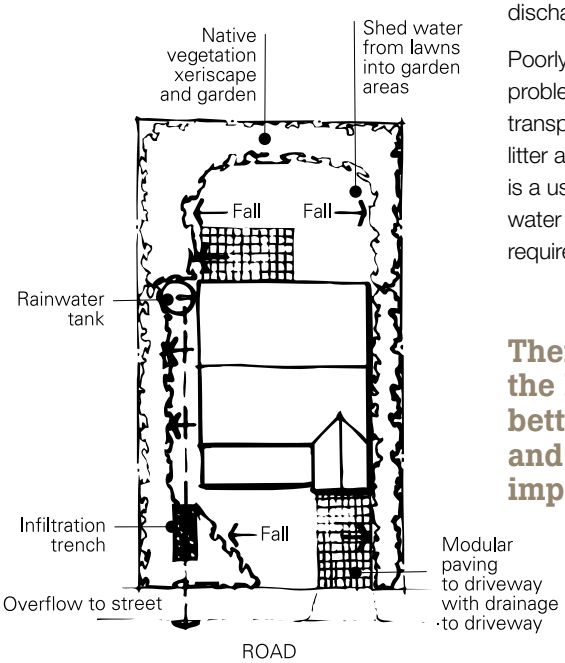
Stormwater

Stormwater is rainwater plus anything the rain carries along with it. Stormwater can be considered a valuable resource. Its re-use leads to water savings and reduced environmental impact.



In urban areas stormwater is generated by rain run-off from roof, roads, driveways, footpaths and other impervious or hard surfaces. In Australia the stormwater system is separate from the sewer system. Unlike sewage, stormwater is generally not treated before being discharged to waterways and the sea.

Poorly managed stormwater can cause problems on and offsite through erosion and the transportation of nutrients, chemical pollutants, litter and sediments to waterways. Stormwater is a useful resource that can replace imported water for uses where high quality water is not required, such as garden watering.

There are a number of steps the homeowner can take to better manage stormwater, and reduce the environmental impact of their home.

> Avoid cut and fill on your block when preparing the building foundations. Attempt to maintain the existing topography and drainage pattern.

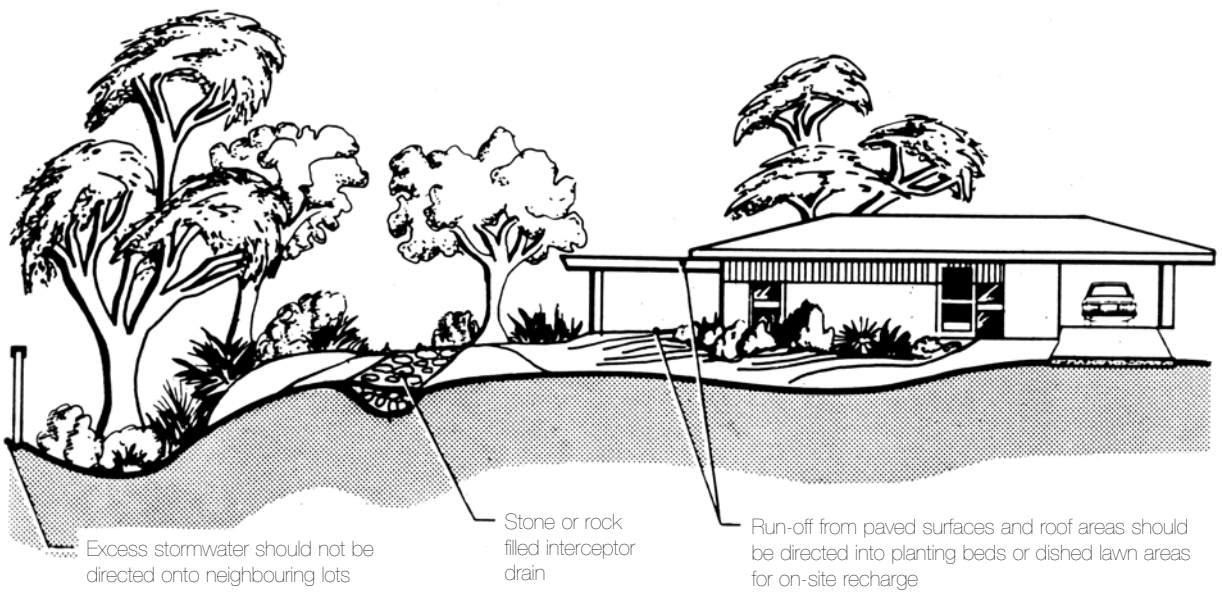
> Retain vegetation, particularly deep-rooted trees. These lower the water table, bind the soil, filter nutrients, decrease run-off velocities, capture sediment and reduce the potential for dryland salinity.

> Detain stormwater on your block where practicable through use of permeable paving, pebble paths, infiltration trenches, soakwells, lawn, garden areas and swales.

> Reduce erosion potential on site during building works by minimising the time that land is left in an exposed, unstable condition. Employ sediment traps and divert 'clean' stormwater around the disturbed site.
[See: 2.8 Sediment Control]

> Minimise the area of impervious surfaces such as paved areas, roofs and concrete driveways.

> Grade impervious surfaces, such as driveways, during construction to drain to vegetated areas.



> Harvest and store roof water for use. [See: 7.3 Rainwater]

> Take care with the substances you use on your land as they can end up in the stormwater. Do not over-use fertilisers, herbicides and pesticides – follow the manufacturer's instructions regarding amount and frequency of application. Look for organic alternatives.

> Avoid the use of solvent based paints. When using water based paints, clean brushes and equipment on a lawn area to trap contaminants before they reach waterways. Plant based paints are the most environmentally benign.

> Visit a car wash that recycles wash water. If this is not an option wash your car on the lawn or on an area that drains to lawn. The nutrients (mostly phosphates and nitrates) in the detergent fertilise the lawn instead of degrading waterways. Note that many native plants do not tolerate detergents.

> Do not build on flood plains as the land may be periodically subject to inundation and may possess a high water table. Councils can advise on the 1 in 100 year flood level.

THE TRADITIONAL APPROACH

Pipes

The traditional stormwater management response relied on conveyancing. Water was conveyed by a pipe or channel from a collection area to a discharge point. The collection area is your house or street and the discharge point is the nearest ocean, creek, river or lake. The conveyancing system sought to remove the most water (high quantity) from a site in the shortest time possible (high velocity). Large, impervious paved areas and big pipes are typical of conveyancing.


Edwina Richardson

The traditional system of conveyancing is highly effective in reducing stormwater nuisance and flooding on site, unless the pipes get blocked. Conveyancing does not solve the problem but merely transfers it to the other end of the pipe and ultimately upsets the local water balance. Stormwater is carried rapidly with its suspended litter, oil, sediment and nutrients and dumped in an ocean, river or lake. The receiving water body then becomes flooded and temporarily polluted because all the stormwater arrives at one time.

WATER SENSITIVE URBAN DESIGN

Water Sensitive Urban Design (WSUD) seeks to approximate the natural water balance on-site prior to the land being built on. It achieves this by slowing the water velocity of stormwater run-off, providing natural filtration, on-site detention and infiltration. The water eventually reaches the river, lake or ocean but has been cleaned and filtered by the soil and used by plants before it gets there.

The objective is to minimise impervious surfaces so that the least amount of water flows off-site into the stormwater system. At the scale of the individual household, options such as permeable paving on driveways and footpaths, garden beds designed for infiltration (raingardens), lawns and vegetation, swales and soakwells can detain stormwater and increase percolation into the soil.

In some cases it may be advisable to place perforated pipes beneath the infiltration areas to direct excess stormwater to the stormwater system. See the references at the end of this fact sheet for more details about options and possible designs.

Water Sensitive Urban Design provides the improved aesthetics and comfort associated with more vegetation. Habitat for native wildlife is improved and the area is cooler in summer. It reduces the need for garden watering and decreases water bills. Erosion and the downstream effects of stormwater pollution on nearby rivers, lakes or ocean are reduced.

THINGS TO CONSIDER

Water Sensitive Urban Design is applicable on all sites but the degree of application will vary according to the site's opportunities and constraints. All sites should be able to maximise permeable surfaces such as garden beds, lawns, porous paving and paths.

When seeking to install sub-surface units such as soakwells and infiltration trenches the following things should be considered.

Site

Soil type – check the soil type. Sandy soils are excellent for infiltration but clay soils tend to become waterlogged. This will affect the efficiency of some of the water sensitive design solutions. For example, water sensitive design in heavy clay soils may need to be supplemented with traditional conveyancing methods.

Soil depth – ensure that you have sufficient soil depth. Areas with shallow soil underlain by impervious rock such as granite, shale or limestone may impede infiltration and may require some stormwater pipes to remove water for discharge off site.

Groundwater – determine the depth to groundwater. A high groundwater table may reduce the effectiveness of infiltration methods during storms.

Slope – ensure that the stormwater design accounts for the terrain as severe slopes increase run-off velocities.

Regulations – check with your local council before employing water sensitive design solutions. Some components of WSUD may conflict with local government drainage regulations.

OTHER DESIGN SUGGESTIONS

Ensure there are no illegal cross connections of sewer and stormwater drains. This is where the stormwater drain discharges into the sewer system and can cause sewage overflows on your property during heavy rain.

Prevent rain from washing sediment (eg sand, soil) into stormwater with a roof, tarpaulin or awning.

Divert stormwater from driveways, paths and other impervious surfaces to vegetated areas to catch, filter and infiltrate water rather than directing water to the stormwater system.

Measures to promote water conservation

> Appropriate landscaping [See: 2.4 Sustainable Landscapes; 7.6 Outdoor Water Use]

> Water harvesting [See: 7.3 Rainwater]

> Stormwater and greywater recycling. [See: 7.4 Wastewater Re-use]

Environmental benefits

Downstream environmental benefits of reduced stormwater pollution:

> Rivers, lakes and beaches will be cleaner and safer for swimming.

> Flooding will be reduced.

> Waterways will look cleaner.

> Councils will need to spend less money emptying stormwater traps.

> The environment will be healthier for plants and animals.

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ADDITIONAL READING

Contact your State / Territory government or local council for further information on managing stormwater.
www.gov.au

Argue J (ed) (2004), *Water Sensitive Urban Design: Basic Procedures for Source Control of Stormwater*, University of Adelaide
www.waterbalance.ca/waterbalance/dynamicImages/370_WSUDHandbookPeerReviewMar2005.pdf

Hatt B, Deletic A and Fletcher T (2004), *Integrated Stormwater Treatment and Re-Use Systems*, Monash University

Llyod S, Wong T and Chesterfield C (2002), *Water Sensitive Urban Design – A Stormwater Management Perspective*, CRC for Catchment Hydrology, Industry Report.

Mobbs M (1998), *Sustainable House: living for our future*, Choice Magazine, Sydney.

Stuart McQuire. (2007), *Water Not Down the Drain: A guide to using rainwater and greywater at home*
www.notdownthedrain.org.au

Water Sensitive Urban Design
www.wsud.org/literature.htm

CASE STUDIES

Some recent examples of neighbourhood and sub-division scale water sensitive designs are described below. While the principles of WSUD can be applied at any scale, larger developments can capture some economy of scale benefits.

Kogarah town centre is a multi building high-density development in Sydney. It employs water efficient fixtures indoors, and harvests and treats rainwater from roofs for re-use in toilets and other purposes where drinking-quality water is not required. Stormwater from paved areas is collected to irrigate the landscape which provides biological treatment and filtration. Under-drains collect the filtered irrigation water for further treatment and re-use. A water feature using recycled water creates connection between people and the site's natural water cycle.

Inkerman D'Lux (formerly Inkerman Oasis) is an apartment development in the Melbourne suburb of St. Kilda for 245 dwellings. It recycles all stormwater from roofs and ground flows and sufficient domestic greywater from the residential units to meet the needs for flushing toilets and garden irrigation. On-site wetlands pre-treat the stormwater, while greywater is pre-treated in an aeration balance tank to remove solids. The pre-treated water is combined and treated by a membrane bioreactor and a UV disinfection system, to produce a high quality water for non-potable use.

Christie Walk (pictured) is an 'eco-city' development in inner-city Adelaide, with 27 dwellings as a mixture of townhouses, apartments and straw bale cottages. All stormwater from roofs, balconies and impervious surfaces are collected in two underground tanks below the car parking areas, and re-used for toilet flushing and irrigation after filtration and disinfection.
[See: 9.2 and 10.1 Case Studies]

599 Payne Road is a growing housing development for 22 large allotments at The Gap near Brisbane. Each new dwelling collects, treats and disinfects rainwater for all indoor uses using individual rain tanks that may be topped up by two large communal rain tanks that have town supply backup for dry periods. Household greywater is treated on-site using Biolytix vermiculture technology, and re-used in subsurface irrigation. Bioretention drains throughout the development increase percolation of stormwater into the ground.

Mawson Lakes is a growing suburb in outer Adelaide, with a planned 4300 dwellings by 2010, as well as retail, commercial, education and recreation facilities. Storm water run-off is treated in natural wetlands and used to fill lakes within the development. Wastewater and stormwater is collected, treated and supplied to all houses, industries and open spaces by dual reticulation for outdoor water use and toilet flushing. Seasonal balancing of non-potable water supplies is achieved using aquifers to store surplus stormwater and treated wastewater, for retrieval during summer and dry seasons.