Stormwater

Stormwater is the water draining off a site from the rain that falls on the roof and land, and everything it carries with it. The soil, organic matter, litter, fertilisers from gardens and oil residues from driveways it carries can pollute downstream waterways.

Rainwater refers only to the rain that falls on the roof, which is usually cleaner. However, stormwater can be a valuable resource. Reusing stormwater can save potable water and reduce downstream environmental impacts.

In urban areas stormwater is generated by rain runoff from roofs, 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 off site through erosion and the transportation of nutrients, chemical pollutants, litter and sediments to waterways. Well-managed stormwater can replace imported water for uses where high quality water is not required, such as garden watering.

A homeowner can take simple steps to manage stormwater and reduce its environmental impact.

Take some simple steps to better manage stormwater and reduce the environmental impact of your 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. They lower the watertable, bind the soil, filter nutrients, decrease runoff velocities, capture sediment and reduce the potential for dryland salinity.
- 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 the appendix 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.

A stormwater site plan can help reduce stormwater runoff from the site.

- Detain stormwater on your block where practicable through use of permeable paving, pebble paths, infiltration trenches, soakwells, lawns, garden areas and swales.
- Harvest and store roof water for use. (see Rainwater)
- Take care with the substances used on your land as they can end up in the stormwater. Don’t overuse fertilisers, herbicides and pesticides; follow the manufacturer’s instructions on the amount and frequency of application. Look for organic alternatives.

Water sensitive urban design slows stormwater runoff and improves filtration and infiltration.
Avoid using solvent-based paints. After 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 floodplains as the land may be periodically subject to inundation and may have a high watertable. Councils can advise on the 1 in 100 year flood level.

The traditional approach

The traditional stormwater management response relied on conveyancing. Water was conveyed by a pipe or channel from a collection area (e.g. house and street) to a discharge point (e.g. 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.

The traditional system of conveyancing is highly effective in reducing stormwater nuisance and flooding on site, unless the pipes get blocked. But it merely transfers the problem to the other end of the pipe and ultimately upsets local water balance. Stormwater is carried rapidly with its suspended litter, oil, sediment and nutrients, and dumped into a receiving waterbody that 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 imitate the natural water balance on site before the land is built on. It slows stormwater runoff to gain 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.

**Water sensitive urban design slows stormwater runoff to gain natural filtration, on-site detention and infiltration.**

The objective is to minimise impervious surfaces so that the least 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 infiltration areas to direct excess stormwater to the stormwater system. See ‘References and additional reading’ for publications on options and possible designs.

The improved aesthetics and comfort associated with more vegetation also improve habitat for native wildlife and make the area cooler in summer. It reduces the need for garden watering and decreases water bills. Also reduced are erosion and the downstream effects of stormwater pollution on nearby rivers, lakes or the ocean.

Flood mitigation

Many new houses have on-site detention facilities constructed as part of their home drainage system. The facilities, usually large concrete basins built beneath driveways, are designed to capture stormwater runoff from a residential lot and hold it a little longer to reduce the impact of downstream flooding. The stored water drains slowly through a small opening near the base of the tank to the stormwater system. When many properties in flood prone areas have these detention systems, the downstream flood ‘peak’ during large storms is reduced and flood damage minimised. Local councils set regulations for on-site detention systems; check with your local council to see if your new home needs one.

**On-site detention facilities capture stormwater runoff from a residential lot and hold it a little longer to reduce the impact of downstream flooding.**
Things to consider

WSUD is applicable on all sites but the degree of application varies 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.

Before installing subsurface units such as soakwells and infiltration trenches, consider the following matters for your site:

**Soil type** — Check the soil type, which affects the efficiency of some WSUD solutions. Sandy soils are excellent for infiltration but clay soils tend to become waterlogged. For example, water sensitive design in heavy clay soils may need to be supplemented with traditional conveyancing methods.

**Soil depth** — Ensure that the soil has sufficient 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. Severe slopes increase runoff velocities.

**Regulations** — Check with your local council before employing WSUD 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, i.e. the stormwater drain discharging into the sewer system. They can cause sewage overflows on your property during heavy rain.
- Prevent rain from washing sediment (e.g. 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.
- Divert excess overflow from hard surfaces such as driveways, patios and roofs through downpipes to a raingarden to filter water before it enters local waterways through the stormwater system.

Measures to promote water conservation

- Appropriate landscaping (see Outdoor water use; the appendix Landscaping and garden design)
- Water harvesting (see Rainwater)
- Stormwater and greywater recycling (see Wastewater reuse)

Environmental benefits

The downstream environmental benefits of reduced stormwater pollution are:

- cleaner rivers, lakes and beaches that are safer for swimming
- reduced flooding
- councils spending less money emptying stormwater traps
- a healthier environment for plants and animals.

References and additional reading

Contact your state, territory or local government for further information on managing stormwater: www.gov.au


Sydney Metropolitan Catchment Management Authority (SMCMA). Water Sensitive Urban Design Program. www.wsud.org

Case studies

These recent examples of neighbourhood and subdivision scale water sensitive designs show that the principles of WSUD can be applied at any scale. However, larger developments can capture some economy of scale benefits.

**Kogarah town centre**, a multi-building high-density development in Sydney, employs water efficient fixtures indoors. It harvests and treats rainwater from roofs for reuse in toilets and other purposes not requiring drinking-quality water. Stormwater from paved areas is collected to irrigate the landscape, and be biologically treated and filtered. Under-drains collect the filtered irrigation water for further treatment and reuse. A water feature using recycled water connects people with the site’s natural water cycle.

**Inkerman D’Lux** is a 245-apartment development in the Melbourne suburb of St Kilda. It recycles all stormwater from roofs, and ground flows and domestic greywater from the residential units, to supply non-mains water for toilets and garden irrigation. On-site wetlands pretreat the stormwater; greywater is pretreated in an aeration balance tank to remove solids. The pretreated water is combined and run through a membrane bioreactor and UV disinfection system, to produce high quality water for non-potable use.

**Christie Walk**, an ‘eco-city’ development in inner-city Adelaide, has 27 dwellings as a mixture of townhouses, apartments and strawbale cottages. All stormwater from roofs, balconies and impervious surfaces is collected in two underground tanks below car parking areas and reused for toilet flushing and irrigation after filtration and disinfection.

**Baltusrol Crescent** (pictured), off a suburban street in south-eastern Melbourne, comprises household lots each with a bioretention system. Gravel beds and vegetated areas drain and filter the stormwater that lands on each property before it slowly passes into conventional stormwater drainage beneath the road.

**Mawson Lakes**, a growing suburb in outer Adelaide, has about 4,500 dwellings, and retail, commercial, education and recreation facilities. Stormwater runoff 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. Non-potable water supplies are seasonally balanced by using aquifers to store surplus stormwater and treated wastewater for retrieval during summer and dry seasons.

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