see AS 3855).
8.4 INSTALLATION

8.4.1 General: The installation of tanks shall be as follows:

(a) All tanks shall be installed on bases, plinths or supports designed to support the weight of any such tank and its contents when filled to maximum capacity, without undue distortion taking place.

(b) All metallic tanks, or such other tanks as may be directed, shall be installed with a membrane of non-corrosive insulating material between the support and the underside of the tank.

(c) Every tank shall be supported in such a manner that no load is transmitted to any of the attached pipes.

(d) All tanks shall be accessible for inspection, repairs, maintenance and replacement.

(e) Every tank shall be provided with cover, designed to prevent the entry of dust, roof water, surface water, ground water, bird or animal life.

8.4.2 Access – Access to tanks shall be provided in accordance with the following:

(a) Adequate headroom and side access shall be provided for every tank to enable inspection, cleaning and maintenance procedures to be carried out to the interior and exterior of the tank.

(b) Where the interior depth of any storage tank exceeds 2m, access ladders of standard design and dimensions comply with AS1657, shall be installed.

8.5 Tank Design (water storage)

8.5.1 General

Water storage tanks shall be designed and connected in accordance with figure 8.1. Tanks with dual water supply shall maintain the air gap in accordance with clause 4.6.3.2(a). Where the capacity exceeds 500 L provision shall be made at the base for easy removal of sludge.

8.5.2 Tank Cover

Any tank that supplies potable water shall be provided with a cover which shall be –

(a) close fitting

(b) secured in position if the tank is located externally; and

(c) provided with a covered access opening not smaller than 0.5m², where the whole cover is not removable.

8.11 Marking of Tanks

Except if installed in domestic or residential buildings all tanks shall have their intended use identified with not less than two permanent notices attached to each tank in readily visible positions, one on the front of the tank and one on the cover.
PREFACE

Reference to AS/NZS 3500.2.2, National plumbing and Drainage, Part 2.2 Sanitary plumbing and drainage – Acceptable solutions sets out a means of achieving minimum deemed-to-satisfy requirements for the objectives and performance requirements of this standard.

It is recognized that the content of this part Standard would usually be the responsibility of a regulatory body. Nevertheless, owing to the reforms taking place in the industry at present, no national body has yet been identified to take up such responsibilities. Therefore, for the purpose of this edition the document is published as part of the AS 3500 series. If in the future a national regulatory administration is identified, the Standard will be modified accordingly.

SECTION 6. FUNCTIONAL REQUIREMENT – SANITARY FIXTURES AND APPLIANCES

Sanitary fixtures and sanitary appliances using water borne waste disposal are to be provided with adequate disposal system.

SECTION 7 PERFORMANCE REQUIREMENTS

7.1 Sanitary plumbing system - A sanitary plumbing system using water-borne waste disposal shall be designed and constructed to:
   (a) convey sewage or sullage to a sanitary drainage system or an approved disposal system;
   (c) avoid the likelihood of water, foul air and gases entering buildings.

7.2 Sanitary drainage system – A sanitary drainage system using waterborne waste disposal shall be designed and constructed to:
   (a) convey sewage from a sanitary plumbing system to an approved disposal system
   (g) protect against internal contamination
   (h) prevent damage to the sewerage system, where applicable.

7.3 No sewage system – Where no sewerage system is available for disposal of sewage, an on site disposal system is to be provided, installed, operated and maintained in a manner that:
   (a) avoids the likelihood of sewage, foul air or gases entering buildings
   (b) provides access for maintenance
   (c) allows for effective cleaning
   (d) avoids the likelihood of root penetration or the entry of ground water
   (e) avoids the likelihood of damage from superimposed loads or normal ground movement
   (f) protects against internal contamination
   (g) does not constitute a risk to health; and
   (h) provides a healthy and safe disposal system when non-waterborne disposal is used.

9. MEANS OF VERIFICATION - Verification acceptable to a regulatory authority can be demonstrated either:
   (a) by calculating and certification by persons or organizations with recognised credentials in the design or testing of sanitary plumbing and drainage; or
   (b) by satisfying the required criteria when tested in accordance with specified test method endorsed by an auditing body.
National Plumbing and Drainage
Part 2.2 Sanitary plumbing and drainage – acceptable solutions
AS/ NZS 3500.2.2-1996

PREFACE
This standard was prepared by the joint standards Australia Standards New Zealand Committee WS/14 on the national plumbing and drainage Code to supersede AS 3500.2-1990. The object of this revision is to issue it as a joint Australian/New Zealand Standard and incorporate amendments and additions arising from industry requirements.

This standard has been written in a format setting out minimum deemed-to-satisfy requirements compatible with legislation of authorities who can enforce regulations and authorize products for connections to their systems.

The terms ‘normative’ and ‘informative’ have been used in this standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a standard, whereas an ‘informative’ appendix is only information and guidance.

FORWARD
STATUTORY REQUIREMENTS
Attention is drawn to the relevant statutory requirements with respect to –
(a) The qualifications of persons permitted by law to do plumbing or drainage work;
(b) The administrative procedures to be followed by persons performing plumbing or drainage work;
(c) The authorization of certain materials, products, fixtures, fittings and other components for connection to sewage systems.

RULINGS AND INTERPRETATIONS
Inquiries concerning the interpretation of specific clauses contained in AS/NZS 3500.2.2 should be directed initially to the regulatory authority responsible for the locality within which work is, or is to be, conducted. In the event that further clarification is required, the inquiry may be directed in writing to committee WS/14, which is responsible for the joint Australian/New Zealand National Plumbing and Drainage Code. The project's manager, Committee WS/14, standards Australia will process inquiries and issues replies.

PROVISION FOR REVISION
This standard necessarily deals with existing conditions, but is not intended to discourage invention or to exclude materials, equipment and methods which may be developed in future. Revisions will be made from time to time in view of such developments and amendments to this edition will be made only when absolutely necessary.

SECTION 1 SCOPE AND GENERAL
1.1 SCOPE
This standard sets out the requirements for the design and installation of sanitary plumbing and drainage from the fixtures to a sewer, common effluent system or on-site disposal system, as appropriate.

Construction of a sanitary plumbing and drainage installation in accordance with this standard is deemed to satisfy the requirements of AS 3500.2.1.
The standard applies to new installations as well as alterations, additions or repairs to the existing installation. Illustrations used in this standard are diagrammatic only and have been chosen without prejudice.

NOTE: the pre-treatment of trade wastes is not specified in this standard.

SECTION 2 MATERIALS AND PRODUCTS

2.1 SCOPE OF SECTION This section specifies material and product requirements. Alternative materials or methods may be used if proven to be equal to or better than those specifically referred to herein.

2.2 AUTHORIZATION Materials and products used in the installation shall comply with the relevant statutory requirements for authorization and with this standard.

NOTE: In Australia refer to SAA MP52, in New Zealand refer to the regulating authority.

2.3 SELECTION AND USE The materials and products used shall be selected to ensure satisfactory service for the life of the installation. Factors to be taken into account include:
   (a) the type of usage likely to occur and the nature of the liquids to be conveyed
   (b) the type of nature of the ground and the possibility of chemical attack therefrom
   (c) the physical and chemical characteristics of the materials and products
   (d) the possibility abrasion by solids in the flow, or of chemical attack; and
   (e) The range of temperatures likely to discharge to the drainage system.

3.17 COMMON EFFLUENT DRAINAGE SYSTEMS

3.17.1 GENERAL All sanitary plumbing and sanitary drainage in common effluent drainage systems shall comply with the relevant sections of this standard.

3.17.2 DRAINAGE CONNECTIONS Drains connected to common effluent drainage systems shall be installed in accordance with the following:
   (a) Discharge from fixtures shall pass through septic tank except that cleaners' sinks shall either discharge through a sullage tank, where provided, or directly to the drain from the septic tank to the common effluent drain (see notes). Waste fixtures may pass through a sullage tank where it is impractical to discharge through septic tank due to location and available fall.
   (b) Drains from septic or sullage tanks or cleaners sinks to the common effluent drain shall be not less than DN 80 and not more than DN 100 and shall be laid of not less than 1%.
   (c) Air admittance valves shall not be installed on septic tanks. If air admittance valves are installed on an existing installation they shall be moved.
   (d) An inspection shaft shall be provided in accordance with clause 4.4.3 and may be of same diameter as the drain.
   (e) Inspection opening shall be provided in accordance with clause 7.7 and also on:
      (i) the inlet to the septic tank; and
      (ii) the outlet of the septic tank, within 2.5 m of the tank, where the connecting drain is greater than 10 m in length.
   (f) Drains, both existing and new, shall be tested in accordance with section 12.
   (g) Soakage wells stormwater, roofwater and subsoil water drainage shall not be connected to the common effluent drain.
3.17.3 SEPTIC TANKS
Septic tanks, as part of the common effluent drainage system, shall be sized, constructed and installed in accordance with AS 1546 and the regulatory authority’s requirements. Septic tanks shall be inspected for soundness and hydrostatically tested before connected to the effluent drain.

3.17.4 SULLAGE TANKS
Sullage tanks shall be constructed and installed in accordance with the requirements for specific tanks.
- The minimum capacity of a sullage tank for a single dwelling shall be 450L.
- Tanks may be rectangular or circular.
- Rectangular tanks shall have a water depth, length and width ratio of approximately 1:1.5:1. Circular tanks shall have a water depth to diameter ratio 1:1.

SECTION 4. DRAINAGE SYSTEM
4.2 POINT OF CONNECTION
4.2.1 GENERAL A drain shall connect to the sewer only at a point provided by the regulatory authority and the connection shall be no less than DN 100.
NOTES:
When connecting fixtures that operate to a sewer by gravity, care should be taken to ensure that the flood level rim of the lowest fixture or trap is of adequate height above the soffit of the sewer so as to avoid the sewer discharging onto the property under normal operating conditions.

4.2.2 PROTECTION OF SEWERS
Whenever any property is opened for any purpose, all measures necessary shall be taken to protect the authority’s sewers from damage during the course of any work on the drain and to prevent the entry of:
(a) extraneous water
(b) soil, sand and rock
(c) the contents of any septic tank; or
(d) any other substance, the discharge of which would impede the operation of the sewer.

6.3 TRAPPING OF FIXTURES AND APPLIANCES
6.3.1 GENERAL
The discharge from all sanitary fixtures and appliances shall pass through traps before entering drains, soil pipes and waste pipes. Traps shall be in the same room as the fixtures they serve and shall be accessible.

6.3.2 Water Seal
Under normal operating conditions, fixture traps shall retain a water seal of not less than 25mm.

SECTION 10 PUMPED DISCHARGE
10.8 PUMPED DISCHARGE FROM WASTE FIXTURES
10.8.1 GENERAL
Pumping shall only be permitted where gravity connection from a waste fixture is not possible. The location of the pumping apparatus shall be positioned adjacent to the waste fixtures.
National Plumbing and Drainage  
Part 3.1 : Stormwater Drainage - Performance Requirements  AS/NZS 3500.3.1-1998

1 SCOPE
This standard specifies the performance requirements for materials and products, and design and installation of roof drainage systems, surface drainage systems and subsoil drainage systems.

4 OBJECTIVE
The object of this standard is to:
(a) minimize risks of injury or inconvenience to people and damage to property caused by stormwater;
(b) protect stormwater drainage systems of a property, and the external stormwater drainage network, from damage; and
(c) ensure that stormwater drainage systems will satisfy the requirements of items (a) and (b) through out their design lifetime.

5 FUNCTIONAL REQUIREMENT
All components of a stormwater drainage system for a property shall provide protection against the adverse effects of stormwater flows.

6 PERFORMANCE REQUIREMENTS
6.1.2 OVERFLOW DEVICES OR MEASURES
Overflow devices or measures shall be installed where overtopping of roof drainage system could cause significant monetary loss, property damage or personal injury, and shall be designed in accordance with clause 6.1.1 (b) taking into account the effect of obstructions and blockages.

6.3 SUBSOIL DRAINAGE SYSTEMS
Subsoil drainage systems for the removal of excess ground water and the reduction of soil moisture levels shall be designed:
(a) So as not to cause damage to the buildings and other facilities by changing soil moisture conditions; and
(b) With advice from a suitability qualified competent person having expertise in assessing soil and groundwater behavior.

6.4 POSITION AND MANNER OF DISCHARGE
The position and manner of discharge of the stormwater drainage system shall be to the satisfaction of the appropriate authority.

6.5 STORMWATER DRAINAGE SYSTEMS
Stormwater drainage systems shall:
(a) convey stormwater to a point of connection using gravity flow where possible;
(b) avoid the likelihood of blockages;
(c) avoid the likelihood of leakage and penetration by roots;
(d) provide access for maintenance and clearing blockages;
(e) avoid damage to the external stormwater drainage network where the stormwater is being discharged to such a network;
(f) Avoid the likelihood of damage from superimposed loads on normal ground, or building movements;
(g) Prevent the entry of sewage, trade waste or both;
(h) Prevent the entry of stormwater to the sanitary drainage system; and
(i) Avoid the likelihood of damage to buildings or site works, in particular during the construction phase.

7 **DEEMED TO SATISFY**

The following are deemed to satisfy the performance requirements specified in clause 6

(a) Acceptable solutions as specified in AS/NZS 3500.32.
Verification by design and analytical methods, supplemented, where required, by laboratory testing.
National Plumbing and Drainage
Part 3.2 Stormwater drainage acceptable solutions AS/NZS 3500.3.1-1998

PREFACE
The objective of this standard is to provide installers with acceptable solutions for materials and products and design and installation of stormwater drainage systems. These solutions are not intended to exclude the use of other solutions.

This edition sets out acceptable solutions for the following:
(a) Roof drainage systems
   (i) A general method for design incorporating recent Australian research on the following:
      (ii) Eaves gutter systems – procedures similar to those of AS 2180 – 1986 but with significant decreases in the ratios for the effective cross-sectional area of eave gutter to vertical downpipes.
      (iii) Box gutter systems – procedures similar to those in AS 2180 – 1986 with additional procedures for sump/side overflow and sump/high capacity overflow devices.
      (iv) Valley gutters – procedures based on research published in 1988 by Martin and Tilley (see paragraph 2).

1.1 SCOPE AND APPLICATION
1.1. SCOPE
This standard specifies the acceptable solutions for materials and products, and design and installation of roof drainage systems and subsoil drainage systems to the point(s) of connection to the external stormwater drainage network.

1.3.13 ON-SITE STORMWATER DETENTION (OSD) TANK
A tank for the temporary storage of stormwater to reduce the peak flow to the stormwater drainage network.

1.3.14 OVERFLOW DEVICE
A device for use with the roof drainage system to safely divert flow in the event of the blockage.

Appendices

D Guidelines for rainfall intensities
G Examples of acceptable overflow measures of eaves gutters
H General information for design of eaves gutter systems – example
I Box gutter systems general method

The guidelines demonstrate historical data on rainfall patterns across Australia, which then is used to calculate the volume of water which needs to be discharged via the eaves gutters and downpipe system.

H General information for design of eaves gutter systems – example
   Design for 20 year ARI
   HB114
I Box gutter systems general method
   Design for 100 year ARI
National Plumbing and Drainage
Part 4.1 Hot Water supply systems performance requirements AS/NZS 3500.4.1-1997

1 SCOPE
This standard sets out the requirements for the design and construction of the hot water services, from the water services to the points of discharge.

2 APPLICATION
This standard applies to new installations, alterations, additions and repairs to existing installations.

NOTE: This standard should also be read in conjunction with Australian by-laws and regulations of the regulatory authority.

7.2 NON POTABLE WATER SUPPLIES Pipe outlets and fittings supplying non-potable hot water shall be clearly identified.

7.3 HOT WATER TEMPERATURES Where hot water is provided to fixtures and appliances used primarily for personal hygiene, it shall be delivered at a temperature not exceeding 50°C to avoid the likelihood of scalding.

7.6 HOT WATER STORAGE Heated water shall be stored under conditions which prevent the growth of legionella bacteria.

National Plumbing and Drainage
Part 4.2 Hot Water supply systems acceptable solutions AS/NZS 3500.4.1-1997

SECTION 1 SCOPE AND GENERAL

1.4 WATER QUALITY Water quality can have a significant effect on the performance and life of water heaters. Information on water quality may usually be obtained from the local water supply utility. Where water heaters are deemed unsuitable for connection to a town water supply, advice shall be sought from the manufacturer who may request a water sample for analysis (see appendix B.)

National Plumbing and Drainage
Part 5: Domestic installations AS/NZS 3500.5:2000

This standard has been produced as a condensed version of the Australian Standards AS/NZS 3500 parts 1,2,3,4.

This standard is only intended for domestic installations. The standard is difficult to cross reference with AS3500 Parts 1,2,3,4, as the clauses are not aligned with the standard from which it refers to.

Many State authorities do not recognise or endorse the use of this standard.
On Site Domestic –Wastewater Management
AS/NZS 1547:2000

PREFACE
The revision has been broadened in scope to:
(a) Include performance statements necessary to define outcomes and to accommodate new technologies
(b) Provide the basic performance provisions for septic tanks (AS/NZS 1546.1 – 1998) and introduce performance requirements to cover all types of wastewater-treatment units, and land-application systems.

This revision does not address issues of sustainable reuse of water.

FOREWORD
The WS/13/1 Committee is made up of public health regulations, environmental protection regulations, consultants, soil scientist, local government health and environment inspectors, system manufacturers, plumbers and drainlayers, who collectively represent many years of experience in this area. It is the committees firm belief that on-site domestic-wastewater-treatment is a viable, long—term, sustainable system of wastewater management.

At least 20% of the populations of Australia and New Zealand depend on on-site wastewater-treatment of their personal and domestic waters.

For a joint Australian/New Zealand standard to have status, it must accommodate the current legislative requirements and on-site domestic wastewater practices of both countries. Land-development pressures, the need for quality, and need for practical guidance on means of enhancing the overall performance of on-site wastewater practices must also be accommodated. Further, given the wide range of choice of design criteria utilized by designers and consultants, the standard must ensure that sound public health and environmental outcomes are achieved, regardless of the design approach selected.

The failures of the past are due in large measure to a lack of understanding of the systems by the users, inappropriate capacity of tanks, or poor siting or design of land-application systems. In addition, people are transient; people are forgetful and negligent; there is a lack of knowledge about the operation and maintenance of on-site domestic-wastewater systems; and there is a lack of or insufficient, management, control, and provision of guidance of on-site domestic-wastewater systems.

Standards for septic tanks and domestic effluent land application have previously been developed in the expectation that a technically exact approach to design and implementation was possible. Time has shown this expectation to be misplaced. Any one number of factors can vary throughout the year and could prevail in determining the effective performance of an on-site system. In addition, most areas in Australia and New Zealand are composed of soils that are not amenable to a basic perspective approach to septic tank plus trench system, and in many cases the perspective approach has not achieved sound environmental outcomes. Finally, the standard clean water percolation test, which has been used for so long, has shown it’s limitations and is no longer used by most modern designers as the sole design approach.

The committee has adopted a new approach that focuses on outcome, ie. desired results, that are needed to achieve sustainable public health and environmental performance and the processes needed to achieve these, rather than prescribing how to achieve such outcomes. This has resulted in a significantly different standard.
The committee’s belief that if on-site domestic-wastewater systems are to be effective and sustainable, and play their part in protecting public health and environment, a system of management and control needs to be in place. The committee largely considered that the initiation of the control process infrastructure and the establishment of on-going support and guidance, by default falls to the regulatory authorities to take up. However it is done, some system of management and control, either regulatory or private or both, needs to be instigated for the greater benefit of public health and environment.

The term ‘land-application’ has been used in place of the more familiar term ‘disposal’. This has been done to recognize that the septic tank (or other on-site wastewater treatment unit) provides only partial treatment of wastewater flow and that the soil and vegetation within the land application area both treat and take up the effluent.

PART 1: GENERAL

1.2.3 GREYWATER REUSE
This standard covers the subsurface land application of greywater after primary treatment. It does not cover the direct application of greywater onto land for reuse purposes, nor does it provide details of greywater-deversion systems.

1.4 APPLICATION
1.4.1 GENERAL
This standard is intended to be used by regulators, administrators, planners, wastewater practitioners, educators, real estate staff/lawyers and homeowners. It shall be read in conjunction with the regional and district plans, by-laws, rules and regulations of relevant regulatory authorities of Australia and New Zealand.

1.5 LEGISLATION
1.5.1 AUSTRALIA
The relevant regulatory authority controls the collection and treatment of domestic-wastewater. This authority may operate under the guidance of the State health department, or may be the State health department itself – working in conjunction with the department responsible for the environment or with split responsibility depending on the overall size of the system – or alternatively be the State environmental agency.

1.6.30 GREYWATER
The domestic wastes from baths, showers, basins, laundries and kitchens specifically excluding water closet and urinal wastes. Grey water does not normally contain human waste unless laundry tubs or basins, are used to rinse soiled clothing or baby’s napkins.

1.6.37 MAINTENANCE CERTIFICATE
A document that certifies that an on-site domestic-wastewater system has been inspected by an accredited person and is judged to be properly operated and maintained.
APPENDIX E
PLUMBING INDUSTRY COMMISSION – VICTORIA RECYCLED WATER PLUMBING GUIDE APRIL 2003

APPENDIX F
AUSTRALIAN PLUMBING INDUSTRY JOURNAL – WINTER 1999
RAINWATER TANKS FOR THE 21ST CENTURY

APPENDIX G
VICTORIAN EPA INFORMATION BULLETIN
REUSE OPTIONS FOR HOUSEHOLD WASTEWATER PUBLICATION 812 NOV 2001

& SA DHS wastewater / reclaimed water guidelines
APPENDIX H

Summary of Main AS/NZS 3500 Series Changes (April 2004)

Part 1 – Water Services

Title change – revisions include

- Materials used
- Clarification on fire services & water tanks
- New provisions for non drinking water service and rainwater tanks
- Multi unit developments
- Incorporation of previous amendments & rulings

Section 2 – Materials & Products

- General limitations applying to metallic & plastics pipes & fittings
- Specific limitations for metallic pipes
- Specific limitations for plastic pipes
- Appendix B lists acceptable pipes & fittings

Section 3 – Sizing of Water Services

- Simultaneous flow rates in liters per minute
- Minimum pressure at outlets (50 kPa)
- Maximum pressure within buildings (500 kPa)

Section 5 – Installation of Cold Water Services

- Proximity to other services reviewed
- Location. (Note) Prevention of unreasonable temperature rise
- Bushfire zones. Exposed pipes to metallic

Section 9 – Non Drinking Water Services

- Scope: Recycled water services from Authority mains
- Permitted use is determined by Health Authority & EPA. eg. Toilet flushing, garden irrigation
- Cross connection control
  - Containment protection
  - No cross connections between drinking water & non drinking water services
  - Cross connection for non drinking water service must comply with Section 4
  - All external tap outlets on drinking water service to have hose connection vacuum breakers
- Installation requirements
  - The same requirements for drinking water apply
  - 100mm separation required above ground
  - 300mm separation required below ground
  - Hose tap outlets: Warning signs required
  - Identification tape for below ground pipe
- Marking & labeling
  - Materials to be colored lilac
  - Labeled Warning: Recycled or reclaimed-water – do not drink

Water meters
• Colored lilac
• Standard plumbing threads
• Testing & Commissioning
  • Tested for cross connection

Section 14 – Rainwater tanks
• Scope: System from a rainwater tank
• Water Authority may determine containment protection
• DHS determines guidelines on the use of rainwater
• Installation requirements
  • The same requirements for drinking water apply
  • Marked rainwater at one metre intervals
  • Water outlets identified as rainwater
• Interconnection between service pipes
• Appropriate backflow prevention device to protect:
  • Mains supply
  • At cistern connection (or air gap within cistern)
  • Backflow into tank

Section 15 – Multi Unit Developments
• Scope: Applies to main lines of water services for 20 or more residential buildings up to 3 stories in height
• Optional to comply with WSAA standards or AS/NZS 3500
• AS/NZA 3500 requires:
  • Divide valves
  • Ring mains and flushing points at dead ends
  • Fire services to Fire Authority requirements
Part 2 – Sanitary Plumbing & Drainage

Section 2– Materials & Products
- General limitations applying to metallic & plastic pipes & fittings
- Specific limitations for metallic pipes
- Specific limitations for plastic pipes
- Specific limitations for other materials
- Appendix C lists acceptable pipes & fittings

Section 3 – Drainage design
- Proximity to other services reviewed
- New table, angle of response – soil types
- Connection of basement fixtures
- New clause, connection of flood prone areas

Section 4 – Drainage systems
- New clause, swept entry type junction 50mm throat radius

Section 6 – General requirements for sanitary plumbing systems
- Self sealing devices
- Air admittance valves
  - Trap vents, Group vents, Stack vents and Branch drain vents

Section 12 – Multi Unit Developments
- Scope: Applies to main lines of a sanitary drain for 20 or more residential buildings up to 3 stories in height
- Optional to comply with the WSAA standards or AS/NZS 3500
  - AS/NZS 3500 requires:
    - Maintenance shafts for drain clearing & TV at:
      - Each change of direction
      - Main line junctions
      - Spacing not greater than 150m
- Scope: 3 or more residential buildings
  - At each individual allotment:
    - Inspection shaft
    - Additional overflow relief that may have lesser separation

Part 3 – Stormwater Drainage

Section 3 – Roof Drainage Systems > design
- Catchment area, new table 3.2 Slope factor for eaves gutters
- Spreaders
  - Sarking required for tiled roofs 1800mm either side
  - Sealed laps of corrugated 1800mm either side
- Eaves gutter sizes & catchment area per downpipe
  - Two new graphs – figures 3.5 (A) & 3.5 (B)
    - 1:500 & steeper
    - Flatter than 1:500
- New clause on effective cross section area of eaves gutters

Section 4 – Roof Drainage Systems > installation
- Revised table 4.1, expansion joints in box gutters

AS3500 Appendix H – General method for the design of eaves gutter systems
- New example for flat eaves gutters
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