2.2 Maintenance practices

2.2.5 Road/pavement repairs/resurfacing and road runoff

Description

Activities to repair potholes and degraded footpaths, as well as road and carpark resurfacing, have the potential to contaminate stormwater. Specific management practices need to be applied to minimise this risk, such as planning maintenance activities, modifying road resurfacing and footpath maintenance practices, managing spills and sweeping.

In addition, substantial amounts of pollutants are generated during daily roadway use, which can threaten the health of local water bodies by contributing heavy metals, hydrocarbons, sediments, gross pollutants and nutrients. Table 1 highlights typical highway runoff constituents and their primary sources.

Table 1. Typical highway runoff constituents and their primary sources

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmospheric deposition
Nitrogen, Phosphorus	Atmospheric deposition, roadside fertiliser application
Lead	Tyre wear, vehicle exhaust
Zinc	Tyre wear, vehicle exhaust, grease
Iron	Vehicle rust, steel highway structures, moving engine parts
Copper	Metal plating, brake lining wear, moving engine parts, bearing and brushing wear, fungicides and insecticides
Cadmium	Tyre wear, insecticides
Chromium	Metal plating, moving engine parts, brake lining wear
Nickel	Diesel fuel and petrol, lubricating oil, brake lining wear, metal plating, asphalt paving
Manganese	Moving engine parts
Sulphate	Fuel
Petroleum/hydrocarbons	Spills, leaks of motor lubricants, hydraulic fluids, asphalt surface leachate

Source: US EPA (1997).

Potential risks to stormwater quality from roads, carparks and footpaths include:

- discharge of sediments, heavy metals and hydrocarbons from the wear and tear of the road surface, vehicle tyres and vehicle brake linings;
- discharge of hydrocarbons during road and carpark resurfacing work (e.g. during a spill or unexpected rainfall event);
- discharge of bitumen overspray during road and carpark resurfacing activities;
- discharge of alkaline slurry from concrete cutting activities; and
- discharge of wastewater from the washing of machinery and tools (e.g. cement mixers and pumps).

Applicability

This management practice is applicable to all areas with roads, carparks and footpaths, and includes sealed and unsealed surfaces. It is particularly relevant in steeply sloping catchments with a high proportion of directly connected impervious surfaces and sensitive receiving waters.

Improving the quality of stormwater runoff from road surfaces is usually a priority in urban areas, given the significant load of stormwater pollutants that can be generated from road runoff, and the efficiency of traditional drainage systems in transporting this load to receiving waters. While the potential for environmental harm from road runoff is often significant, there is a high degree of variability in the quality of this runoff. For example, the US EPA (2001) noted that the level of pollutants found in road runoff is determined by many site-specific factors such as:

- traffic volume;
- traffic movement (e.g. areas where vehicle braking and acceleration is frequent);
- climate;
- maintenance regime, including incident response procedures (e.g. to manage vehicle accidents and spills);
- surrounding land use;
- design of the road and associated drainage network;
- presence of roadside vegetation (and the use of herbicides or insecticides on this vegetation); and
- frequency and type of accidents and spills that can discharge a variety of hazardous substances to stormwater.

Recommended Practices

Management practices recommended by VSC (1999) and US EPA (2001) are summarised below. Ideally, these management practices would be part of an environmental management system (see Section 2.5.1) that includes regular training, auditing/risk assessments, performance reporting mechanisms, etc.

Site preparation and planning

- ✔ Where there is the threat of material entering side entry pits during maintenance activities (e.g. road base, aggregate, or bitumen), install temporary inlet filters (e.g. using geofabric).
- ✔ Ensure material such as packing sand, cement, gravel, crushed rock and excavated material is stockpiled away from any drainage paths and covered to prevent erosion.
- ✔ Ensure that procedures and training exist so that resurfacing activities do not occur when rainfall is imminent or occurring. This guideline also applies to cement stabilisation activities.
- ✔ Pavement should be repaired in sections to reduce the spillage of paving materials during the repair of potholes and worn pavement.
- ✔ Ensure spill clean-up kits are available and site staff are trained in their use. These kits may be needed to trap hydrocarbons spills from machinery/plant or from runoff following an unexpected rainfall event during resurfacing.

Bitumen/resurfacing work

- ✔ Do not carry out bitumen spraying in windy conditions.
- ✔ Place only the required amount of screenings on the bitumen.
- ✔ Ensure loose aggregate is swept up at the completion of works.
- ✔ Use pollution prevention techniques such as drip pans and absorbent materials for all paving machines to limit leaks and spills of paving materials.
- ✔ Consider the use of porous asphalt when replacing surfaces, to reduce the volume of stormwater runoff and associated pollutant loads.

Concrete work

- ✔ Undertake concrete mixing and clean-up operations in a designated area that is capable of containing wastewater. Small amounts of wastewater can be allowed to evaporate or infiltrate into the soil.
- ✔ Ensure a contingency measure is in place to prevent any spilt material from entering the drainage network when using concrete pumps.
- ✔ Allow concrete waste and slurry to set before disposal off-site.
- ✔ Prevent wastewater from concrete cutting, brick cutting, or grinding activities from entering the stormwater system. Where it is not practical to trap this wastewater, or direct it to a permeable area for infiltration, the wastewater should at least be filtered through a geofabric material. However, filtering will not affect the pH of this wastewater, which can be very high for wastewaters involving concrete.
- ✔ Remove any cover material and formwork from the site once concrete has cured.

'Housekeeping' practices

- ✔ Remove all excess material from the work site before leaving, including all waste concrete, packing material and soil. Loose material should be swept from hard surfaces, not flushed.
- ✔ If equipment/plant needs to be washed on-site, ensure that it is undertaken in an area where stormwater will not be contaminated (e.g. on a well-grassed area). Ideally, equipment/plant should be washed in a sewered wash bay. An Industrial Waste Permit is required to connect and discharge these wastes to sewer. Further information is available from the Water Corporation via <www.watercorporation.com.au/indwaste> or by telephoning the Customer Service Centre on 13 13 95. Section 2.2.8 provides further best practice guidelines for maintenance and washing of vehicles and equipment.

Related maintenance practices

- ✔ Regularly sweep roads, carparks and paths that are identified as 'hot spots' for sediments and gross pollutants (see Section 2.2.1 for more details).
- ✔ Regularly remove accumulated pollutants (e.g. sediments and gross pollutants) from nodes in the stormwater network that may accumulate pollutants, such as pits and infiltration sumps (see Section 2.2.2 and Chapter 9 for more details).
- ✔ Where roadside vegetation exists (e.g. along highways), ensure that it operates as an effective filter strip to improve the quality of road runoff and to promote infiltration. In addition, restrict the use of herbicides and insecticides on roadside vegetation, and ensure maintenance staff use appropriate handling and application procedures for these materials. See Section 2.2.7 for more information on vegetation maintenance practices. See Chapter 9 for more information on swales and vegetated filter strips.
- ✔ Use indigenous vegetation along roadsides, paths and in swales, as recommended in Section 2.2.7 and Chapter 9.

Benefits and Effectiveness

The US EPA (2001) reported that limited data is available on the effectiveness of road maintenance practices in removing pollutants from stormwater runoff (e.g. see the limited data in the table below). However, preventative maintenance and strategic planning are recognised as cost-effective methods to minimise contamination of stormwater runoff and reduce the risk of environmental harm to the receiving environment.

Table 2. Road maintenance management practices: indicative effectiveness and cost

Management Practice	Effectiveness (% removal*)	Indicative Cost (in 1993 US dollars)
Maintaining roadside vegetation (as a filter strip)	Sediment control: 90% average. Phosphorus and nitrogen: 40% average. Chemical oxygen demand (COD), lead and zinc: 50% average. Total suspended solids (TSS): 60% average.	Natural succession of vegetation allowed to occur: • average = US$100/acre/year; and • range = US$50 - $200/acre/year.
Street sweeping (see Section 2.2.1 for more information)	Smooth street, frequent cleaning: • TSS = 20% • COD = 5% • Lead = 25% Smooth street, infrequent cleaning: • TSS = N/A • COD = N/A • Lead = 5%	Average = US$20/kerb mile. Range = US$10 - $30/kerb/mile. (See Section 2.2.1 for Australian costing data)
Litter control	N/A	Accepted as economical practices to control or prevent stormwater impacts.
General maintenance	N/A	Accepted as economical practices to control or prevent stormwater impacts.

* Assumed to be either the approximate per cent reduction in the stormwater's average annual loads or event mean concentrations.

Source: US EPA (1997).

Challenges

The following challenges may need to be addressed to improve implementation:

- Budgeting for the cost and effort associated with implementing new procedures, additional equipment and staff training.
- Budgeting for the cost associated with delaying maintenance work (e.g. waiting to undertake resurfacing activities until rainfall is unlikely to occur).
- Overcoming the difficulty in trapping and/or effectively treating wastewaters on hard surfaces (e.g. wastewater from concrete cutting equipment, where there is no opportunity to direct this wastewater to an infiltration area).
- It relies upon staff fully implementing procedures, as well as the continual improvement of procedures and practices. An environmental management system can provide the framework to minimise this risk (see Section 2.5.1 for more details).

Cost

The primary costs associated with introducing improved stormwater management practices during road/pavement maintenance involve the purchase of new equipment, the time associated with implementing new procedures, the time associated with staff training and the cost of accessing specialist expertise. Some indicative cost information from the US is provided in Table 2. Employing good maintenance practices is an efficient and low-cost BMP to eliminate or reduce the impacts of pollutants associated with road systems.

Additional Information

Further information about roadside swales and vegetated filter systems is provided in Chapter 9. For more information on planning, construction and maintenance of roads, see the Department of Environment's *Roads in Sensitive Environments* Water Quality Protection Note (DoE, 2004).

Examples / Case Studies

None are currently documented, although improved road maintenance practices are being implemented throughout Australia, particularly where agencies are implementing environmental management systems. For example, Main Roads Western Australia are developing an 'Environmental Guideline: Water Protection', which addresses road / bridge construction and maintenance issues.

References and Further Information

Department of Environment 2004, *Roads in Sensitive Environments*, Water Quality Protection Note, July 2004, Department of Environment, Perth, Western Australia.

United States Environmental Protection Agency (US EPA) 1997, *Guidance Specifying Management Measures for Sources of Nonpoint Source Pollution in Coastal Waters*. United States Environmental Protection Agency on-line guideline. Cited at: <www.epa.gov/owow/nps/MMGI/Chapter4/index.html> (first published as a guideline in 1993).

United States Environmental Protection Agency (US EPA) 2001, *National Menu of Best Management Practices for Storm Water Phase II*. United States Environmental Protection Agency on-line guideline: <www.epa.gov/npdes/menuofbmps/menu.htm>.

Victorian Stormwater Committee (VSC) 1999, *Urban Stormwater - Best Practice Environmental Management Guidelines*, CSIRO Publishing, Melbourne, Victoria.

Water and Rivers Commission 1998, *Washdown of Mechanical Equipment*, Water Quality Protection Note, August 1998, Water and Rivers Commission, Perth, Western Australia.