



# Water sensitive urban design

## Erosion control and sediment

### Summary

This fact sheet highlights opportunities for erosion control and sediment management outcomes to be delivered through application of water sensitive urban design (WSUD) techniques. It is intended to assist the development industry to identify solutions that deliver multiple outcomes such as protecting environmental values, maintaining aquatic ecosystems and improved wellbeing of Western Australians, in addition to improved sediment management.

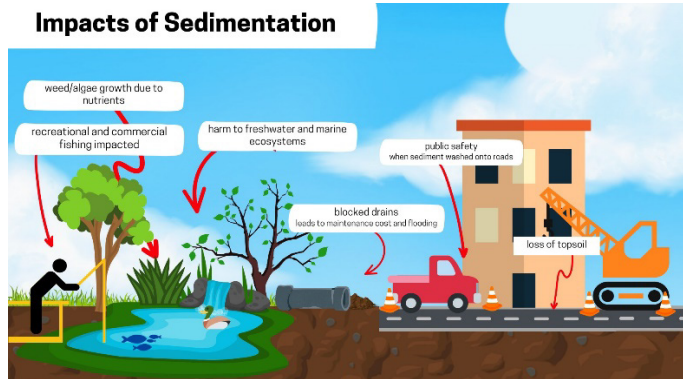
### Introduction

Soil erosion is the wearing of the earth's surface caused by running water, rainfall, wind, ice, and other geological agents. Erosive processes include detachment, entrainment, suspension, transportation and mass movement of eroded material. Sedimentation is the deposition of sediment displaced by the various erosive processes.

Sediment in its native form and concentration is a natural part of the environment. However, when found in unnatural concentrations and quantities or in places where it is not naturally located, it is considered a pollutant or contaminant. In some cases, sediment can also transport phosphorus, metals and other contaminants.

Sedimentation can cause significant environmental impacts and harm to terrestrial, freshwater and marine ecosystems. Sediment can also impact public safety and reduce the functioning of assets, particularly drains, that significantly increases maintenance activities.

Erosion and sedimentation is commonly associated with inappropriate construction and building practices.



Under the *Environmental Protection (Unauthorised Discharges) Regulations 2004*, it is an offence to discharge sediment into the environment. Many local governments also have local laws that prevent sand/sediment and water from leaving property boundaries.

### WSUD and sediment management

The techniques used to control erosion are different from those used to trap sediments. Erosion control is focused on preventing soil erosion, while sediment management traps sediment displaced by up-slope soil erosion. In general, the most efficient and cost-effective way of minimising sedimentation is to reduce the extent, duration, and severity of soil erosion.

Sediment removal involves physical and biological processes. Treatment methods based on physical processes are often the first to be used in the treatment train. Physical processes usually involve trapping gross pollutants and coarse sediments and sedimentation of finer silts and clay sized particles. Once gross pollutants and coarse sediments are removed, other biological removal processes can be applied.

WSUD solutions can be applied at various scales to facilitate the treatment, infiltration, detention and/or conveyance of stormwater. These systems are designed to collect sediments as part of a water quality treatment train.

The sediment trapping effectiveness of systems can vary and is dependent on the particle size of the sediment. Gross pollutants (i.e. not sediment) are often described as particulates larger than 5mm (or 5000 microns), while soluble pollutants, which includes some sediment, are generally particles smaller than 0.45 microns. Most vegetated WSUD solutions are effective at treating sediment in between these sizes.

	Bioretention swales	Bioretention basins /raingardens	Vegetated swales/ buffer strips	Sand filters	Sedimentation basins	Constructed wetlands
<b>FUNCTION:</b>						
Water quality treatment	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Flow attenuation	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓✓
Stormwater conveyance	✓✓✓	✓	✓✓✓	✓	✓	✓
<b>Particle size removal</b>						
Coarse-Medium particles 5000 µm-125 µm	■	■	■	■	■	■
Fine particulates 125 µm-10 µm	■	■	■	■	■	■
Very fine/Colloidal particulates 10 µm-0.45 µm	■	■	■	■	■	■
Dissolved particles <0.45 µm						

Source: *Water sensitive urban design guidelines, South-eastern Councils. Melbourne Water*



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#### Opportunities

WSUD structural controls that are effective at managing sediment include soakwells, biofilters, raingardens, tree pits, swales, buffer strips, living streams, sediment basins and constructed wetlands.

By recognising the role WSUD can play in supporting State, regional or local objectives and in promoting collaboration between those responsible for planning, designing and managing infrastructure and other stakeholders, we can maximise the potential for WSUD to improve sediment management. The following will help in developing an effective sediment management plan:

- Understand local soil and climate- sediment processes.
- Prevent sediment mobilisation in the first place - this is the cheapest option.
- WSUD treatment chains are most effective and provide ecosystem services.
- Routine inspections are required to check functionality and track sediment loads. Maintain and rectify as needed to maintain performance.
- Supplementary watering for vegetation health may be needed during prolonged dry periods.

Other WSUD site management measures such as using filter socks in front of drainage inlets, designation of soil stockpile areas, street and path sweeping and controlling site entry/exit points should also be included in the sediment management plan.

#### Why manage sediment with WSUD approaches?

There are a number of reasons for applying WSUD principles and approaches to manage sediment.

- WSUD systems provide effective removal of sediment and heavy metals.
- Managing sediment on site reduces the costs to governments and the community for stormwater, river and wetland management.
- Natural systems generally have lower capital and maintenance costs than constructed proprietary systems.
- Vegetated assets provide green spaces and cooling in urban environments, as well as habitat for local plants and animals.
- WSUD systems reduce runoff and increase stormwater storages, which reduces flash flooding.
- WSUD solutions often require less space than other sediment capture and treatment systems.

#### Limitations to WSUD systems

Excess sediment runoff into WSUD systems can limit infiltration and clog the filter media.

WSUD systems in poor condition can arise from partially/ fully blocked inlets. This risk can be minimised through regular inspections and rectification of inlet, finished surface levels and/or extended detention levels if required.

Incorrect plant selection and a lack of plant species diversity can result in mass plant failure. Plant health outcomes can be optimised through a combination of good design and maintenance. Planting success can be achieved by ensuring the design specifies an appropriate plant density, regular maintenance, and more attention during the plant establishment period.

In built-up catchments, land availability often limits the type of WSUD system that can be used to manage sediment runoff. However, retarding basin retrofits that incorporate sediment traps have been successful in some cases.

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#### References and further information:

Perth NRM, Sediment Task Force resources <https://www.perthnrm.com/resource/sediment-management/>

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