Chapter 6 Source Controls

Key references

NSW Department of Housing, 1998, *Managing Urban Stormwater: Soils and Construction*.

EcoRecycle Victoria, 1998, *Manufacturers Waste Reduction Manual*.

EPA, 1995, *Environmental Guidelines for Major Construction Sites*.

EPA, 1991, *Construction Techniques for Sediment Pollution Control*.

6.1 Introduction

Dealing with pollution at source is the most effective means of protecting stormwater quality. This chapter describes some tools available to local government and other agencies to help manage stormwater pollution resulting from municipal operations and household, business and construction activities in urban areas. These include:

- **Municipal operations**: source control measures for local government activities that may affect stormwater quality.
- **Construction activity**: developing site management plans and best practices to implement the plan.
- **Business surveys**: performing surveys to determine the nature and extent of business activities likely to cause stormwater pollution.
- **Education programs**: ways to prepare and deliver education programs to reduce stormwater pollution from household and business activities.
- **Enforcement**: measures that can be taken to complement education and other management programs.

Elements of source control dealing with managing the quantity of run-off from urban areas are covered in sections describing Water Sensitive Urban Design (Chapter 5) and Flow Management (Section 7.10).

The pollution generating activities of business and industry are not addressed in any detail by these Guidelines. Major waste management activities of industry are dealt with by EPA through licensing and waste management agreements. However, there are many waste generating activities not part of major industrial processes that are not subject directly to EPA licensing or regulation and which have significant potential to pollute stormwater.

Responsibility for dealing with these pollution generating activities rests with managers of the business enterprise. Education backed up by enforcement is the best means of ensuring business managers are aware of their potential to pollute stormwater and have knowledge of the measures available to minimise pollution risks. The business survey section provides a method for self-assessment or independent appraisal of business activities and their pollution potential, to enable better targeting of education and enforcement programs.

6.2 Municipal operations

Through its operations in areas such as street cleaning, waste collection and road maintenance, local government directly influences the quality of stormwater within a catchment. By applying stormwater best practices in its operational activities, local government can significantly improve the quality of urban stormwater run-off.

There are three main areas of local government activity that can affect stormwater quality. These are:

- planning of asset construction and maintenance;
- maintenance operations; and
- staff training to improve practices.

To help ensure project managers, council staff and contractors consider all aspects of water quality in their activities, a simple checklist is provided in Section 6.2.4.

6.2.1 Planning of asset construction and maintenance

Stormwater quality is an essential consideration during the planning of asset construction and maintenance activities. An analysis of each activity's potential to pollute should be undertaken and improved methods designed into the activity to minimise pollutant generation. A number of best practice methods are described in Sections 6.2.2 and 6.3.2 for maintenance and construction activities.

Construction activity planning

The construction of buildings, roads, drains and open spaces all have the potential to produce pollutants that may enter the stormwater system.

Eroded soils with associated adsorbed pollutants and litter are major pollutant sources during construction activity. Significant reductions in these pollutants can be achieved by using a combination of improved construction practices, structural and vegetation measures and soil stabilisation techniques. A site management plan should be prepared, incorporating a range of control measures that are complimentary to the construction plans.

Fundamental to reducing erosion is restricting activity in areas prone to erosion to minimise disturbance and exposure of the soil. Careful planning and siting of works will reduce the opportunity for erosion to occur.

Much municipal construction and maintenance work is performed by contractors. When developing an asset construction and maintenance specification or brief, the specification should contain a clause that stipulates the need for consideration of stormwater quality. For example:

Example clause

The impact of XXX Road must take into consideration the issue of stormwater quality and include an erosion and sediment control plan with appropriate treatments and operational features to minimise stormwater pollution in accordance with the 'Best Practice Environmental Management Guidelines for Urban Stormwater' (Stormwater Committee 1999).

For the majority of construction activity council should ensure that works are planned to minimise erosion and sediment generation. For major construction activity a site management plan should be required.

To help council staff assess any construction activity for its pollutant potential and evaluate a site management plan, a checklist is presented in Section 6.3.3.

Maintenance activity planning

Sensible planning of operational procedures for each maintenance activity is the key to minimising their impact on stormwater. Inspections to identify those activities that are significant sources of pollution are an essential component of this planning process.

Information from inspections can be used to change operational activities to improve stormwater quality. Ongoing monitoring of these activities is required to ensure stormwater pollution is minimised.

Monitoring may be carried out through inspections, reviewing the number and type of complaints, and through contract reporting mechanisms. As in all survey schemes, good record keeping is vital.

6.2.2 Source controls for maintenance activities: index

There are a number of simple and practical changes to maintenance activities that local government can implement at minimal cost and achieve significant improvement in the quality of stormwater run-off.

In performing maintenance activities, the goal is to prevent waste material entering the stormwater drainage system. The following sections describe procedural guidelines for a range of typical local government maintenance activities.

Maintenance activity No. 1: Street cleansing

Description

Roads, carparks and footpaths make up approximately 70 per cent of urban impervious surfaces and are major areas of pollutant accumulation.

Street cleansing (usually sweeping) is a widely used practice to reduce accumulations of litter, dirt and vegetation from streets and footpaths. The primary purpose is to maintain attractive streetscapes, and large amounts are spent by municipalities annually. Street cleansing for stormwater quality improvement is usually a secondary consideration although sweeping is often claimed to improve stormwater quality.

There have been few investigations into the pollutant removal effectiveness of street cleansing. Some studies have concluded that street sweeping will achieve little in regard to stormwater quality improvement because of the small size of many street sediments, the frequency of rainfall, timing of sweeping practices with pollutant build-up and

unfavourable field conditions, such as parked cars blocking the streets and windy conditions (see Walker, Allison, Wong and Wootton 1999). Significant increases in expenditure on street cleansing aimed solely at improving stormwater quality may therefore not be effective. Other measures may be of greater benefit, for example litter traps or the frequency of street litter bin clearing.

There are a number of simple ways that existing street cleansing programs can be improved to maximise the benefits to stormwater quality. A series of best practice guidelines are presented below.

Improvements to stormwater quality are best achieved by focusing on 'hot-spots' rather than routine regular cleansing of all streets. Coordination and integration between street cleansing and other maintenance activities is also essential to maximise the benefits of street cleansing. Along with regular street cleansing programs, tailored programs should be provided to manage the additional impacts of specific maintenance, construction and other activities such as public events.

Street cleansing: suggested measures

Planning and monitoring

- *Program assessment*: review the emphasis and flexibility of cleansing programs to ensure there are adequate resources for targeted activities (hot-spots and special events).
- *'Hot spots' focus*: identify 'hot spots' where pollutants accumulate and target these during cleansing programs (e.g. commercial areas and construction sites).
- *Pit/pit trap cleansing*: identify opportunities to use street cleansing plant for alternative stormwater quality improvements such as pit/ pit trap cleansing.
- *Monitoring*: establish a data recording system, monitoring the areas cleaned and the quantities of material collected. Adjust the cleansing programs to maximise waste collection.

Coordination with other activities

- *Activities audit*: assess all maintenance and operational activities to determine their potential to pollute (e.g. street cleansing prior to routine fire hydrant flushing).
- *Maintenance/cleansing*: ensure maintenance programs such as grass cutting or road repairs include appropriate street cleansing.
- *'One off' cleansing*: allow for 'one-off' cleansing operations during special events.

Community coordination

- *Community information*: advise the community of street cleansing schedules to help clear the streets of cars during cleansing.
- *Off-peak cleansing*: tailor street cleansing schedules to ensure busy areas are swept during off-peak periods.
- *Restrict parking*: in areas of greatest pollution, install temporary parking restrictions to help clear these areas of vehicles during cleansing times.

Operational restrictions

- *Discharge to drains*: do not permit street sweepers to discharge waste water or material into the drainage system.
- *Flushing and wash-down*: restrict washing of footpaths and flushing of kerbs, unless into a specifically designed storage/filtration system prior to entry into the stormwater system (see IMEA 1996).
- *Limited access areas*: where mechanical equipment access is limited, hand sweeping is preferred.

Figure 6.1 Street sweeping.

Maintenance activity No. 2: Drain maintenance

Description

Drainage maintenance includes inspection, cleaning and repair of open and piped drains, pits, litter traps and outfall structures.

Stormwater systems maintenance should be planned and coordinated to ensure excessive build-up does not occur. Frequent inspections of pollutant build-up 'hot spots' will help determine the most effective cleaning frequencies.

Drain maintenance: suggested measures

- *Monitor*: via regular inspections, assess the accumulation rates of litter, silt, leaves and other pollutants in various parts of the drainage system.
- *Identify 'hot spots'*: identify stormwater drain inlets/pits that require more frequent cleaning.
- *Plan cleaning frequency*: adjust drain cleaning frequency to suit pollutant accumulation rates.
- *Waste collection*: to collect waste material during drain cleaning, use machinery that does not sweep waste further into the drainage system (e.g. suction sweepers or hand sweeping and pick-up).

Maintenance activity No. 3: Domestic waste and recycling collection

Description

Spillage during kerbside waste and recycling collections can contribute considerably to stormwater system pollution. The amount of spillage is affected by wind, rain and the type of collection system used.

The thoroughness of garbage collectors, recycled waste collectors and householders in the disposal/collection process also impacts on the spillage rate, as does the shape and size of the bin itself. Choose waste collection bins carefully—consider the container's potential to spill and the access it affords to scavenging animals.

Domestic waste and recycling collection: suggested measures

- *Collection vehicles*: use lifting and emptying mechanisms that minimise spillage risk.
- *Spillage policy*: collection contractors should only use dry methods to clean up spillage and should notify council of any spilled material not resulting from the collection operation.
- *Collection containers*: recycled waste collection containers should be fully enclosed, e.g. mobile garbage bins (MGB) for domestic recyclables.
- *Green waste*: if deposited on nature strips, green waste should be collected as soon as possible.
- *On-site chipping*: all residue from on-site chipping should be collected or swept.
- *Hard rubbish collection*: establish local laws prohibiting nature strip storage of hard rubbish for longer than seven days prior to the nominated collection date. Program hard rubbish collection to support this.

Maintenance activity No. 4: Council bin design and cleaning

Description

The type of street and park litter bins used will affect the amount of litter reaching the stormwater system. Reference should be made to Waste Management Council, 1996, *Best Practices in Litter Management: A Guide for Local Government*, which provides good examples of bin selections, siting and emptying frequencies.

City of Whitehorse contract clause example

The City of Whitehorse has rendered its litter bin service. The following are extract clauses from its litter bin collection contract, which offer good examples of litter pollutant control:

Street litter bins

Clearing of bins: Contractor must empty litter bins at frequency specified in the schedule. Not withstanding that a collection frequency for litter bins has been specified, the contractor must ensure that the litter bins are useable by the public at all times and that the volume of material in the litter bin never exceeds seventy-five per cent (75%) of the capacity of the bin.

Spilt litter: At the time of emptying the litter the contractor must clean up any spilt litter within a two metre radius of the litter bin whether the spillage was caused by the contractor or other causes.

Council bin cleaning: suggested measures

- *Monitor use*: undertake audits to identify those bins most heavily used, particularly those near drainage pits and waterways. Schedule these for particular attention during cleaning programs.
- *Appearance*: select bins that look clean, attractive and are easily identifiable.
- Design: the aperture of the bin should be small enough to discourage illegal dumping, yet acceptable for normal litter.
- *Size*: bin size should be based on minimising emptying frequency while discouraging illegal dumping.
- *Locations*: bins should be located near the source of the litter (e.g. ATMs or fast food outlets).
- *Emptying*: the frequency of emptying should ensure that the bins do not overflow—typically, bins should not be more than 75 per cent full before clearing. The clearing contractor should be responsible for cleaning up litter within a specified radius of the bin.

Maintenance activity No. 5: Pavement repairs

Description

Pothole patching, footpath maintenance, bitumen and concrete works are all potential sources of pollutants. These sources include bitumen overspray, concrete residues and pavement cutting dust. Pavement repair techniques should limit the generation of such pollutants.

'Grinding' is a technique used to 'level up' adjacent concrete slabs in a footpath. For small movements, this technique is preferred to slab replacement. Water is used for cooling during grinding, producing a fine particle residue. As a result, grinding work practices need to be reviewed to ensure minimal grinding 'slurry' reaches the stormwater system.

Pavement repair: suggested measures

Site preparation

- *Side entry pits*: where there is a threat of material entering side entry pits, install temporary inlet filters.
- *Material storage*: material such as packing sand, gravel, crushed rock and excavated material should be stockpiled away from any drainage flow path and covered to prevent erosion (refer Construction activity No. 5: Materials storage).

Bitumen work

- *Spraying*: do not carry out bitumen spraying in windy conditions.
- *Screenings*: place only the required amount of screenings on bitumen.

Concrete work

- *Mixing*: concrete mixing and clean-up operations should be carried out in a designated area capable of containing excess water.
- *Concrete pumps*: provide appropriate protection to trap any spill material when using concrete pumps.
- *Concrete waste*: allow concrete waste and slurry to set before disposal off-site.
- *Concrete cutting*: waste water from brick and concrete cutting activities should be contained and either recycled or allowed to evaporate.

Site clean-up

- *General*: clean the site prior to leaving and remove all excess material including all waste concrete, packing material and soil.
- *Formwork*: remove any cover material and formwork from the site once concrete has cured.

Maintenance activity No. 6: Unsealed roads

Description

Unsealed road maintenance involves grading, pothole patching and the re-sheeting of gravel or crushed rock pavements and shoulders. Reducing erosion and siltation is the key to best grading practices for unsealed roads.

The aim of grading operations should be to maximise the life of the pavement and reduce the need for grading. This will, in turn, minimise the risk of erosion and siltation. Selection of suitable pavement materials and proper compaction is a key factor in achieving this.

Unsealed roads: suggested measures

- *Scheduling*: avoid grading when road surface is extremely dry. Time grading operations to coincide with peak road material moisture content. Complete grading operations on a daily basis.
- *Compaction*: use compaction equipment in conjunction with grading.
- *Filter strips and sediment traps*: ensure road run-off passes through a vegetated filter strip or sediment trap before discharging to a waterway.
- *Road materials*: where possible, use road materials that easily bind together and minimise contamination of run-off with fine particles. Chemical adjustment of road materials may also be feasible to reduce suspended sediment generation.
- *Slopes and crossfalls*: shoulder slopes should be 3–10 per cent. Pavement crossfall should generally be in the range of 3–8 per cent.
- *Table drains*: construct table drains in a 'U' shape to prevent scouring of inverts and divert outputs to ensure no direct connection to a waterway. Where table drains are likely to erode during stormwater flows, install energy dissipaters such as rubble or rock.

- *Temporary .lters* : where sediment threatens to enter culverts, drains or side entry pits, install temporary filters.
- *Cut-off drains*: provide regular cut-off drains to minimise the potential erosion of road edges, particularly on steep grades.
- *Waterway crossings*: seal pavement and shoulders at waterway crossings wherever possible to limit erosion potential.

Maintenance activity No. 7: Parks, reserves, golf courses and medians

Description

Grass cuttings, leaves and prunings are all potential sources of stormwater contamination.

City of Manningham contract clause example

The following are sample contract clauses suitable for reducing the effect of mowing activities:

> 'Prior to grass cutting all loose litter, rubbish or debris shall be cleared from the mowing area.' (Performance criteria: Absence of litter, rubbish or debris)
>
> 'All grass clippings and other debris to be swept or cleared from adjoining paths, gutters, paved surfaces and garden areas.' (Performance criteria: No clippings or other debris after cutting operations)

Parks, reserves, golf courses and medians: suggested measures

Planning and coordination

- *Monitor*: monitor key pollution indicators for each park and garden (e.g. the number of people using the area, types of pollutants, proximity to waterways and so on).
- *Map*: determine the vegetation layout and the amount of open grassed areas adjacent to open waterways for each area. Encourage indigenous species to be planted that do not require slashing and also provide habitat and food for wildlife.
- *Maintenance methods*: determine, according to park activities, appropriate work practices to minimise pollution risks. Determine where specialist maintenance methods and equipment may be required and develop structural controls to trap pollutants.
- *Coordinate*: in areas adjacent to kerbs and channels, coordinate activities such as mowing or pruning with street cleaning operations.

Grass cutting

- *Preparation*: prior to grass cutting, remove litter and debris from the area.
- *Technique*: cut grass so that the mower throws the grass cuttings away from waterways, open drainage structure, kerbs and channels.
- *Cuttings removal*: at the completion of the day, sweep up all grass cuttings, leaves, prunings and so on left on paved areas—earlier if rain is imminent.

- *Areas adjacent to open waterways*: reduce grass mowing activities in these sensitive areas by either using indigenous grasses or replacing grasses with low ground cover.

General park maintenance

- *Plant selection*: along open waterways, choose plant species that are part of the food chain and add to the natural balance between flora and fauna—these generally require less maintenance and watering than exotic species.
- *Fertiliser*: use slow release organic fertilisers where possible. Avoid fertilisers in areas where wash-off can result in the fertiliser entering the drainage system.
- *Herbicides*: avoid spraying herbicides adjacent to open waterways or on windy days. Consider alternative weed control methods.
- *Mulch*: use mulch covers over garden areas to assist in absorbing and filtering water flows.
- *Ground cover*: use natural grasses and indigenous plants to reduce water needs and improve infiltration.

Maintenance activity No. 8: Material storage

Description

Stockpiles of any uncompacted matter such as crushed rock, gravel, packing and bricklayers sand, loose timber, screenings or prunings can all contribute to stormwater pollution. Rainfall or water flowing through or over such stockpiles is the most immediate cause of this type of pollution.

Material storage: suggested measures

- *Storage location*: locate stockpiles on a paved surface, ideally on a high elevation site, with stormwater flow directed away from the site.
- *High risk materials*: toxic materials, hydrocarbons or materials rich in nutrients or metals must be stored either indoors or under cover.
- *Stockpile covering*: store materials under a roof, or with plastic or other suitably secured sheeting. Always store scrap metal under cover and regularly clear the stockpile from the site.
- *Non-roofed stockpiles*: non-roofed material storage areas should be designed to prevent direct run-off into the stormwater system.
- *Stormwater inlets*: ensure stormwater inlets are protected from stockpile spillages and leaks.
- *Site inspection*: inspect storage areas and liquid containers for damage or leaks at least every six months.

Maintenance activity No. 9: Plant and equipment

Description

Plant and equipment can be sources of pollutants such as lubricants, coolants and fuels. Where possible, plant should be stored under cover. Where this is not practical, regular inspections and the use of drip pans are encouraged.

Washing and cleaning of plant can produce extremely high concentrations of pollutants. Appropriate wash water treatment and disposal systems must be installed in all 'wash-down' areas.

The following recommendations refer to the storage, refuelling and maintenance of council plant and equipment.

Plant and equipment: suggested measures

Storage and storage areas

- *Plant and equipment covering*: store vehicles and equipment under cover wherever possible (Figure 6.2).
- *Plant inspections*: program and record the results of regular plant inspections.
- *Parking plan*: designate parking areas for each vehicle to facilitate leak tracing.
- *Leakages*: develop procedures for reporting, repairing and cleaning up of leakages.

Cleaning plant and equipment

- *Cleaning schedule*: clean plant regularly and routinely.
- *Wash-down areas*: provide designated 'wash-down' areas with appropriate run-off treatment (Figure 6.3).
- *On-site cleaning*: use grassed areas where on-site cleaning is required.
- *Signage*: install suitable signage, identifying specific area use and prohibiting oil and solvent disposals into the stormwater system.

Refuelling plant

- *Area design*: use concrete paved areas—bitumen deteriorates as a result of fuel or oil spillage. The area design should contain all spills and ensure spillages cannot enter the stormwater system (Figure 6.4).
- *Spills*: clean up spills using 'dry' methods. Maintain a supply of dry clean-up material and directions for its use adjacent to or within the refuelling area.
- *Signage*: post signs to instruct operators not to 'top off' or overfill fuel tanks.
- *Inspection*: inspect fuel areas daily and identify any leakages.
- *Cleaning*: do not hose area during cleaning.

Vehicle maintenance

- *Preferred location*: where possible, perform vehicular maintenance indoors.
- *Outdoor maintenance*: if performed outdoors, designate a specific area, keep it clean at all times and use dry clean-up practices. Ensure the site is correctly drained.
- *Drip trays*: keep drip trays or containers under the vehicles at all times during maintenance.
- *Drain*: drain fluids from any disused vehicles kept on-site for scrap or parts.

Figure 6.2 A temporary storage facility, undercover and with a spoon drain to redirect surface flow (City of Manningham).

Figure 6.3 A designated wash-down area at the City of Manningham's works depot. A paved, undercover area draining to a sump (City of Manningham).

Figure 6.4 A fuelling area: paved, undercover area with a spoon drain to redirect surface run-off (City of Manningham).

Maintenance activity No. 10: Unloading and loading areas

Description

Unloading and loading areas are generally heavily trafficked, with a variety of goods and materials being moved about continually. The high degree of machinery operation married with the potential for spillages and breakages, present pollution risks in these areas.

Unloading and loading areas: suggested measures

- *Location*: locate loading areas indoors where possible. Ensure stormwater flow is directed away from the loading area site.
- *Vehicle inspection*: transport vehicles should be continually checked for fluid leaks.
- *Spillage/leakage clean-up*: develop and implement procedures for the prompt clean-up of any spills. Drivers/operators should be responsible for any spillage due to their plant or operation.
- *High risk materials*: where high risk materials are handled, a treatment system for any spilt materials should be installed.

Maintenance activity No. 11: Building maintenance and construction

Description

Buildings generate a substantial amount of stormwater from their large roof areas. It is important that building stormwater systems are adequately maintained to minimise stormwater pollution.

Dust, paint, solvents, steel filings, timber residue and other wastes are all produced during building construction. Project or site managers must understand the nature of the materials they are working with and their potential to pollute stormwater.

The following simple practical maintenance techniques can reduce levels of building site stormwater pollution.

Buildings: suggested measures

General building repairs

- *Materials storage*: store building materials under cover or in contained areas.
- *Site cleaning*: clean the repair or construction site daily. Do not use water for cleaning the site.

Painting and surface treatment

- *Leakage containment and treatment*: ensure paint or solvent leakages cannot enter the stormwater system. Treat a paint spill as a chemical spill.
- *Paint residue and dust*: use a ground cloth to collect dust and paint residue during scraping, sanding and painting.
- *Paint disposal*: clean water-based paint equipment where residue cannot enter stormwater system. Clean oil-based paint equipment where the waste material can be collected and disposed of as hazardous waste.
- *Spray painting*: avoid spray painting outdoors on windy days.

Figure 6.5 Many building maintenance practices can pollute stormwater.

Building drainage design and maintenance

- *Design*: stormwater drains should be either connected directly into an appropriately designed stormwater system or routed over a suitably sized grassed area.
- *Inspection*: inspect building stormwater systems at least annually.
- *'Hot spots'*: identify debris/sediment collection 'hot spots'. Program inspections and removal of materials to minimise the potential for debris accumulation.
- *Maintenance*: clean drain inlets, spouting, downpipes and pipes at least twice per year.

Maintenance activity No. 12: Graffiti removal

Description

Graffiti removal can result in toxic run-off, which can be washed into the stormwater system.

Graffiti removal: suggested measures

- *Waste water*: wash-down water and other materials resulting from graffiti removal should not enter the stormwater system.
- *Temporary filters* : fit temporary inlet pit filters, where required, to prevent pollutant entry.
- *Site clean-up*: sweep the site and dispose of any waste materials appropriately.

Maintenance activity No. 13: Emergency response

Description

All councils are required to prepare an emergency management plan (EMP), which identifies procedures for response to various types of emergencies. These procedures should include a response to stormwater incidents. The EMP should include a current drainage network plan showing the catchment boundary, all inlet points, direction of flow, location of outfalls and open waterways, and location of ecologically sensitive areas.

A number of organisations are responsible for dealing with spills and other pollution incidents. While the municipality's EMP should be followed by council officers encountering pollution incidents, the following guide will assist others to respond to such situations. In any emergency or pollution situation the primary objective must be to ensure safety and to contain pollution or prevent further spillage.

It is important to initiate established emergency response systems that are designed to deal with such situations. In most situations a single contact will be sufficient to initiate the appropriate emergency response.

Emergency services, Metropolitan Fire Brigade or Country Fire Authority should be notified in the event of a chemical or hazardous substance spillage. This may be the first call in the event of a serious incident.

Where drainage systems are affected, the 'owner' or 'manager' of the system should be notified. For local drains this will be the municipality. Larger drains and waterways are usually the responsibility of the waterway authority—in Melbourne and surrounding areas this is Melbourne Water; in regional Victoria this may be the responsibility of the regional Catchment Management Authority.

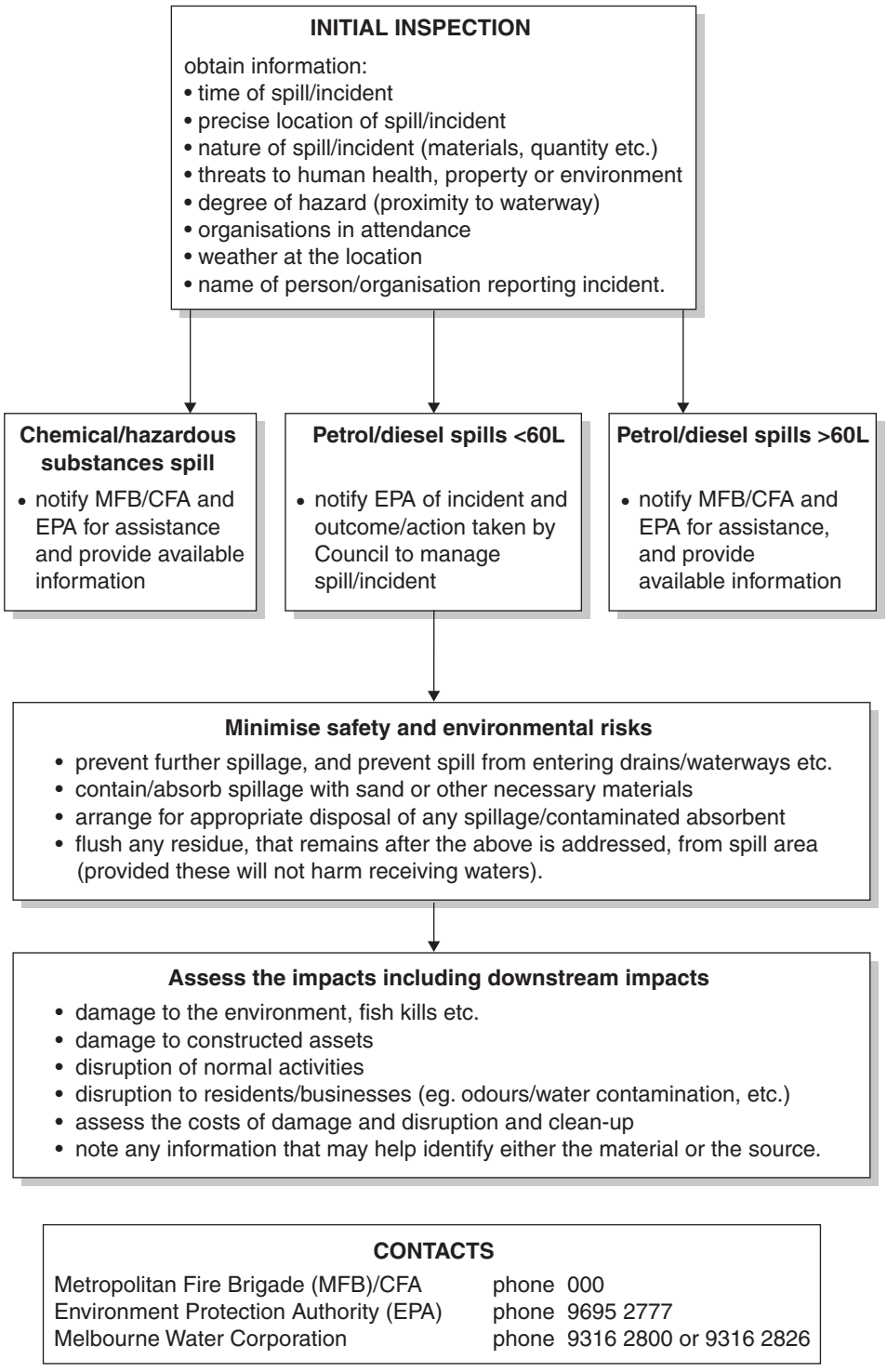
EPA should be notified, either directly or via the EMP, of pollution incidents involving the discharge of waste material to the stormwater system. This notification is in addition to notification of the asset owner/manager and will initiate action to address the pollution source.

Spills to the environment often involve fuels and oils from vehicle accidents. As emergency services have standard procedures for dealing with fuel spills, it is not necessary to notify EPA of such incidents except when the spill is greater than 60 litres.

A number of organisations are responsible for dealing with pollution spills. Figure 6.6 is a guide for responding to spill incidents and determining what action to take.

6.2.3 Training and staff awareness

Improved stormwater quality is largely dependent on the comprehension, acceptance and adoption of best practices by municipal staff. Staff training in these practices will assist implementation. The following systems can be developed to establish and maintain staff knowledge and awareness:



* Melbourne Water Corporation or the relevant Catchment Management Authority also need to be notified where their drains or waterways are affected.

Figure 6.6 Responding to spill incidents.

- *staff work groups*: these provide effective forums for the review of current work practices and the development of appropriate new work practices;
- *performance indicators*: develop a range of key work practice performance indicators to be used in work group reviews;

- *routine monitoring programs*: train staff to routinely check activity procedures and their effect on stormwater pollution;
- *work practice audits and training*: periodically audit employee work practices and regularly review work performance and implement training; and
- *contract inclusions*: write contracts that clearly instruct sub-contractors to work in accordance with these guidelines.

6.2.4 Council source control checklist

The following checklist can assist council staff to identify and address any aspects of council operational activities that may affect stormwater quality. The checklist can be used to refer back to the relevant sections within the Guidelines which provide further information on these issues. Section 6.3.3 provides a checklist that could be used to assess site management plans for construction activities.

The checklist is divided into two parts.

- *Part A* deals with the *planning of construction and maintenance activities*. This should be completed at the planning stage of each project/contract and can be referred to when writing specifications.
- *Part B* describes *maintenance activities* that potentially impact on stormwater quality. Choose the section that is relevant to a particular activity and use the checklist to ensure that all aspects of the activity that may affect stormwater quality are considered.

Part A: Planning asset construction and maintenance	**Maintenance activity or section number**
Do the works have the potential to affect stormwater quality? if yes:	
A1: Maintenance planning ▪ Can alternative measures be used (e.g. grass cutting: use alternative species, use grass catchers)? ▪ Can clean-up measures be employed during the works (e.g. street sweepers following grass mowers)?	Section 6.2.1
A2: Construction planning ▪ Is the site larger than one hectare? if yes: – You need to develop site management plan. See the checklist in Section 6.3.3	
if no: – Are mitigation measures required on-site (e.g. open bin or skip, hay bales or silt fences on boundary, prompt revegetation of site, prevent sediment export from vehicles)? – Are the measures suggested appropriate?	Section 6.3.3

Part B: Maintenance activities	**Maintenance activity or section number**
❑ Pavement repairs	
Ensure that:	Maint. activity No. 5
– measures are taken to prevent pavement material from entering the stormwater system; and	Maint. activity No. 8 Maint. activity No. 9
– all materials are removed from the site when work is completed.	Maint. activity No. 10 Section 6.2.4
❑ Unsealed roads	
Ensure that:	Maint. activity No. 6
– measures are taken to minimise erosion and siltation;	Maint. activity No. 8
– suitable road material is used;	Maint. activity No. 9
– thorough compaction of road material is performed; and	Maint. activity No. 10
– works are timed to reduce the risk of erosion and siltation.	Section 6.2.4
❑ Street cleansing	
Ensure that:	
– programs have been developed to cater for 'hot spots';	Maint. activity No. 1
– an auditing program is implemented to allow revision of cleansing schedules;	
– the cleansing program is coordinated with other council activities;	
– operators of street cleansing machinery and equipment are well trained;	
– refuelling, loading, vehicle maintenance and wash-down areas are equipped with structures to prevent pollutants from entering the stormwater system;	
– routine inspections and maintenance are performed for all equipment and plant; and	Maint. activity No. 8
– training procedures are put into place for staff in regard to accidental spills and disposal of waste from cleansing equipment.	Maint. activity No. 9 Maint. activity No. 10 Section 6.2.4
❑ Drainage maintenance	
Ensure that:	
– regular inspection and maintenance programs are performed;	Maint. activity No. 2
– auditing programs are in place to assess if the maintenance schedule is being followed;	
– appropriate machinery is being used;	
– refuelling, loading and vehicle maintenance areas are equipped with structures to prevent pollutants from entering the stormwater system;	Maint. activity No. 8 Maint. activity No. 9
– routine inspection and maintenance programs for equipment and plant are implemented; and	Maint. activity No. 10
– staff are trained to deal with accidental spills and maintenance of the drainage system.	Section 6.2.4
❑ Domestic waste, recycling and council bin collection	
Ensure that:	
– appropriate vehicles and receptacles are being used for waste collection to minimise pollutants/waste materials entering the stormwater system;	Maint. activity No. 3
– staff are trained in appropriate best practice techniques to minimise spillages;	
– collections are frequent enough to minimise spillages/loss of materials entering the stormwater system;	
– an auditing process is established to ensure that collection frequency is maintained as specified on schedules and spillages, or other losses are minimised;	
– local laws have been developed to discourage illegal dumping or poor litter management by local businesses and residents (e.g. building sites, commercial areas);	Maint. activity No. 8 Maint. activity No. 9 Maint. activity No. 10
– refuelling, loading and vehicle maintenance areas are equipped with structures to prevent pollutants from entering the stormwater system;	Section 6.2.4
– an inspection and maintenance schedule for equipment and plant is implemented; and	
– staff are trained to deal with accidental spills during collection of waste and recyclables.	

❑ Parks, reserves, golf course and median strips	
Ensure that:	
– appropriate management practices are conducted to minimise grass, leaves and prunings from entering the stormwater system;	Maint. activity No. 7
– the type of vegetation planted increases infiltration;	
– appropriate fertilisers are used and operators are trained in appropriate application techniques;	
– refuelling, loading and vehicle maintenance areas are equipped with structures to prevent pollutants from entering the stormwater system;	
– routine inspections and maintenance are performed on all equipment and plant; and	Maint. activity No. 8 Maint. activity No. 9
– staff are trained so their actions minimise the impact on stormwater quality.	Maint. activity No. 10 Section 6.2.4
❑ Building maintenance and construction	
Ensure that:	
– materials are stored under cover;	Maint. activity No. 8
– building and cleaning wastes are not disposed of into the stormwater system; and	Maint. activity No. 9
– staff are trained in stormwater quality best practice techniques.	Maint. activity No. 10 Maint. activity No. 11 Section 6.2.4
❑ Graffiti removal	
Ensure that:	
– no toxicants are washed into the stormwater system; and	Maint. activity No. 12
– staff are trained in stormwater quality best practice techniques.	Section 6.2.4
❑ Emergency response	
Ensure that:	
– A response plan for spills has been incorporated into council's emergency response plan.	Maint. activity No. 13

6.3 Construction activity

Construction activity can be divided into two phases. The land development phase and the building phase. Both of these phases are known to result in serious stormwater pollution unless managed appropriately.

Land development stage

Land development involves making undeveloped land suitable for urban uses through land forming and provision of services such as roads, drainage, water supply, sewers, electricity and gas. Land development usually involves major earthworks resulting in significant potential for contamination of stormwater by eroding soils (Figure 6.7).

Building stage

Building construction can result in significant soil disturbance as well as contaminate stormwater with building wastes. Pollutants can include litter, rubble, concrete mixer waste, paints, plaster, brick sand, cleaning products and imported soils, etc (Figure 6.8).

Figure 6.7 Land development results in significant vegetation removal and soil disturbance.

Effective source control measures employed during construction can greatly minimise the impact of both phases of construction activity on stormwater quality. Site management plans are an effective means of planning and implementing measures to minimise the generation of pollutants from construction activities.

This section discusses the issues involved with both phases of construction and provides some best practice measures that can reduce pollutants reaching the stormwater system. General guidelines for developing a site management plan are also included.

A checklist illustrates the steps involved in the planning process and a range of controls are described that can be applied in site management plans. More detailed design guides for site control measures can be found in NSW Department of Housing, 1998, *Managing Urban Stormwater: Soils and Construction*.

Figure 6.8 Building construction waste.

6.3.1 Site management plans

For building and development works on areas larger than one hectare a site management plan is recommended. The plan should include:

- a description of measures to mitigate pollution threats to stormwater;
- recommendations that can be followed easily and used on-site (usually including A1 size plans); and
- a commentary that describes the development of the plan.

The purpose of the plan is to ensure that effective soil and water management is an integral part of construction works.

For sites smaller than one hectare, the objective of stormwater quality protection remains the same. Most of the pollution control tools are equally applicable to small sites, although more emphasis on building waste management is necessary. The checklist in Section 6.3.3 can be used to ensure that adequate provision has been given to pollution control on-site even if not presented in a formal plan.

Site management plan objectives

Site management plans aim to minimise the generation and export of sediment and other pollutants resulting from construction activities. Generally this can be achieved through:

- coordination of erosion controls with construction activities, including the staging of works;
- minimising soil exposure during construction;
- hasty and extensive revegetation works;
- effective management of water on to, within and from a site;
- provision of suitable access tracks and loading, unloading, maintenance and wash-down areas;
- effective litter management and 'house-keeping' practices;
- employing sediment capture techniques for large sites; and
- a flexible plan that can incorporate unexpected changes in the design or severe weather conditions.

NSW Department of Housing (1998) presents extensive practical techniques for developing a site management plan and provides details of measures that can be employed to manage erosion and sediments on site.

It is recommended that all site management plans have, as a minimum, the following features:

1 *Set of drawings* clearly showing the site layout and features and locations of erosion control works and other measures to minimise pollution.

2 *A narrative* accompanying the plans to describe how erosion and sediment control measures were chosen and their maintenance requirements.

3 *Background information* including site boundaries, contour maps, existing vegetation, location of site access and other impervious areas and existing and proposed drainage pathways with discharge points also shown.

4 *Program of works* containing details on the nature and specific location of works (revegetation, cut and fills, run-off diversions, stockpile management, access protection), timing of measures to be implemented, and maintenance requirements (extent and frequency).

5 *Engineering details* outlining methodologies for each control measure, with supporting engineering calculations for all proposed sediment basins, constructed wetlands, GPTs, etc. Details should include procedures for construction and maintenance requirements as well as the predicted performance of each measure.

Section 6.3.3 contains a checklist for developing and assessing site management plans.

6.3.2 Source controls for construction activities: index

The are a number of simple ways to minimise pollution from construction sites. Significant improvements can be achieved with careful planning and coordination between construction activities and control measures.

The following eight source control measures highlight the main concepts for reducing pollution from construction sites.

Figure 6.9 Exposed soils and unprotected drainage lines can erode readily.

Construction activity No. 1: Erosion control

Description

During construction, site clearing leaves soil exposed and it can be easily eroded. The following list provides a guide to preventing erosion on construction sites.

Erosion control: suggested measures

- *Programming*: install erosion control measures before construction commences. Schedule construction activities to minimise land disturbance.
- *Land clearing*: minimise the extent and duration of land clearing.
- *Site access*: limit and control site access and, where possible, use permanent roads rather than temporary access tracks. Ensure temporary access roads are stabilised.
- *Services*: coordinate the provision of site services to minimise disturbance.
- *Stockpiles*: locate stockpiles away from concentrated flows and divert run-off around them.
- *Stormwater and run-off systems*: install temporary drains and minimise concentrated water flows. Control stormwater velocity where necessary with temporary energy dissipater structures. Divert run-off around trench excavations or disturbed areas.
- *Rehabilitation*: revegetate or stabilise all disturbed areas as soon as possible.

Figure 6.10 Stabilisation and revegetation protect soils from erosion.

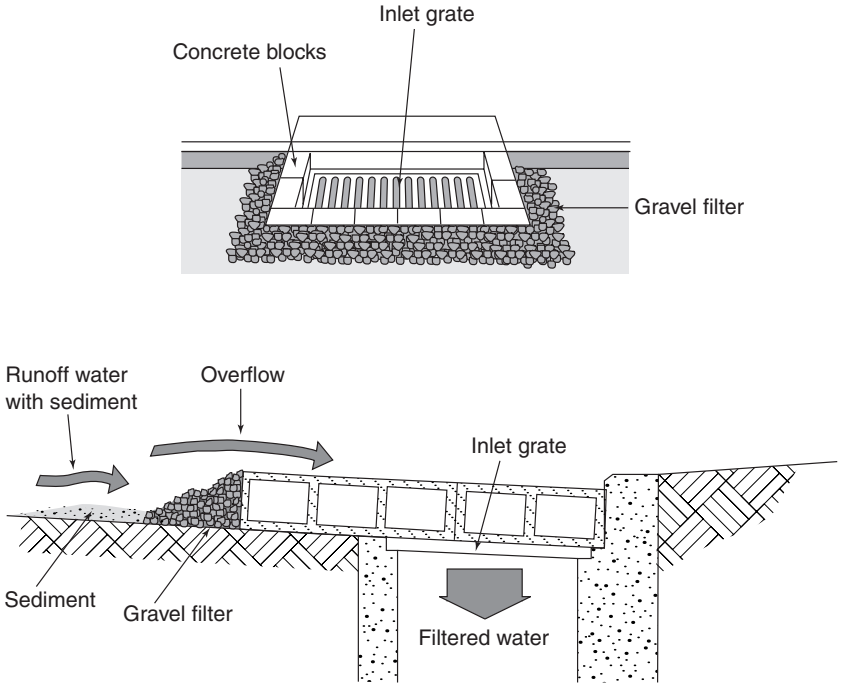


Figure 6.11 Block and gravel filter.

Construction activity No. 2: Sediment collection

Description

If erosion does or is likely to occur on a site, sediment export is an inevitable result. The following measures may be employed to capture the sediment and reduce the amount of sediment that leaves the site.

Sediment collection aims

- to minimise the generation of dust, litter and debris within the site;
- to introduce a regular site maintenance schedule; and
- to install sediment control devices to capture mobilised sediment.

Sediment control: suggested measures

- *Grass filter strips* : these encourage sediments to settle as water passes over a vegetated area.
- *Sediment filters* : these use materials such as fine mesh or geofabric to filter run-off prior to discharge.
- *Sediment traps*: temporary sedimentation basins.
- *Temporary side entry pit filters* : small removable structures that prevent sediment entering kerb inlets (such as a block and gravel filter shown in Figure 6.11).
- *Drop inlet filters* : such as straw bales and silt fences, which prevent sediment entry to the drainage system.

Construction activity No. 3: Site water control

Description

Managing the collection and flow of stormwater on a construction site is a key factor to minimising erosion and sediment export.

Site water control: suggested measures

- *Plan and prepare*: identify drainage lines and control measures to treat estimated stormwater volumes and sediment loads.
- *Water diversion*: to reduce run-off over exposed areas, re-direct water using diversion earth banks and catch drains. Prevent water from running over cut or fill batters. Provide piped or lined drains if this cannot be avoided.
- *Temporary drains*: build temporary drains as short as possible and do not connect directly to waterways.
- *Erosion prevention*: minimise the quantity of stormwater entering disturbed areas. Use grass or rock beach drains to prevent scouring and energy dissipaters to break up high velocity flows.
- *Bridge facilities*: provide properly constructed vehicular crossovers for crossing waterways.
- *Maintenance*: implement site inspections, maintenance and cleaning programs.

Construction activity No. 4: Equipment storage and maintenance

Refer Section 6.2.2, Maintenance activity No. 9: Plant and equipment.

Construction activity No. 5: Materials storage

Description

Stored material that has been poorly located or left unprotected can be a source of pollutants.

Materials storage: suggested measures

- *Stockpile location*: locate stockpiles and other material storage away from drainage lines and at least ten metres from waterways.
- *Stockpile construction*: minimise the number and size of stockpiles. Construct stockpiles with a height to width ratio less than 2:1. Surround unstabilised stockpiles and batters with silt fences or drainage systems that will collect and treat contaminated water.
- *Stockpile maintenance*: cover any stored material to protect it from rainfall. Mulch, roughen and sterile grass seeding can be used on any batter or topsoil stockpile that is to be maintained for longer than 28 days.

See Figures 6.12 and 6.13.

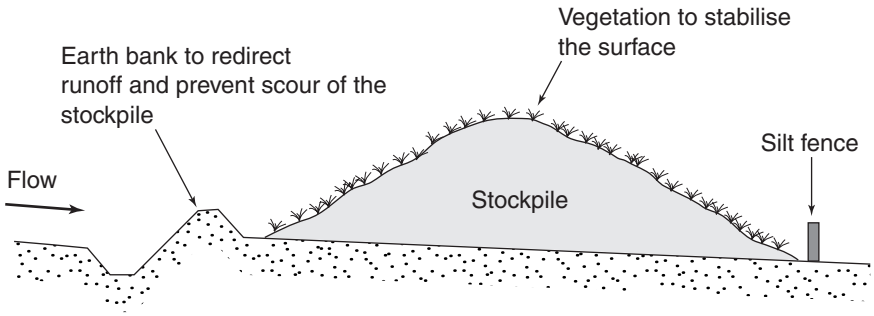


Figure 6.12 Stockpile management.

Figure 6.13 A silt fence around a stockpile.

Construction activity No. 6: Litter control

Litter control: suggested measures

- *Litter storage and housekeeping*: maintain a high standard of housekeeping. Store all litter carefully so it cannot be washed or blown into the stormwater drainage systems.
- *Rubbish bins*: provide bins for construction workers and staff at appropriate locations, particularly where food is consumed.
- *Daily site clean-up*: clean up site of all litter daily.
- *Rubbish disposal*: dispose of scrap materials (e.g. off-cuts and scrap machinery components) in a responsible manner.
- *Staff education*: conduct ongoing staff awareness programs, reinforcing the need to avoid littering.

Local laws can also be an effective way to control litter on construction sites. Clauses from such laws can be included in contracts to specify appropriate litter management practices.

Local law examples

'The builder must provide an on-site container to dispose of wind blown refuse for the duration of the building work. The bin must not be allowed to overflow.' (City of Casey).

'When carrying out building works on your premises make sure you have the necessary permits and have organised suitable waste collection for all building waste.' (City of Melbourne, as part of promotional campaign to clean up laneways within the city)

Construction activity No. 7: Building activity

Refer to Section 6.2.2, Maintenance activity No. 11.

Construction activity No. 8: Wash-down practices

Description

Building activities such as concrete delivery and pouring, masonry cleaning, grinding and demolition, and painting, can all involve wash-downs during clean-up. Unmanaged, these activities can contribute many pollutants to stormwater. It is therefore imperative to ensure that all wash-down run-off is contained on-site.

Wash-down: suggested measures

- *Designated areas*: providing designated wash-down areas that deliver wash-down wastes away from the stormwater system.
- *Containment*: contain wash-down run-off on site by using holding basins to prevent entry to the stormwater system.
- *Temporary filters* : fit temporary inlet pit filters near wash-down areas to prevent pollutant entry to the drainage system.
- *Spillage/leakage clean-up*: develop and implement procedures for the prompt clean-up of any spills.
- *Site clean-up*: sweep wash-down areas regularly to prevent additional pollutants being mobilised.

6.3.3 Site management plan checklist

The following checklist can be used to help develop a site management plan or to assess that adequate measures for stormwater protection will be implemented on a proposed development. The checklist highlights the key components and considerations that a site management plan should incorporate.

Site management plans: checklist	**Construction activity or section number**
General	
▪ Is the site larger than one hectare?	
if yes:	
– You need to develop a site management plan. See the checklist in Section 6.3.3	Section 6.3.2
if no:	
– Use building best practices to reduce pollution threats (e.g. open bin or skip, hay bales or silt fences on boundary, prompt revegetation of site, prevention of sediment export by vehicles)	
Presentation of site management plans	
▪ Will the works require soil to be exposed?	
if yes, have adequate site management plans been prepared with:	
– plans in scale of at least 1:2000; and	
– accompanying documents that explain the rationale for proposed actions.	
Details of site management plans	
▪ Do the plans have adequate information on	
1 Location of features such as:	Section 6.3.1
– site boundaries;	Section 6.3.2
– vegetation type and areas to be protected;	
– drainage pathways including contours and discharge points;	
– impervious surfaces (access roads and parking areas);	
– natural features to be protected (e.g. streams and wetlands);	
– limits of vegetation clearing;	
– areas for storage including hazardous materials and stockpiles;	Const. activity No. 5
– areas of grading, cutting and filling; and	
– access tracks to be installed.	
2 Coordination with construction plans:	
– major milestones in construction and how the erosion and sediment control measures relate to these.	
3 Proposed control measures including where appropriate:	Section 6.3
– diversion of water from construction areas;	Const. activity No. 3
– erosion control measures;	Const. activity No. 1
– sediment retention measures;	Const. activity No. 2
– provision for stockpile location and management;	Const. activity No. 5
– plans for vegetation removal and revegetation;	
– adequate access provisions to and from the site;	Maint. activity No. 10
– measures and actions for unexpected events (e.g. storms, work stoppages);	
– maintenance requirements for each measures recommended; and	
– timing of measures in relation to the construction program.	
Review construction plan	
▪ Is the construction plan integrated with the site management plan and does it provide for:	Section 6.3.2
1 implementation of erosion and control measures within the construction plan;	
2 coordination with site management plans;	
3 flexibility for unforseen events; and	
4 any other issues not otherwise covered that could affect stormwater quality?	
Construction site best practices	
▪ Are there procedures in place to deal with:	
1 litter control on-site and from the site;	Const. activity 6
2 refuelling and maintenance of vehicles and equipment;	Maint. activity 9
3 unloading and loading to minimise spillages;	Maint. activity 10
4 training for staff in procedures for accidental spills; and	Section 6.2.3
5 wash-out and wash-down for painting, concrete works, grouting, etc.	Const. activity 7/8
6 storage of materials on-site.	Maint. activity 8

6.4 Business surveys

Some business activities have significant potential to pollute the stormwater system. For example:

- commercial areas are known to generate high levels of litter;
- industry can contaminate stormwater through poor control of industrial processes, or the transport, handling and storage of goods;
- food preparation businesses may have poor facilities for waste handling and disposal; and
- the motor vehicle repair industry uses and produces many materials with potential to seriously contaminate stormwater and pollute waterways.

Responsibility for dealing with these pollution generating activities rests with the managers of the business enterprise. Education backed up by enforcement is the best means of ensuring business managers are aware of their potential to pollute and have knowledge of the measures available to minimise pollution risks.

Surveying business operations is an effective means for determining the extent and nature of activities with the potential to pollute and therefore targeting education and enforcement programs appropriately. The remainder of this section presents a methodology and checklist for conducting surveys of businesses that have the potential to pollute urban stormwater.

Education is a key tool for addressing stormwater pollution generated by business. Methods for developing education programs, a range of educational tools and examples of proven programs are presented in Section 6.5.

6.4.1 Stormwater pollutant surveys

The purpose of a survey is to identify business activities that are potentially generating pollutants likely to affect stormwater quality. Surveys can be used to help target pollution reduction programs (e.g. to locate a treatment measure or target an education program) or can be used to assess the performance of a program to improve business practices. The survey process itself can also be used to raise awareness amongst business operators of their potential to pollute.

Business surveys

Business surveys are a useful tool for determining the nature and extent of activities with the potential to pollute local waterways. A survey can be carried out by face-to-face or telephone interview or mailed question sheets. Surveys can be targeted (specific area or industry), random (a certain number of enterprises within an area), or representative (enterprises

selected as being representative of a broader group). The checklists in the next section can form the basis of a survey questionnaire. Development of a survey program should be carried out in conjunction with the local operations group of the EPA. Local Waterwatch groups or other community groups may also be able to assist carrying out surveys.

Water quality assessment

Another way of surveying activities that affect stormwater quality is through water quality monitoring. Data collected from water quality monitoring can be used to isolate catchments that contribute high concentrations of pollutants. Some pollutants are indicative of specific problems and these data can be used to isolate the problem and then perform a detailed investigation to locate the source (e.g. high levels of E. coli in drains indicate the presence of faecal contamination and an illegal sewer connection to the stormwater system is a possible cause).

Water quality monitoring data are collected by EPA in Victoria and in Melbourne by Melbourne Water. These organisations can provide data and also advise on water quality monitoring methods and equipment. The Waterwatch Program is also a way of involving the community with a water quality monitoring program.

More detailed investigations can involve remote videos or plumbing inspections in the drainage network to identify pollution sources. However, these methods are costly and time consuming. Before considering such investigations it is recommended that an initial survey (using the checklists) of problem areas is undertaken to appreciate the extent and nature of the problem and to assess whether a more detailed investigation is warranted.

6.4.2 Stormwater quality checklists for businesses

The checklist presented in this section is designed to evaluate a range of business related activities for their potential to pollute and can be used as the basis for questionnaires. Use of the checklists will help identify the nature and extent of those activities. This will assist the development and targeting of management programs.

Introductory questions	
	if yes, go to:
1 Are paved areas ever cleaned?	Section 1
2 Are any materials stored outside?	Section 2
3 Is material delivered onto the premises?	Section 3
4 Can packaging become litter?	Section 4
5 Does the business produce waste?	Section 5

1 Pavement cleaning/ wash-down areas	**Notes**
▪ Are paved area wastes swept and picked up for disposal?	
▪ Are appropriate chemicals used for cleaning?	
▪ Are clean-up wastes prevented from entering gutters/drains/ stormwater system?	
▪ Is litter the only waste likely to be generated on pavements?	
▪ Are there designated wash-down areas?	
▪ Is all plant maintenance performed in contained areas?	

2 Material storage and spill control

- Are storage containers regularly checked for leakages and storage levels?
- Are outside storage areas contained (e.g. bunding) to prevent any materials reaching the stormwater system?
- Are they protected from vandals/pests/water?
- Are there contingency plans for spills/escape of stored materials?
- Are staff trained in spill procedures regularly?
- Are high risk areas isolated from the drainage system?

3 Delivery and transfer

- Are there designated delivery areas?
- Are delivery areas under cover and protected from run-off?
- Are delivery areas regularly inspected and cleaned?
- Are spill capture boxes used to contain spills on-site?
- Are loads covered when leaving the premises?
- Are there spill control procedures in place, and are staff trained?

4 Litter management

- Are areas that generate litter regularly cleaned?
- Are bins provided for customers/staff?
- Are the paved areas surrounding the premises regularly cleaned to remove litter?
- Have sources of litter been identified?
- Have litter management measures been reviewed recently?

5 Waste storage and disposal

Waste storage and collection

- Are stored wastes protected from escape during high winds or rain?
- Is the storage area isolated from the stormwater system?
- Should material escape the storage container, will it be contained on-site?
- Are waste containers always emptied before reaching capacity?
- Are waste collections regularly monitored to ensure no escape?
- Is the contractor required to clean-up after collection?
- Are storage containers protected from vandals and pests?

Waste discharges

- Are all wastes prevented from entering the stormwater system?
- Are there diversion or containment systems to prevent stormwater contamination?
- Are systems regularly inspected or tested?
- Are staff trained in their operation?

6.5 Education programs

Education is a key source control tool for dealing with activities carried out within residential households and business premises which have the potential to contaminate stormwater run-off. Individually these activities may seem insignificant. Given the number of households in urban areas (in Melbourne 70 per cent of the urban area is residential, or approximately 1.5 million homes), the total impact on stormwater quality can be very significant.

In many cases simple changes in attitude and behaviour can vastly reduce pollution of stormwater from domestic activities. This section describes a methodology for developing effective education and awareness programs for stormwater pollution. This includes a number of education tools and examples of successful programs.

6.5.1 Developing an education program

Why education programs are appropriate

Education is a most appropriate and effective strategy for minimising stormwater pollution for many reasons, including:

- **targeting diffuse sources**: the 'diffuse source' nature of the stormwater pollution problem means that structural solutions are often less effective than education.
- **targeting the individual**: the behaviour of individuals at home and work greatly influences stormwater quality. By targeting home and work practices, great improvements can be made.
- **whole community impact**: education has the capacity to mobilise the whole community and can therefore have a major effect on stormwater quality.
- **linking opportunity**: education provides the opportunity to clearly link individual behaviour and water quality.
- **a major motivator**: simple messages such as 'stormwater flows untreated into our rivers and oceans' is a major motivator for appropriate behaviour.

Education should be an integral part of any stormwater management program. Best results will be achieved when education is used to support a range of regulatory, policy and economic mechanisms.

An education program is not an isolated set of activities; it is a number of integrated activities targeting different people for particular purposes.

Developing an education program

Effective community education requires a thorough understanding of the

- environmental issues;
- audience;
- behaviour targeted; and
- best ways to achieve an improved environment.

Objectives

When planning an education program, consideration should be given to both short and long term objectives.

Short term objectives

To improve the understanding of:

- how the streets, the stormwater system, rivers and oceans are interconnected; and
- how daily activities affect stormwater quality.

Long term objectives

- to encourage a true sense of responsibility for, and appreciation of, urban waterways.

The development process

There are seven key steps in planning an effective community education program. Figure 6.14 shows the steps in the process.

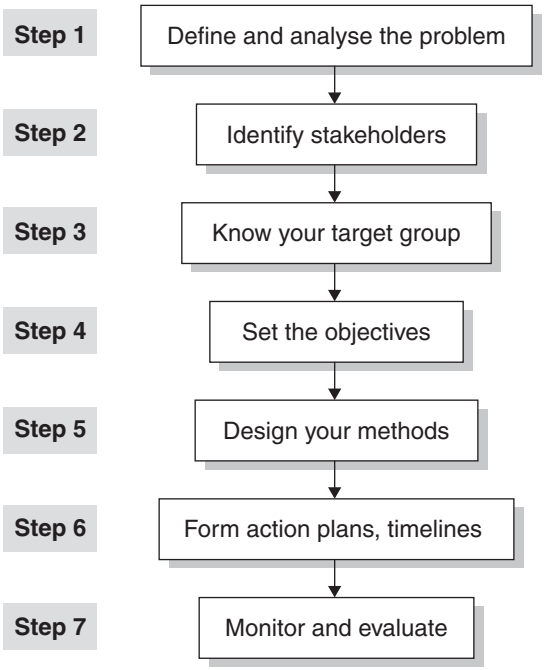


Figure 6.14 Stages of developing an effective community education program.

Step 1: Define and analyse the problem

This is best achieved by breaking the stormwater pollution problem down into component parts. It is essential to determine the sources of pollution and who impacts on these sources.

Step 2: Identifying stakeholders

Identifying who has a stake in the issues and involving them in the project planning and delivery will help ensure success. Stakeholders can be defined according to many crite-

ria. These can include geographical region, ethnic background, socio-economic group, age group, occupational group, special interest groups or behavioural or attitudinal sectors within the broader community.

There are a number of stakeholders that may affect stormwater quality. These include:

1 **Commercial businesses and industry**: for example shopping centres, the construction industry and the car repair industry. Many of these businesses are represented by industry associations.

2 **Land holders and residents**: for example local residents, farmers, local environmental and community groups.

3 **School/youth groups**.

4 **Municipal staff**.

Step 3: Know your target group

Precise identification of the target group is essential in developing a quality community education program.

Knowing the target group means much more than simple identification. It requires development of a complete profile, so that the most effective communication methods can be identified. This can include demographic information such as age, gender, socio-economic status and level of education.

Step 4: Set objectives

Once the issues and the target groups are identified, specific program objectives can be set. The objectives indicate the awareness, understanding or attitudes that are targeted.

Identify one or two simple key messages to communicate these objectives to the target audience. These messages can be categorised as follows:

1 **Informative messages**: these convey facts. For example, '90 tonnes of dog faeces is produced each year in metropolitan Melbourne'.

2 **Feeling messages**: these get people emotionally involved in an issue. For example, 'plastic bags in waterways can kill or injure animals'.

3 **Responsibility messages**: such messages appeal to a person's sense of what is right or proper. For example, 'people in the car industry should be using the sewerage system and not the drainage system to dispose of car wash effluent'.

4 **Empowering messages**: a message to empower people to act. For example, 'individual actions, no matter how small, do make a difference'.

5 **Action messages**: these advise people of how they can become directly involved. For example, 'don't wash paint brushes in the sink. Dispose of excess paint by wiping it on newspaper, wash the brush with water then poured the water on your lawn or garden'.

Step 5: Design your methods

The most successful programs use techniques specifically designed for the target audience. Determine which education tools and techniques are likely to work most effectively with a particular target group.

A mixture of techniques may increase the chances of success. Finally, you will need to check that there is an appropriate balance between tools which inform and those which facilitate action. More about tools later in this chapter.

Step 6: Form action plans and timelines

Planning the education program requires consideration of costing, timelines, distribution, approvals and briefs. The plan guides all project activity and should be revisited often during the project.

Costing

Identify initial and recurrent costs including staff, ongoing costs and the possibility of any potential income. There are a number of factors to consider when costing a project including:

1 **Funding sources**: what possible sources of funding are there beyond one organisation. Are there any 'in-kind' opportunities?

2 **Sponsorship**: is sponsorship from the commercial/ industrial sector possible?

3 **'Trim to fit'**: how can the project be modified if sufficient funds are not found?

Step 7: Monitor and evaluate

This requires the collection of information and records to show the effectiveness of the project. This is often the most difficult step and is too often neglected.

Audit review questions might include:

1 Did the message(s) reach the audience to the extent expected? How is this known?

2 Were the message(s) understood?

3 Were the expected outcomes reached? Did behaviour change?

Linking programs

A broad infrastructure of stormwater and environmental education programs and resources exists to help in program development.

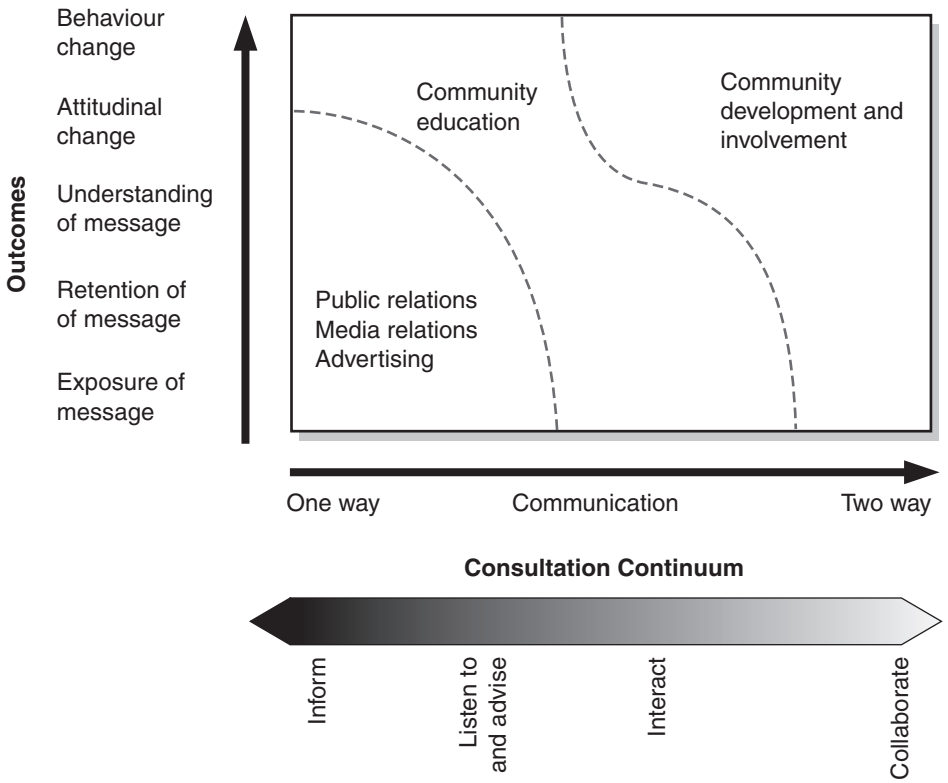


Figure 6.15 The communication model.

1 **Local programs**: integrate stormwater quality programs into existing local programs run by council or other agencies.

2 **External programs**: link in with an existing programs in other municipalities around the state or country.

3 **Advisory groups**: involve focus or advisory groups in the development of education programs.

Tips for effective communication

Community education messages need to be communicated clearly from the outset. The following are suggestions for effective communication:

1 **Clear and concise**: provide a clear, concise and consistent message describing how the target audience contributes to storm water quality programs and how it can reduce its impacts.

2 **Plain English**: use everyday language. Use external reviewers to reduce the use of technical terms, acronyms and jargon.

3 **Simple messages**: break up complicated subjects into smaller more simple concepts. Present these concepts in a metered and organised way, to avoid 'overloading' and confusing the audience.

4 **Link messages**: ensure each message clearly relates to the last in the sequence.

5 **Foreign languages**: translate your messages into the foreign languages within your community. Ensure that cultural differences are considered when messages are translated.

6 **Check correctness**: make sure all messages have a sound, up-to-date technical basis.

The communication model shown in Figure 6.15 illustrates how behavioural changes are best achieved through two way, collaborative communication.

6.5.2 Educational tools and techniques: index

Most individuals require exposure to the same message many times before becoming conscious of it.

Given limited resources, the question therefore is not which one medium is best, but which mixture of media can deliver optimal results.

This section presents a range of tools that can be used to develop educational programs. These are then illustrated in a number of case studies.

Tool 1: Printed material

Description

Simple residential information sheets can quickly become monthly or quarterly publications containing a variety of stormwater quality information. Such publications should incorporate program logos and slogans, so that the material is easily associated with other program material and the program in general.

Examples

Newsletters, fact sheets, brochures and posters.

Tool 2: Media

Description

Selected media activities can offer widespread publicity and the opportunity to relay the messages repeatedly.

Examples

Press releases, advertising and public service announcements.

Tool 3: Signs

Description

Billboards and council vehicles present another opportunity for relaying a message related to stormwater.

Tool 4: Community programs

Description

There is a wide choice of community-based programs available, ranging from simple drain stencilling through to clean-up days and establishing 'friends' groups to look after particular areas. All offer huge potential to work with the community and its resources.

The short lead time and low maintenance costs of a storm drain stencilling program makes it an attractive activity for local communities (see Case study 1).

Examples

Storm drain stencilling, community clean-up days.

Tool 5: Displays

Description

Direct contact between municipal staff and the public can provide an excellent opportunity to relay the importance of stormwater management.

Environmental booths may be set up at special functions and festivals, or during periods of particular environmental significance; for example Arbour Day, National Water Week or World Environment Week (see Case study 2).

Tool 6: Community water quality monitoring programs

Description

Encouraging community participation in environmental monitoring programs provides an excellent means of 'hands-on' education.

In Victoria, three highly successful water quality monitoring programs have adopted this approach: Waterwatch, Community Streamwatch and Beachwatch. All are excellent community water quality monitoring programs, which have been interlinked into other programs throughout Victoria (see Education program examples 3, 4 and 5).

Tool 7: Launches

Description

Attracting public attention through a launch is a great way to boost the profile of an education program. Guest speakers can be incorporated into the launch program to communicate important issues.

Tool 8: Local action committees and groups

Description

A number of councils around Victoria are using committees as a means of developing and coordinating stormwater programs. Examples include the Darebin Creek Coordinating Committee and Merri Creek Management Committee (see Case studies 6 and 7).

Tool 9: Consumer programs

Description

Point of purchase displays and other programs that provide information to consumers about waste provide an effective means of waste management. These raise environmental consciousness at the prime source of packaging waste.

Examples

Grocery bags with logos and slogans, environmental ratings of products, consumer information.

Tool 10: Business programs

Description

Many businesses have the potential to cause stormwater pollution. Education efforts can be focused on these 'priority' business groups. Small businesses, in particular, need assistance with understanding the problems of stormwater pollution and how to improve practices.

Successful business programs that have been run in Victoria include the Considerate Business Program which targeted local shop traders (see Case study 6), and the Local Motor Vehicle Repair and Services Industry Program (see Case study 8). A certification program can be initiated to ensure developers and contractors meet best practice standards. This process ensures a minimum competence level has been achieved and that stormwater pollution prevention plans are in place.

Example

Workshops and publications, business charters, environmental ratings of businesses.

Tool 11: School education programs

Description

Developing environmental awareness from an early age is an effective long term means of changing community behaviour and attitude.

Councils have been most effective in developing local environmental education programs for schools. The Plenty River Discovery Program is an example of a program designed by local councils for school education (see Case study 9).

When developing a school education program, 'fun' is the key element. Start with the key environmental messages, then design fun and exciting activity programs to relay these message.

Facility tours of a wastewater treatment plant or a municipal waste collection centre, or contests to develop posters and calendars, are examples of fun ways to develop children's awareness of stormwater issues.

It is important to discuss the program with school teachers, to determine their needs and how the environmental education program may fit into the school curriculum.

There are a number of current programs that can be incorporated into education schedules. These include Community Streamwatch or Waterwatch for water quality sampling or drain stencilling.

Existing programs and providers

For councils lacking the resources or time to put together an education project, an education provider may be an alternative option. The *Environmental Education Contacts Directory 1997* available from the Victorian Association of Environmental Education, provides a comprehensive listing of education providers throughout Victoria.

There are a variety of education providers offering environmental programs, which local councils can promote to local schools. Some examples include the Gould League

Figure 6.16 A typical drain stencil message.

(Moorabbin), CERES (East Brunswick) and Scienceworks (Spotswood). Councils may choose to support or promote school attendance at these programs as a positive approach to environmental education.

The following programs can easily be promoted by local government to schools:

- Catchment Connections (refer to Case study 10),
- Beach Secrets: Marine Program (refer to Case study 10),
- Bay Litter Watch Program: An Environmental Project, conducted by the Gould League (refer to Case study 10),
- Drain Watch and Waterways Watch (refer to Case study 11),
- Rain and Drain Chemistry: Atmospheric and Stormwater Pollution (refer to Case study 12).

6.5.3 Examples of education programs

This section presents a range of education programs used around Victoria.

Drains to the Bay: A Water Pollution Kit

CASE STUDY 1

Melbourne Water

Target audiences	Years three to six primary school students
Objectives	To develop an integrated education program on stormwater pollution, meeting teachers' needs and linking in with the Victorian curriculum and standard framework.
Approach	The Drains to the Bay kit is used to create an awareness of the stormwater pathway, the pollutants that are picked up, the impact of these pollutants and how we can reduce the problem. The kit can be adapted by teachers to form the basis of their own water pollution program, or they can follow the format and activities supplied.
Support material	The kit contains a 10-minute animated video and a 50-page teacher's booklet, which includes over 32 activities and background notes. Stencilling kit: the stencilling of pollution messages on side entry pit covers or nearby footpaths is a key activity described in the kit. Stencil kits reading 'Care about the Bay—Litter Washes Away' have been provided to Rotary clubs for distribution to program participants. For bayside municipalities a dolphin is incorporated in the stencil, so that children and adults can associate marine wildlife with stormwater pollution. Councils that lie further inland prefer to use a platypus in their stencil designs to make the association with local waterway habitat.
Achievements	▪ Over 700 education kits have been sold since 1992. ▪ The drain stencilling program in Melbourne has been extended through a partnership between Melbourne Water and Rotary. Since September 1995, 50 rotary clubs have become involved, purchasing around 100 Drains to the Bay school education kits to pass on to local primary schools. ▪ The Cities of Manningham, Wyndham, Maroondah, Banyule, and the Shire of Melton have also purchased kits. These have been passed on to local community groups and schools. ▪ The program achieved finalist status in 1993 Australian Teachers of Media (AToM) Awards. ▪ The Brighton Rotary Club was awarded the 1994–95 Rotary International Significant Achievement Award for its involvement in the Drains to the Bay Program.
Contact details	Further information can be obtained by contacting Melbourne Water on (03) 9235 7100, or Rob Tucker of Brighton Rotary on (03) 9555 0522.

Envirofest: A Community Education Awareness Festival

CASE STUDY 2

Cities of Manningham, Banyule, Nillumbik; Parks Victoria and Eco-Recycle

Target audience	Local community
Objectives	It is hoped that visitors to the festival develop a greater understanding of environmental issues and how their actions can be changed for the better.
Approach	Adopting a different environmental theme each year, Envirofest is an annual event held at Westerfolds Park in Templestowe. It attracts more than 10,000 people from across Melbourne. The festival is held on the first Sunday in June to coincide with World Environment Week.
Requirements	▪ Local schools are asked to participate in environmental education projects, all of which are displayed on the day. ▪ In 1997, 17 early childhood centres from around the area participated in the Drains to the Bay Program. Children from each centre were supplied with stencilling kits, which were modified to include a platypus figure—a locally familiar symbol, which provides a ready association with the local waterways. ▪ The centres were encouraged to use plant- or animal-based detergents or soaps rather than those based on photochemicals.
Achievements	With the backing of three municipalities surrounding Westerfolds Park in 1996, Envirofest became a truly regional festival. The cities of Banyule and Nillumbik joined the city of Manningham as major sponsors.
Contact details	Further information on this project can be obtained from Pam Pagigiotis (City of Manningham) on (03) 9840 9362.

Waterwatch: Waterway Community Monitoring Program

CASE STUDY 3

Department of Natural Resources and Environment

Target audience	Local community
Objectives	▪ To increase community awareness and understanding of water quality issues. ▪ To increase community involvement in management decisions affecting the water resource. ▪ To encourage collaboration between the community and the resource managers. ▪ In the long term, to generate useful data for community and agency use, complementing data presently collected by agencies' monitoring networks.
Approach	The community monitoring networks comprise community groups and schools, acting in partnership with local resource management agencies to: ▪ monitor environmental and water quality in their catchment; ▪ share data throughout the catchment; ▪ detect catchment environmental problems; ▪ jointly develop appropriate action; and ▪ assess and review catchment-based management plans and activities.
Requirements	Anyone with an interest in monitoring and water quality issue can participate (e.g. Landcare groups, community organisations, school groups and so on).
Support material	A range of material is available on request: manuals, equipment and so on. Waterwatch also has an internet site http://www.vic.waterwatch.org.au.
Problems and issues	Throughout Victoria, a wide range of individuals and groups participate in Waterwatch. These include landholders and water authorities, through to primary and secondary students. In conjunction with their local water authority or agency, groups develop their own Waterwatch Program based on a wide range of catchment environmental issues. The partnership determines a monitoring program, ensures that quality assurance and control occurs, feeds results back to the water managers and develops appropriate follow-up actions.

	The Waterwatch Program currently collects information about: ▪ stream or wetland habitats, ▪ biological monitoring for macro-invertebrates, algae and E. coli, and ▪ monitoring of temperature, pH, turbidity, nutrient content (nitrogen and phosphorous), dissolved oxygen, conductivity and flow rate.
Achievements	▪ Over 500 monitoring groups are currently involved, supported by more than 90 partners and program sponsors. ▪ Waterwatch was the winner of the Australian Financial Review/Telstra 1996 Internet Award.
Contact details	Contact Waterwatch Victoria on (03) 9412 4663 or (03) 9412 4072.

Figure 6.17 Students conducting water quality sampling as part of Waterwatch. (Photo courtesy of Waterwatch Victoria (DNRE))

Figure 6.18 The Camel Trek entourage taking water quality samples along the Goulburn River from the junction of the Goulburn and Murray rivers to Eildon Weir. One of the many unique monitoring activities conducted as part of the Waterwatch Program. (Photo courtesy of Waterwatch Victoria (DNRE))

Melbourne Waterwatch: A Community Water Quality Monitoring Program for the Port Phillip Region (formerly Community Streamwatch)

CASE STUDY 4

Melbourne Water

Target audiences	▪ Local community ▪ School groups
Objectives	To develop a schools and community waterway monitoring network that in turn becomes the advocate for behavioural change among the wider community.
Approach	Schools: a hands-on learning project with real world outcomes. Students become teachers and communicators. Groups work in partnership with local councils and Melbourne Water. Groups: an opportunity for groups to demonstrate the improvements they have made with revegetation and educational projects.
Requirements	▪ Any school or group can join the Melbourne Waterwatch mailing list and be part of its annual 'Snapshot'. ▪ Intending participants should liaise with their local council conservation officer who in turn will contact Waterwatch staff.
Support material	▪ Manuals ▪ Monitoring kit ▪ Free training days ▪ Internet site ▪ Videos ▪ Sponsorship tool kit ▪ Local coordinators are employed by councils and provide day-to-day support for Waterwatch groups.
Achievements	▪ A Melbourne-wide network. ▪ A high degree of publicity and support. ▪ A $400,000 wetland area constructed at Newport with corporate sponsorship.
Contact details	Further information can be obtained by contacting Melbourne Water on (03) 9235 2100.

Beachwatch: A Community Beach Monitoring Program for Port Phillip Bay

CASE STUDY 5

EPA

Target audiences	▪ All beachgoers ▪ Local bayside communities ▪ Residents of urban catchments around Port Phillip Bay ▪ Media
Objectives	▪ To provide a regular information service about beach conditions and water quality around Port Phillip Bay during summer. ▪ To focus people's attention on our beaches. ▪ To raise community awareness about the causes of beach pollution, especially stormwater pollution.
Approach	▪ Throughout the summer, volunteer Beachwatchers report on beach conditions, including stormwater outlets, while the EPA monitors beach water for E. coli levels. ▪ Information is provided to the public via a regularly updated phone service. This information is also placed on the internet and regularly distributed to media. Any problems with stormwater outlets are mentioned. ▪ The Beachwatch Program maintains a high media profile over the summer months.

	▪ EPA also advises councils of any reports of concern about beaches and stormwater outlets. When applicable, EPA investigates any reports of pollution from stormwater outlets. This occurs throughout the year.
Support material	▪ EPA information bulletins are issued annually, providing an overview of beach conditions and water quality during the summer. These emphasise the major impact of stormwater pollution on beaches in Port Phillip Bay, and provide positive tips on 'what you can do'.
	▪ Posters, billboard advertising, T-shirts and suncaps are also used to promote the program.
Problems and issues	▪ Focus will be increased on 'community involvement' rather than information services.
	▪ Volunteer Beachwatchers will be engaged in 'community monitoring' of beaches and stormwater outlets, as per other successful catchment management community education programs.
	▪ Other information products or services will be developed, e.g. radio reports.
Achievements	Since 1991, the Beachwatch Program has contributed to a heightened awareness of:
	▪ the potential health risks of swimming in bacteriologically contaminated water,
	▪ the fact that such contamination results from urban pollution via our stormwater system.
Contact details	Melinda Nutting, EPA Customer Service, on (03) 9695 2700.

Considerate Business Program

CASE STUDY 6

Merri Creek Management Committee, City of Moreland

Target audience	Local shop traders
Objectives	▪ To create awareness of the relationship between the stormwater system and litter pollution in waterways.
	▪ To promote litter waste minimisation with traders.
	▪ To provide traders with appropriate litter and waste minimisation information and advice.
Approach	▪ Audits were conducted to determine the source of existing problems in the shopping district.
	▪ Extensive shop owner interviews were carried out, advising each of best practice methods for waste disposal and shop front maintenance.
	▪ Literature describing stormwater pollutant sources and their effects was provided.
	▪ Community awareness was developed through the Litter Sisters mime act, performed on trams throughout the area. The performance provided a particularly novel and successful means of getting the message across. This component of the project was fully funded by the City of Moreland with support from the Public Transport Commission (PTC).
Requirements	▪ A 'fee for service' scheme.
	▪ Traders who participated in the program were given an accreditation certificate and window sticker for display.
	▪ Customers were encouraged to use calico bags instead of plastic.
Support material	▪ List of appropriate recyclable waste collectors.
	▪ Stickers and certificates.
Problems and issues	Timing and cost.
Achievements	The number of Sydney Rd, Brunswick and Coburg trader memberships increased from 52 in 1994, to 132 in 1996.
Contact details	Merri Creek Management Committee Education Officer, on (03) 9380 8199.

Environmental Education Program for Schools

CASE STUDY 7

Merri Creek Management Committee

Target audience	Primary and secondary school students years three to seven, school management, staff and parents.
Objectives	▪ To encourage an appreciation of the unique character of the Northern Yarra catchment waterways. ▪ To create an awareness of the environmental impacts of land management practices on local waterways over time. ▪ To achieve a change in attitude and behaviour in regard to litter and water pollution.
Approach	A whole school community approach is adopted, using theatrical performance as a stimulus. The program is also hands-on, interactive and curriculum focused. Topics: Understanding your Local Waterway—a performance, creek walk and support materials exploring: ▪ geological history, catchment and landforms; ▪ indigenous people, their culture and land-use practices; ▪ European settlement and land-use practices; ▪ indigenous flora and fauna; and ▪ weeds and feral animals. Water Pollution and Litter—a performance, drain stencilling activity and support material exploring: ▪ the difference between the stormwater and sewerage systems; ▪ the connection between the stormwater system and local waterways; and ▪ the environmental impacts of floatable litter and water pollution. Sources of litter and what we can do about them. This involves an in-school student letter audit, report and recommendations.
Requirements	Fee for service, class time provisions, access to a local waterway plus school administration and teachers' support.
Support material	A school program promotional video. Topic based on curriculum standard framework, with teacher's background information, graphic material and activities. In addition, publications such as *The Disappearance of the Spineless Bug*, *Creek Life* and *Plants of the Merri Merri* are also available.
Problems and issues	Timing program integration within a predetermined curriculum and timetable. Financial barriers in respect to performance cost ($3.50 per student)—this can discourage some schools from full involvement in the program.
Achievements	The program has been successfully piloted to 8 schools in the northern suburbs in 1996. Working with 17 schools in the cities of Darebin and Hume in 1998.
Contact details	Merri Creek Management Committee Education Officer, Phone on (03) 9380 8199.

Local Motor Vehicle Repair and Services Practices

CASE STUDY 8

EPA Dandenong, City of Greater Dandenong, Melbourne Water

Target audience	Local motor vehicle industry
Objectives	▪ To minimise the presently large amounts of industry wastes being discharged to stormwater drains and creeks—particularly Dandenong Creek.
Approach	▪ Provide good information to motor trade describing EPA recommended waste disposal and handling requirements. ▪ Liaise with City of Greater Dandenong. ▪ Write to TAFE colleges conducting motor trade courses and provide them information describing recommended waste disposal methods. ▪ Conduct an enforcement action campaign.
Requirements	Specifically to: ▪ cease the discharge of wash waters from detergent and degreaser washing of vehicles and paints to stormwater; and ▪ encourage the installation of properly built wash basins (connected to sewers) where necessary.
Support material	▪ EPA Publication No. 462 ▪ Dandenong Council Industry advice kit
Problems and issues	Around 1000 premises must overcome a traditional attitude to automotive waste disposal and the stormwater system—that stormwater drains are merely a waste disposal facility.
Achievements	A gradual acceptance of EPA standards by the automotive industry.
Contact details	Ken Taylor, EPA Dandenong on (03) 9794 0876.

Plenty River Discovery Program

CASE STUDY 9

Banyule City Council

Target audience	School students
Objectives	To promote the natural values of the river environment and increase community awareness of requirements for its protection.
Approach	▪ Involve local students in studies of the Plenty River environment, including assessment of habitat values and water quality monitoring. ▪ Incorporate a high level of community involvement in revegetation and restoration activities along the river. ▪ Promote the program through local media, displays and restoration activities. ▪ Integrate Plenty River studies with school course material. ▪ Prepare a report on project outcomes.
Support material	▪ Integration of Melbourne Waterwatch with these studies. ▪ Establishment of the Plenty River Discovery internet site through schools. ▪ Plenty River display materials.
Problems and issues	▪ Poor water quality in Plenty River resulting from urban run-off. ▪ Particular problem pollutants are litter and sediment. ▪ Extensive weed infestations along the river. ▪ Poor access to and community awareness of the Plenty River.
Achievements	▪ Extensive class studies undertaken by Montmorency Secondary College students on the Plenty River.

	▪ As part of this program, the college's years 8 and 10 science students are collecting data and information on the river and its environment. This includes information on its fauna, indigenous plants, weeds, habitat, geology, regional history, sources of litter and other pollutants. Melbourne Waterwatch has been incorporated into the program as the water quality monitoring component. The surveys will not only give the students a greater understanding of the existing eco-system, but will provide important information on human and animal impacts on our waterways. ▪ Involvement of schools and the Friends of Plenty River in revegetation activities. ▪ Media articles in the *Herald–Sun*, local press and school newsletters. ▪ Displays at Banyule festival and Envirofest. ▪ The Plenty River Discovery Report.
Contact details	City of Banyule on (03) 9490 4222.

Catchment Connections

Case study 10

The Gould League of Victoria, Melbourne Water

Target audience	School students
Objective	To provide a range of learning programs for school students. Three programs are available; one program for preps to year two students, and two programs for high school students—one hands-on and the other internet-based.
Approach	▪ Prep to year two program: children participate in an interview with 'King Neptune'. He or she is concerned about litter and other pollutants being washed into the bay. Children discover the wildlife around the beach and rock pools that need protection. ▪ High school students' program: students are provided with activities at the Gould League and along the coast and Mordialloc Creek. ▪ High school internet project: this uses the resources found on the internet to examine the impact of litter on the coast and sea.
Requirements	Bookings are required with Gould League for the two practical programs. Connection to the internet is preferable for the internet project, but a shorter, printed copy can also be mailed. Participants may want to use a neighbouring beach as their monitoring site.
Support material	▪ The Gould League has a permanent display. ▪ Groups receive a teacher's activities pack with relevant CSF links. ▪ Equipment is provided to students to discover life forms along the beach and the rock platform. ▪ Internet site http://www.shnet.edu.au/gould/gould.html ▪ A free *Catchment Connections* booklet is available while stocks last.
Problems and issues	▪ The program focuses on urban waste draining into creeks, rivers and the sea. ▪ Students identify that items washed down drains cause problems in the sea. ▪ Students build model litter traps. ▪ Beach litter is surveyed and counted. ▪ Creek water is monitored for pollutants.
Achievements	*Catchment Connections* allows students to examine the global issues of littering in the sea. The project provides an innovative approach to educating students about litter.
Contact details	Bob Winters at the Gould League on (03) 9532 0909.

Drain Watch and Waterways Watch

CASE STUDY 11

CERES

Target audience	School students
Objectives	▪ To provide experimental environmental education programs about stormwater management and related issues. ▪ To provide hands-on, interactive teaching and learning about, in and for the environment. ▪ To present the environmental, social and economic aspects of the waterways pollution problem.
Approach	▪ Drain Watch (for primary students) A program focusing on stormwater and sewerage, creek pollution (particularly rubbish), habitat (weeds and vegetation), birds and animals. Students explore changes along the Merri Creek, see the open stormwater drain and the MCMC litter trap, then investigate where the rubbish comes from. Students discover ways to protect the creek environments. ▪ Waterways Watch (for secondary students) A unit investigating water testing on the Merri Creek. Stream quality is related to geomorphology and land-use variations (including the use of the creek as a stormwater channel). Physical, chemical and biological indicators and habitat surveys are used to measure the health of the Merri Creek. This program includes a wide variety of physical and chemical tests (e.g. temperature, pH, phosphates, nitrates, chlorides, dissolved oxygen), plus transects and sketch mapping. Specialised equipment is available on-site.
Requirements	▪ Bookings are essential and there is a small charge. ▪ The minimum group size is 20. ▪ Drain Watch can be a half or full day program. ▪ Waterways Watch is usually a full day program. All equipment is supplied, including physical and chemical tests, transect equipment, nets, buckets, microscopes and dishes, aquatic species, identification charts, maps and data graphs.
Support material	All participating groups receive 'post-visit kits', continuing posters and brochures. Groups participating in the Waterways Watch Program receive a specially written booklet.
Problems and issues	CERES Education needs funding to retain its qualified teaching staff and equipment maintenance.
Achievements	In 1996, 3000 students participated in the programs.
Contact details	Contact Eric Bottomley, Education Manager or Cinnamon Evans, Co-ordinator of Environmental Studies on (03) 9387 2609 or (03) 9387 4472.

Rain and Drain Chemistry: Atmospheric and Stormwater Pollution

CASE STUDY 12

Melbourne Water, Science Teachers Association of Victoria, EPA

Target audience	School students
Objective	To help students understand that a knowledge of chemistry is essential in solving some of our most serious environmental problems.
Approach	Part of the Care About the Bay ... Don't Throw It Away Program. Written for use in units one and two of VCE Chemistry, 'Materials and Chemistry in Everyday Life'. An excellent resource for all students of senior chemistry.
Requirements	Interested schools should contact STAV Publishing for an order form. The cost of the *Rain and Drain Chemistry* booklet is $7.50, plus postage and handling.
Support material	*Rain and Drain Chemistry* booklet, which outlines a range of activities designed to help students understand the chemistry of stormwater and the atmosphere. These activities include practical work, analysing information from graphs and other data, concept mapping, role plays and problem solving.
Contact details	Contact STAV Publishing Pty Ltd on (03) 9428 2633.

6.6 Enforcement

6.6.1 Roles and principles of enforcement

Enforcement should be seen as a complement to management and education strategies. Councils have a variety of enforcement responsibilities and powers which are supported by those of other authorities, including EPA and CMAs/Melbourne Water. Enforcement may involve a warning or service of a notice requiring the recipient to carry out specified actions or imposing financial penalties.

Enforcement should be fair, predictable and consistent and should be blind to whether the party involved is an individual, company or government agency. The primary purpose of enforcement should be to prevent future problems by making polluters accountable. This acts to improve the polluter's practices and deter others from carrying out polluting activities.

6.6.2 Who should enforce?

For some types of stormwater complaints and pollution incidents, enforcement provision is available to more than one agency. The powers of council and EPA, for example, overlap. In these cases the agencies need to develop an understanding about who does what and how issues will be resolved.

In principle, the agency that permits a potentially polluting activity should enforce conditions on that activity. In other words, specific approvals (e.g. permit or licence) to use or develop land should be enforced by the permitting agency, including resolution of issues resulting from omissions at the approval stage. In the absence of specific approvals, any general right (e.g. planning scheme) to use or develop land should be enforced by the responsible authority to protect environment or amenity. The significance of an incident may also give some guidance on when local or State enforcement powers should be used. In some instances joint action between council and other agencies may be appropriate.

In general, council should take enforcement action when:

- a use is breaching the general amenity protection clause in relevant land-use zones;
- a breach of the planning scheme or a planning permit exists;
- a local law is being breached;
- a litter offence is noted; or
- a nuisance is being caused.

EPA should take enforcement action when:

- pollution or a state of environmental hazard is occurring or is likely to occur;

- a premises is causing a recurring breach of State environment protection policy;
- a scheduled premises is the source of problems;
- a litter offence is noted; or
- attempts to use local powers have proven ineffective in resolving a problem.

6.6.3 Enforcement powers of local government

Planning controls

The State Planning Policy Framework of Victoria requires all Local Government Planning Schemes to accord with State Environment Protection Policies (SEPP). SEPP (*Waters of Victoria*) states that 'where run-off from the land surface is likely to cause non-compliance with SEPP objectives, control measures such as the elimination or treatment of sources of contaminated run-off and/or changes to land-use or land management practices shall be applied where practicable'. These Best Practice Guidelines provide a practical means for minimising the impacts of urban stormwater run-off. Chapter 4 provides more information on the use of planning controls in stormwater management.

Planning enforcement

An authorised officer of a council may serve a Section 130 (*Planning and Environment Act 1987*) planning infringement notice on any person that the officer considers has committed an offence, including failure to comply with a planning scheme, planning permit or an agreement under the Act. These offences carry a fine of $200 and can stop the development or use of land, require action to prevent or minimise adverse impacts of development, or any other action to expiate the offence.

Council or any person can seek an S119 enforcement order, or the more immediate interim enforcement order, from the Victorian Civil and Administrative Tribunal (VCAT) to require the land-use to comply with the requirements of the planning scheme or a permit or agreement.

Council may authorise staff to conduct enforcement processes under the Planning and Environment Act. Authorised officers have powers of entry and can issue planning infringement notices. Many councils employ planning enforcement officers for this purpose. It is usually council or a delegated senior manager that would make the decision to apply for an enforcement order from the VCAT.

Local laws

Under Section 111(1) of the *Local Government Act 1989* a council may make local laws for or with respect to any act, matter or thing in respect of which the council has function or power under this or any other Act. The intention of this provision is to link a council's local law making power to its functions and powers conferred elsewhere. A local law cannot be inconsistent with an Act or Regulation and to the extent that it is,

it will not comply. This does not necessarily mean, however, that it cannot duplicate an existing law.

Section 8 of the *Local Government Act 1989* provides that a council has the functions listed in Schedule 1 of that Act. Schedule 1 provides that councils have functions relating to the peace, order and good government of the municipal district including environmental control, protection and conservation.

Councils have the power to introduce local laws to protect stormwater quality which is fundamentally related to councils' environmental protection function.

Local laws can protect many aspects of the environment. Some existing local laws which relate to stormwater protection are attached by way of example.

The powers to enforce local laws are usually delegated to local laws officers, but councils can appoint any person (other than a councillor) to enforce the provisions of a local law.

Local laws for stormwater protection: example

The following local laws are currently in use by one or more Victorian councils.

Stormwater

- An owner or occupier of any land must not cause or permit any substance other than stormwater to be discharged from the land into the stormwater system, unless otherwise authorised by council or a statutory authority.

No waste beyond the boundaries

- An owner or occupier of land must not cause or permit the discharge of any solid, liquid or gaseous waste beyond the boundaries of the land, unless otherwise authorised by council or a statutory authority.

Construction sites: protection of roads and stormwater

- A person must not cause or permit the deposition of solid or liquid waste, sand, silt, clay, stones or sediment on roads by vehicles leaving a premises.
- In the event that any waste from a premises is deposited on a roadway, a person must not cause or permit that waste to enter the stormwater system.
- A person must not cause or permit solid or liquid waste, sand, silt, clay, stones or sediment to be discharged from a premises to the stormwater system, unless otherwise authorised by council or a statutory authority.

Construction sites: materials storage

- A person must not cause or permit stored building or other materials to spill, leak or otherwise leave the premises in an uncontrolled manner, or to be left on a road unless otherwise authorised by council or a statutory authority.

The Litter Act

The *Litter Act 1987* provides protection of the environment from the depositing of a broad range of materials including most types of solid or liquid domestic or commercial waste.

Authorised officers under the Litter Act can issue abatement notices and penalty infringement notices for Litter Act offences. Abatement notices can be served where activities have caused or are likely to cause the deposit or escape of litter. Infringement notices can carry fines of between $20 and $600. Council can also initiate prosecution under the Act which can lead to penalties of up to $2000 (deposit of litter) or $4000 and a month's imprisonment (aggravated littering). The Litter Act does not apply to the deposit of any litter that constitutes an offence under the Environment Protection Act.

Council can authorise officers under the Litter Act. Generally local laws officers and environmental health officers are authorised.

Nuisances and the Health Act

Part III of the Health Act 1958 gives exclusive responsibilities and powers to councils to control nuisances which are dangerous to health or offensive. 'Offensive' is defined as noxious, annoying or injurious to personal comfort. It is an offence to cause a nuisance.

Councils must remedy nuisances as far as is reasonably possible by serving the offender with a notice to abate the nuisance. An authorised officer has powers of entry to a premises to enforce the provisions of the Health Act.

The nuisance provisions provide council with an enforcement tool which may cover stormwater impacts which do not breach planning controls, the Environment Protection Act or the Litter Act.

Council environmental health officers are usually delegated powers to enforce the nuisance provisions of the Health Act.

Writing enforceable notices and planning permits

Some general principles for writing notices are:

- start each requirement with an action word;
- place a single, specific, measurable obligation in each requirement;
- provide time-frames for any required works; and
- require the recipient to demonstrate compliance.

Following these principles should ensure that there is no subsequent dispute about whether or not a breach has occurred, and should minimise council's follow-up work.