Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

Chapter 2 Principles and Objectives

2.1 Victorian environmental policy and stormwater management

State environment protection policies (SEPPs) provide a clear statutory framework of publicly agreed environmental objectives. SEPPs identify the 'beneficial uses' (indicating the environmental values) of the land, water or air environment in any particular place. They establish environmental quality objectives at levels which will ensure the protection of these uses. As legally enforceable statutory instruments, SEPPs provide the cornerstone for a wide range of environmental protection and management activities in Victoria.

There are several SEPPs that include urban waterways and other urban waters. *State Environment Protection Policy (Waters of Victoria)* is the statewide policy. This policy contains some catchment specific Schedules—for example Port Phillip Bay and Yarra River. There are also some separate SEPPs for individual catchments such as Western Port. These are progressively being reviewed and included as schedules under the *Waters of Victoria* policy.

The *State Environment Protection Policy (Waters of Victoria)* identifies a number of beneficial uses of Victoria's waterways including:

- natural aquatic ecosystems and associated wildlife;
- water-based recreation;
- agricultural water supply;
- potable water supply;
- production of molluscs for human consumption;
- commercial and recreational use of edible fish and crustacea; and
- industrial water use.

© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

SEPP (Waters of Victoria) requires that run-off from urban and rural areas must not compromise the identified beneficial uses of the receiving waters. Several provisions of *SEPP (Waters of Victoria)* specifically refer to stormwater pollution and require that measures be implemented to control its environmental impact.

These Guidelines establish stormwater quality objectives to assist in determining the level of stormwater management necessary to meet the SEPP requirements.

2.2 Urban stormwater management principles

Protecting the beneficial uses of urban waterways requires an integrated approach directed at managing the volume and rate of catchment run-off, the quality of the run-off and the habitats necessary for supporting a healthy aquatic community.

Flood prevention and public safety remain as fundamental objectives of stormwater system planning and design. Stormwater quality measures should in no way compromise these objectives. In fact, many measures designed for stormwater quality control have inherent water quantity management benefits (and vice versa).

2.2.1 Preservation, source and structural control

Stormwater management should be based on the following three principles:

- **preservation**: preserve existing valuable elements of the stormwater system, such as natural channels, wetlands and stream-side vegetation;
- **source control** : limit changes to the quantity and quality of stormwater at or near the source; and
- **structural control** : use structural measures, such as treatment techniques or detention basins, to improve water quality and control streamflow discharges.

These principles can be applied as part of an ordered framework to achieve environmental management objectives as described in Figure 2.1.

Source controls may be used effectively to avoid a number of stormwater impacts. These measures can include land-use planning, education, regulation and operational practices to limit changes to the quality or quantity of urban run-off before it enters the stormwater system.

Structural control, as the name implies, involves building structures to reduce or delay stormwater flow, or to intercept or remove pollutants after they have entered the stormwater system.

Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

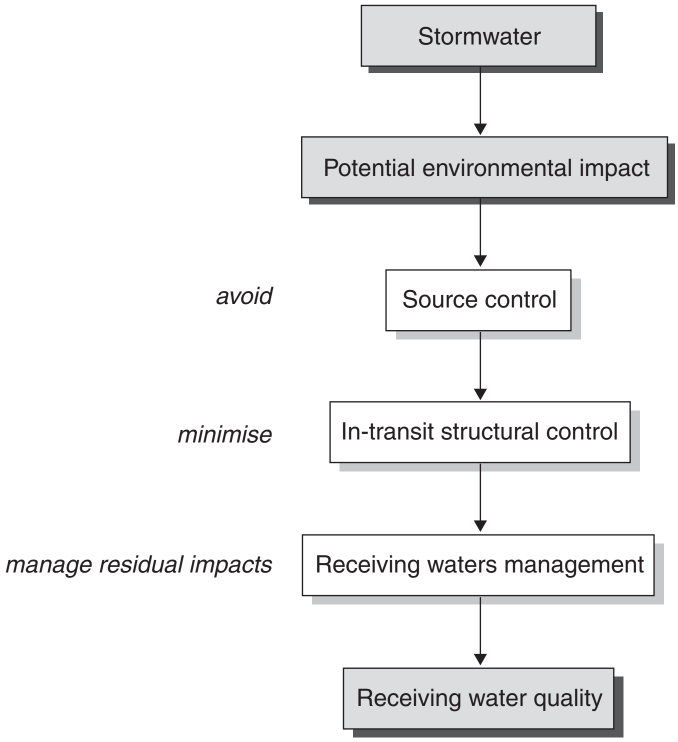

Figure 2.1 Stormwater management framework.

As a last resort, where pollutant levels or stormwater flows remain too high, it may be necessary to manage the receiving environment itself by the use of bed and bank stabilisation techniques or by installing treatment measures such as floating litter traps, by implementing a clean-up program for major pollution accumulation, or by restricting certain uses of waterways (such as recreation or water supply).

Figure 2.2 The last resort: restricting use of receiving waters.

2.2.2 The treatment train approach

Constructing a 'treatment train' using structural treatment measures involves the selection and sequential ordering of treatments to achieve optimal pollutant removal. Different treatments use different processes to remove pollutants, depending on the size range of the pollutant types. No one treatment can remove all stormwater pollutants. To achieve removal for a range of pollutants a number of treatments will be required and the selection and order in which they are constructed is a critical consideration.

Figure 2.3 illustrates typical pollutant types and size ranges that can be addressed with structural controls. The particle size fractions are presented and matched with the removal processes that structural treatments employ. Selection of treatment measures should be based on matching the pollutant type with the removal process.

More details on selecting treatment measures based on target pollutants are provided in Chapter 7.

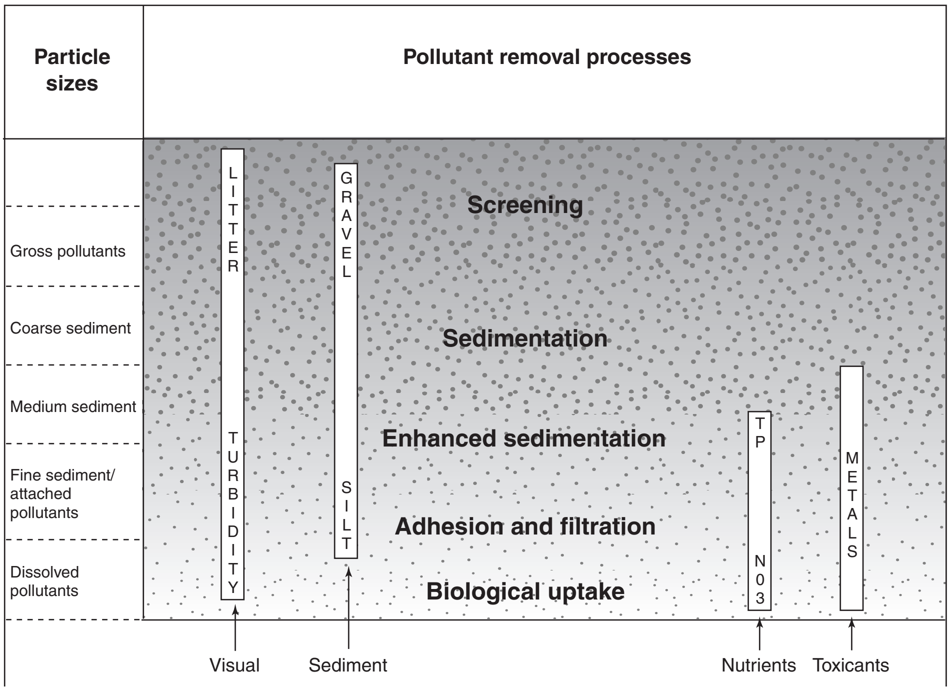

Figure 2.3 Typical pollutants and treatment processes.

2.3 Stormwater performance objectives

2.3.1 Determining performance objectives

The environmental objectives of SEPPs define the required water quality conditions of urban waterways. While the environmental objectives of SEPPs form the targets for stormwater management, there are several ways to estimate the level of stormwater

Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

quality improvement necessary to ensure SEPP objectives can be met and the beneficial uses protected (refer Figure 2.4). These are by either:

- **monitoring**: actual stormwater quality can be compared with receiving water quality to establish the level of treatment necessary to protect beneficial uses, where sufficient monitoring data are available;
- **modelling**: stormwater quality and its potential impact on receiving waters can be mathematically modelled to determine treatment requirements. Some monitoring data are usually required to validate such models; and
- **generic values** : averaged values for typical urban stormwater quality can be compared to receiving water quality and SEPP objectives to indicate the level of improvement required (refer Table 2.1).

Pollutant	Receiving water objective:	Current best practice performance objective:
Post construction phase:		
Suspended solids (SS)	comply with SEPP (e.g. not exceed the 90th percentile of 80 mg/L) (1)	80% retention of the typical urban annual load
Total phosphorus (TP)	comply with SEPP (e.g. base flow concentration not to exceed 0.08 mg/L) (2)	45% retention of the typical urban annual load
Total nitrogen (TN)	comply with SEPP (e.g. base flow concentration not to exceed 0.9 mg/L) (2)	45% retention of the typical urban annual load
Litter	comply with SEPP (e.g. No litter in waterways) (1)	70% reduction of typical urban annual load (3)
Flows	Maintain flows at pre-urbanisation levels	Maintain discharges for the 1.5 year ARI at pre-development levels
Construction phase:		
Suspended solids	comply with SEPP	Effective treatment of 90% of daily run-off events (e.g. <4 months ARI). Effective treatment equates to a 50%ile SS concentration of 50 mg/L.
Litter	comply with SEPP (e.g. No litter in waterways) (1)	Prevent litter from entering the stormwater system.
Other pollutants	comply with SEPP	Limit the application, generation and migration of toxic substances to the maximum extent practicable

1 An example using SEPP (Waters of Victoria 1988), general surface waters segment.
2 SEPP Schedule F7—Yarra Catchment—urban waterways for the Yarra River main stream.
3 Litter is defined as anthropogenic material larger than five millimetres.

Table 2.1 Objectives for environmental management of stormwater.

The preferred method for determining the required level of treatment is by use of monitoring data. However, the inherent variability in water quality experienced both in waterways and stormwater systems means that an extensive monitoring program is usually required to obtain sufficient data for such assessments.

Modelling provides an ability to predict likely changes in water quality associated with proposed urban developments. Such water quality models can be used to establish performance objectives for stormwater systems. These are limited by the availability of local

Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

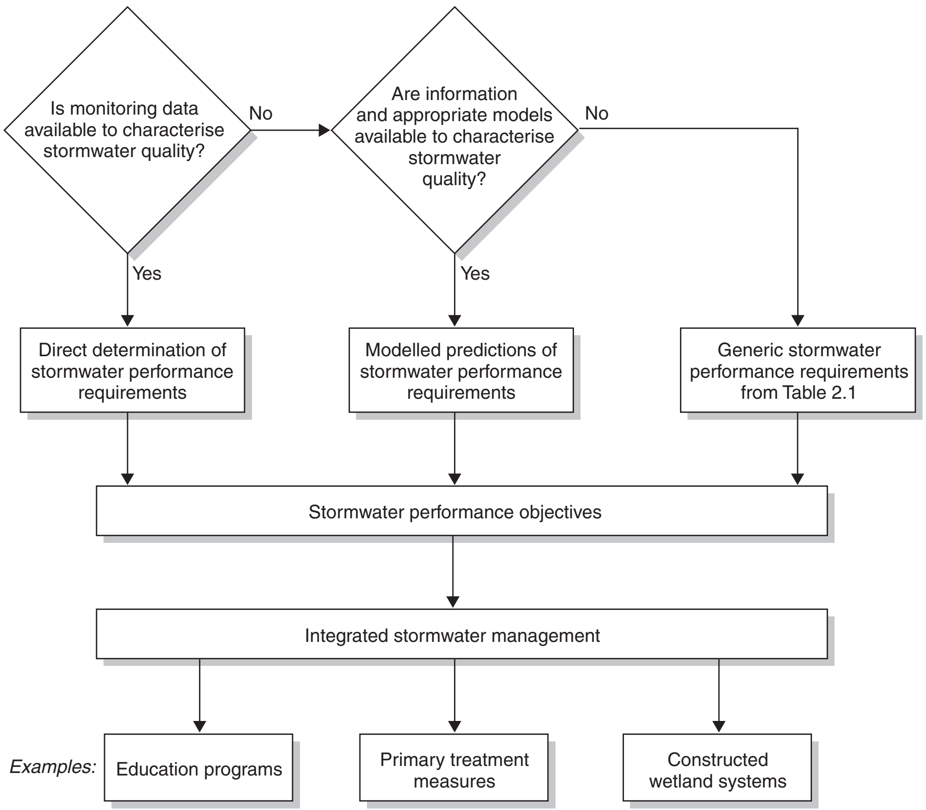

Figure 2.4 Alternative approaches for determining stormwater performance objectives and their context in integrated stormwater management.

water quality data and the understanding of the biological and physical processes that influence water quality and the receiving water environment. There are often significant limits on the confidence with which predictions can be made using water quality models.

The typical quality of urban stormwater and the performance capabilities of certain treatment measures have been determined from a number of studies (Mudgway et al. 1997, and Duncan 1997b).

These measures of typical urban stormwater quality can be compared to SEPP objectives to determine treatment requirements. Performance objectives for stormwater management have been derived using this approach because of the limited availability of water quality data and the limitations of modelling. Table 2.1 presents the performance objectives based on the expected improvement required to meet SEPP objectives and that can be achieved by current best practice techniques.

These performance objectives are indicative only. In many situations, where there are no extreme or unusual factors, stormwater management which achieves these objectives will generally satisfy the environmental objectives of the SEPP.

Further information on the derivation of the performance objectives in Table 2.1 can be found in: L. B. Mudgway, H. P. Duncan, T. A. McMahon and F. H. S. Chiew, 1997, *Best Practice Environmental Management Guidelines for Urban Stormwater. Background Report to*

Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.

the Environment Protection Authority, Melbourne Water Corporation and the Department of Natural Resources and Environment, Victoria, Cooperative Research Centre for Catchment Hydrology Report 97/7, October 1997.

Urban stormwater has a major influence on the water quality of urban waterways. Integrated stormwater management provides a means for minimising the environmental impact from urban stormwater systems. Other sources, such as sewer overflows, septic tank losses, vehicle emissions and so on, can also have significant effects on water quality. These are, however, beyond the scope of these guidelines. It must be recognised that, depending on the relative impacts of these different inputs, improvements to urban stormwater by themselves may not be sufficient to achieve SEPP requirements in some waterways.

2.3.2 Application of objectives

The performance objectives can be achieved by employing a variety of structural and non-structural treatment measures. The stormwater performance objectives should be used to guide planning and design for the environmental management of stormwater including urban form, drainage infrastructure, maintenance and operational programs.

The tools described in Chapters 4, 5 and 6 provide stormwater quality benefits when applied in the appropriate situation or context. Therefore, all of the tools should be considered for use where practicable and in the absence of any apparent adverse impacts. The extent of water quality improvement likely to result from the use of these tools or combinations of measures can be estimated in a qualitative or semi-quantitative manner using the performance information in these guidelines. This allows some judgments to be made on the relationship between proposals and stormwater performance objectives. Consideration of all benefits, including those outside of stormwater quality, should be included in this assessment.

Urban Stormwater: Best Practice Environmental Management Guidelines.
© CSIRO 1999. This electronic edition published by **CSIRO** PUBLISHING, 2006.