2.2 Maintenance practices

2.2.7 Maintenance of gardens and reserves

Description

This guideline focuses on the following management practices that can be applied at parks, gardens, road/drainage reserves and turfed sports fields/venues:

- Plant selection and landscaping design
- Nutrient management
- Irrigation management
- Pest management
- Lawn mowing, top dressing and pruning

The maintenance practices applied to grassed areas and gardens can have a significant potential impact on stormwater and groundwater quality. Potential pollutants include nutrients, sediment, pesticides, wastewater from washing machinery (e.g. mowers), and organic matter (e.g. grass clippings). Possible impacts include eutrophication and elevated levels of turbidity in receiving waters, leading to a variety of adverse impacts on aquatic flora and fauna.

As detailed guidelines are currently available for these practices, including several comprehensive Western Australian guidelines (see Additional Information), this section will:

- reference these guidelines; and
- briefly summarise key aspects that relate to stormwater management.

Note: Xeriscaping and zeroscaping are terms used in various places in the world. Xeriscaping is derived from the Greek word ‘xeros’, which means ‘dry’. Thus, xeriscaping can be simply translated as meaning ‘dry landscaping’. The primary goal of xeriscaping is to create a visually attractive landscape that uses plants selected for their water efficiency (City of Albuquerque, 2003). The Western Australian Waterwise program is based on the same principles. Zero-scaping is sometimes used in relation to landscaping with a focus on water conservation but is not equivalent to xeriscaping. Zero-scaping creates a harsher and less diverse landscape, primarily using rocks and drought-tolerant plants species such as cacti. In contrast, xeriscaping can produce a cool and lush landscape, using a wide variety of water efficient plants (City of Albuquerque, 2003).

Applicability

The following management practices are applicable to all areas where maintenance is undertaken on parks, gardens, road/drainage reserves and turfed sports fields/venues (e.g. ovals, golf courses and bowling greens). However, they are particularly relevant to areas of open space that:

- drain to sensitive receiving waters (e.g. conservation category wetlands, or the Swan-Canning estuary system that is under stress from nutrient inputs);
- are close to water bodies (e.g. river-side parks);
- have soils with poor moisture and nutrient retention capabilities (e.g. sandy soils on the Swan Coastal Plain);
are subject to erosion (e.g. areas on steep slopes);
• are subject to intense rainfall events that may generate surface runoff; and
• are subject to intensive maintenance practices (e.g. highly maintained golf courses).

Recommended Practices

Plant selection and landscaping design

✔ Plant local native species. This will reduce the risks of grass cuttings, deciduous leaves, nutrients and pesticides entering water bodies. Local native plants require less irrigation and maintenance (e.g. little or no nutrient or pesticide application) than exotic species and provide habitat and food for native fauna.

✔ Where local native species are not planted:
  - Minimise the use of deciduous plants. Deciduous plants drop all of their leaves over a short period and decompose quickly, which results in an excessive release of nutrients into water bodies. The leaves also clog stormwater systems. Deciduous plants also change the local habitat values, such as altered shading levels over waterways and reduced micro-habitat zones on the plants. See Water Note 25: The effects and management of deciduous trees on waterways (Water and Rivers Commission, 2002) for more information.
  - Do not plant declared or noxious weeds. Many common plants, such as lantana, gazania and lavender (French and Italian), are weeds. To find out what plants are weeds in Western Australia, go to the Weed Species in WA section of the Department of Conservation and Land Management’s Florabase website: <http://florabase.calm.wa.gov.au/win>. To determine which plants are weeds of national significance, go to the Weeds Australia website: <www.weeds.org.au/natsig.htm>.

Figure 1. Domestic garden with native plants. Native plants require little or no watering, nutrient and pesticide application. (Photograph: Sally Cousans.)

Figure 2. Native vegetation street verge planting, Causeway exit, East Perth. (Photograph: Department of Environment.)

Figure 3. Deciduous leaves can release a large amount of nutrients into receiving water bodies. (Photograph: Eastern Metropolitan Regional Council.)
- Minimise the amount of grassed/lawn areas.
- Minimise the extent of water-consuming planting.
- Apply the basic principles of hydro-zoning (grouping plants on the basis of having similar water requirements) to planting design.
- Match the plants to the soil type.

✔ Maximise the use of water conserving elements and techniques, such as using mulches, ground covers and porous paving instead of lawn.

**Nutrient management**

✔ For turf and grassed areas, use the guidelines provided by DEP & WRC (2001) to determine each area’s fertilisation requirements. This process involves visual inspection of the turf; regular analysis of leaf tissue, soil and water; consideration of the grass species, turf and grass use, weather patterns, ground temperatures, air temperatures, water availability, sunlight intensity and soil conditions; the use of catalysts (where necessary) to convert soil nutrients to a form that can be utilised by plants; synchronising the application of fertiliser with the needs of the plant; and adopting the principle of frequently applying small amounts of fertiliser. DEP & WRC (2001) also provides guidance on calculating fertiliser application rates, and specific factors that should be considered when determining nitrogen and phosphorus application rates.

✔ When applying nitrogen to sandy soils on the Swan Coastal Plain, the quantity of nitrogen applied in any one application should not exceed 40 kg/ha (DEP & WRC, 2001).

✔ Where phosphorus is being applied, special consideration must be given to the level of available phosphorus in the soil; the Phosphorus Retention Index (PRI); and the results of leaf tissue analysis. See DEP & WRC (2001) for fertilisation recommendations for soils with various PRI ranges and see the Phosphorus Action Group’s *Fertilise Wise Guides* (see the Additional Information section).

✔ When determining a suitable fertilisation regime, recognise that reducing the amount of water used on gardens and lawns will also reduce the need for fertilisation (WAWC, 2004).

✔ Where ‘fertigation’ is used to supply plants with soluble nutrients in irrigation water, care is needed to frequently apply very small amounts of nutrients to the plants at a rate at which the roots can take up most, if not all, of the nutrients. This is necessary to minimise the percentage of nutrients that move past the root zone and enter shallow groundwater, as well as the cost of fertilisation. DEP & WRC (2001) suggest that fertigation ‘is ideally suited for the soils of the Swan Coastal Plain that have a poor capacity to retain nutrients. It has the advantage that the fertilisers are only applied when water is required (not in winter) but it has the disadvantage that it requires accurate irrigation systems to avoid areas of over and under application of nutrients’ (p. 16).

✔ Use slow-release fertilisers where possible. Avoid using fertilisers in areas where runoff can result in the fertiliser entering the drainage system or water bodies.

✔ If fertiliser is required, apply in spring or early autumn (September, October, November, March and April). Apply the fertilisers often and in small amounts during the spring and early autumn period.
Applying organic matter or soil amendment to the upper 15 cm of sandy soils can produce multiple benefits. These include the slow release of nutrients, and the retention and recycling of soil moisture and nutrients. For more information on soil amendment, see Section 2.1.2.

While fertilisers are usually applied immediately before watering (WAWC, 2004), extreme care must be taken to ensure that this watering does not generate runoff or leachate to shallow groundwater.

Where possible, establish a buffer zone at least 50 metres wide between fertilised areas and water bodies.

Where drainage channels flow through fertilised areas (e.g. golf courses), apply the principles of water sensitive design to establish a ‘treatment train’ within the drainage corridor (e.g. by using controls such as unfertilised buffer zones, swales, wetlands, ponds, stormwater recycling, etc.).

On intensive horticultural sites that are using high amounts of fertilisers and have sandy soils and shallow groundwater, construct leachate barriers that drain nutrient-rich groundwater to collection basins for reuse. Alternatively, establish shallow groundwater bores down-gradient from the fertilised area to recycle leached nutrients via irrigation systems.

Irrigation management

Detailed guidance on water conserving irrigation practices is available in DEP & WRC (2001) and on the Water Corporation’s website (<www.watercorporation.com.au/savingwater>). The following management practices are highlighted as being important with respect to stormwater:

Ensure that the irrigation system is water efficient (e.g. drip or trickle systems, sprinklers that produce large droplets, sprinklers with matched precipitation rates15, high-quality controllers that have the ability to run separate watering programs for lawn and garden areas, and rain sensors that can be used to prevent irrigation after summer rain storms).

Ensure the design, sensors and settings used for automated irrigation systems do not produce surface runoff from the area being watered or from adjacent impervious surfaces.

The necessary amount of irrigation should be determined with due consideration of grass growth rate, soil type, daily evaporation rate, wind effects, soil temperature and available soil moisture (DEP & WRC, 2001). This can be achieved with modern soil moisture and air sensing devices such as tensiometers, soil moisture sensors, relative humidity measuring devices and wind velocity detectors. Alternatively, recommended irrigation frequencies for the application of 10 litres/m² of water for different types of ‘watering zones’ can be obtained from the Water Corporation’s website (<www.watercorporation.com.au>).

Seek to recycle nutrient-rich shallow groundwater and/or stormwater from the site.

Visually check irrigation systems every week to identify maintenance needs (e.g. the repair of leaks), or, for major irrigation systems, install an automated warning system to identify malfunctions.

Apply mulch to garden beds to improve water retention, smother weeds and prevent erosion.

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15 A sprinkler array with ‘matched precipitation rates’ means the nozzles provide the necessary water to the plants without any plants being over-watered.
Where required, apply soil wetting agents to overcome hydrophobic soil conditions and enhance infiltration of irrigation water. See DEP & WRC (2001) for details of recommended application rates for these agents.

Use soil amendments to improve the water retention capacities of soils, where appropriate. For more information on soil amendment, see Section 2.1.2.

Where nutrient-rich wastewater is used as a source of irrigation water, it is particularly important to control application rates so that surface runoff and shallow groundwater contamination does not occur. A comprehensive monitoring and evaluation program should be established to ensure that this objective is achieved.

Pest Management

Integrated pest management (IPM) is a holistic approach to unwanted plant (weed) and insect control that examines the interrelationships between soil, water, air, nutrients, insects, diseases, landscape design, weeds, animals, weather and cultural practices to select an appropriate pest management plan (US EPA, 2001). The goal of an IPM program is to manage pests to an acceptable level while avoiding disruptions to the environment. It incorporates preventative practices in combination with chemical and non-chemical pest control methods to minimise the use of traditional pesticides (i.e. insecticides and herbicides) and promote natural control of pest species.

Three different non-chemical pest control practices are used to limit the need for chemical pesticides:

- Biological (e.g. predation of pest species by other organisms).
- Cultural (e.g. weeding, handpicking of pests, removal of plants with diseases).
- Mechanical (e.g. pruning, altering the mowing regime, slashing, covering weeds with black plastic or jute matting).

The most effective pest control methods are often a combination of non-chemical and chemical control methods (DEP & WRC, 2001). Where chemical pest control methods need to be used, less hazardous products (e.g. Roundup Biactive®) or target-specific chemicals should be used for control of nuisance/disease vector insects, rather than pesticides that are a greater threat to aquatic systems, such as diazinon and chloropyrifos. The less hazardous chemical pesticides must still be used with the best practice precautions applied to other chemical pesticides.

Methods to reduce the risks from pesticides include:

- Apply according to the label’s recommended rate.
- Do not apply pesticides when rain is occurring or imminent.
- Do not spray pesticides on windy days.
- Where possible, wipe or inject pesticides to avoid spray drift (Water and Rivers Commission, 2001).
- If possible, spray when surface water levels are low (Water and Rivers Commission, 2001).
- Do not apply pesticides when there is a high risk of impact to vulnerable stages of fauna development. For example, avoid the period from egg lay to dispersal of junior frogs into the surrounding area – this period varies, but is generally between late autumn and early spring (Water and Rivers Commission, 2001).
Mix in a coloured dye so that you can see which areas have been sprayed.

Avoid using surfactants in the pesticides, as frogs are particularly sensitive to surfactants (Water and Rivers Commission, 2001).

Detailed guidance on pesticide selection and application, mixing and diluting pesticides, disposal of pesticide concentrates and containers, and pesticides storage can be obtained from the Environmental Guidelines for the Establishment and Maintenance of Turf and Grassed Areas (DEP & WRC, 2001).

The Code of Practice for the Use of Agricultural and Veterinary Chemicals in Western Australia (Department of Agriculture, 2002) provides practical guidance for the safe, responsible and effective use of agricultural and veterinary chemicals. Issues covered include: duty of care, choice and purchase of chemicals, transport, storage, occupational safety and health, environmental protection, management and minimisation of spray drift, minimising residues in agricultural produce, record keeping and responsibilities for owners.

Where pesticides are used in drinking water catchments in Western Australian, this use must be consistent with the State government policy Pesticide Use in Public Drinking Water Source Areas (WRC, 2000). In addition, pesticides must be stored in a covered, bunded and secured area. If disposal of unwanted pesticides and/or pesticide containers needs to be undertaken, consultation should occur with operators of local waste disposal/treatment facilities to identify options for reuse or disposal.

Lawn mowing, top-dressing and pruning

Remove litter and debris before mowing.

Close cropping during mowing is not recommended, as it provides an opportunity for accelerated erosion and increases the area’s irrigation requirements. As a general rule, no more than 33% of the grass leaf area should be removed during one mowing event (DEP & WRC, 2001).

Where possible and where there is not a risk of cuttings entering adjacent water bodies, grass cuttings should be left on the lawn after mowing. Where grass cuttings are collected, they should be composted and reused as fertiliser. Compost should be stored in areas where stormwater and/or groundwater will not be contaminated.

Grass cuttings should not be ‘thrown’ from the mower blades onto hard surfaces (e.g. roads) or into adjacent water bodies. If some cuttings are inadvertently deposited on roads or footpaths, they should be collected by ‘dry’ methods (e.g. sweeping) at the completion of mowing activities. Cuttings should not be blown or swept onto the road or into water bodies or the stormwater system.

In areas adjacent to roads with a kerb and channel, coordinate activities such as mowing or pruning with street cleaning operations (VSC, 1999).
Benefits and Effectiveness

Collectively, these management practices seek to:

- reduce pollutant loads to stormwater and shallow groundwater (particularly nutrients, sediment, pesticides and organic matter);
- reduce the use of mains water for irrigation;
- reduce the volume of surface water runoff;
- where possible, save time and money on maintenance practices; and
- reduce health and safety risks associated with the use of chemical pesticides.

Integrated pest management

IPM has been studied in Maryland, where it was used for managing street trees within a residential suburb (Taylor and Wong, 2002c). As a result, pesticide use was reduced by 79% - 87% due to spot application techniques and average annual costs were reduced by 22% (US EPA, 1997).

The US EPA (1997) also documented reports from a US lawn management company (the Natural Lawn Company) that it reduced its herbicide use by 85% - 90% by switching from blanket applications to spot application. Cost reductions of a similar magnitude were anticipated (Taylor and Wong, 2002c).

Taylor and Wong (2002c) reported that the cumulative performance of IPM and associated non-fertilised buffer strips at the Rosewood Lakes golf course in Reno, Nevada, was measured by long-term water quality monitoring in downstream wetlands. After eight years of water quality monitoring, pesticides were not detected in the wetlands and nutrient concentrations did not show seasonal fluctuations, despite seasonal applications of fertiliser on the course and the potential for surface run-off (Lehner et al., 1999).

The US EPA (2001) highlighted the adverse impacts from water-soluble pesticides, such as diazinon, as a good example of why IPM practices are recommended. A study in the San Francisco Bay region found that diazinon contamination of urban streams resulted from application of this pesticide at a small number of sites in the catchment. Source controls are needed (i.e. the application of IPM practices by government authorities, businesses and homeowners) as structural controls can not significantly reduce pesticide levels once they have entered the stormwater management system.

Challenges

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

- Resources (e.g. time, money and effort) should be invested for maintenance staff to learn and adopt new practices and management plans should be documented, regularly audited and updated.
• Reducing the popularity of green lawns, lush gardens and exotic plant species, as these are an impediment to the widespread adoption of waterwise and fertilise wise gardens and reserves, particularly the adoption of local native plants.

• For integrated pest management, the perception that there is no alternative to pesticide use is a significant barrier to overcome (US EPA, 2001).

• The cost of slow-release fertilisers, soil testing, installing water efficient irrigation systems, irrigation sensor systems and applying fertilisers frequently but sparingly are potential barriers to the adoption of these management practices. However, rebates are offered for many catchment friendly (‘waterwise’) gardening practices/systems.

### Cost

Costs are associated with the development of nutrient and irrigation management plans and the installation of water efficient irrigation or fertigation systems. These may involve significant up-front costs, however savings can be expected due to water conservation and reduced fertiliser use.

Studies have shown significant cost savings when integrated pest management is implemented, due to the significant reduction in applied pesticides (see Benefits and Effectiveness and Examples / Case Studies).

### Additional Information

Resources for catchment friendly gardening are available from:

• *Landscaping Training* - Everlasting Concepts: 4 Season Seminars – designed to assist landscape businesses and all levels of government to utilise WA plants on a large scale (including streetscapes, schools, golf courses, contemporary designs and public open spaces). Advice includes plant recommendations, mulching, soils, fertilising, irrigation, maintenance and environmental weeds. More information via <www.everlastingconcepts.com.au> or by telephoning (08) 9275 3404.

• *Landscaping with Local Plants Policy and Guidelines for Local Government*, Section 2.3.2 in the *Local Government Natural Resource Management Policy Manual* (EMRC, 2004). For further information, contact the Eastern Metropolitan Regional Council on (08) 9424 2222. Available by telephoning (08) 9424 2222 or via <www.emrc.org.au> (select ‘Services’ / ‘Environmental Services’).

• *Environmental Guidelines for the Establishment and Maintenance of Turf and Grassed Areas* (DEP & WRC, 2001).


• *Free Gardening Workshops* – Swan River Trust. These feature information and guidance on fertilise wise and sustainable gardening practices. Telephone (08) 9278 0900 for further information, or refer to <www.swanrivertrust.wa.gov.au>.

• *Fertilise Wise Guides* - The Phosphorus Action Group’s *Fertilise Wise Guides* advise gardeners on appropriate fertiliser types and application rates for soils in the Perth region. For further information and advice about the guides and other available resources, please telephone the Phosphorus Awareness Project Coordinator on (08) 9458 5564. You may also access Fertilise Wise information via the South East Regional Centre for Urban Landcare website <www.sercul.org.au/pag.html>.

• *Local Plants Guides* – The North Metropolitan Catchment Group’s (formerly the North East Catchment Committee, NECC) *Local Plants Community Education Strategy* provides strategies that local
government authorities can undertake to promote and encourage the use of local plants within their communities, as well as providing information and resources to the community to aid in its implementation. This includes a set of ‘Grow Local Plants’ brochures covering suitable species for five soil regions on the Swan Coastal Plain (matching the Fertilise Wise Guides brochures). It will also include comprehensive lists of plants that are suitable for street trees, hedging, etc. Local government authorities will be able to print the relevant brochures for their region, in conjunction with conducting one or more activities outlined in the strategy. For further information, telephone the Biodiversity Coordinator at the North Metropolitan Catchment Group (NMC(G) on (08) 9271 7922.

- To select Perth plants suitable for your soil type, go to the APACE WA website <http://web.argo.net.au/apace/soiltypes.htm> or by telephoning APACE on (08) 9336 1262.

- **Purchasing Local Native Plants** – Go to the Everlasting Concepts website (<www.everlastingconcepts.com.au>), which provides contact details for nurseries throughout WA that stock WA native plants. The website also provides information on how to grow native plants. In addition, the Friends of Kings Park hold several native plant sales throughout the year. Information about the Friends of Kings Park and plant sales is available via <www.kpbg.wa.gov.au>. Select ‘Growing Plants’ / ‘Community Involvement’ / ‘Friends of Kings Park’ / ‘Coming Events’.

- **Wildflower Society of Western Australia** – The Society provides a range of resources (e.g. books) and advice regarding planting local native plants. See their website <http://members.ozemail.com.au/~wildflowers>.

- **Growing Locals – Gardening with Local Plants in Perth** by Robert Powell and Jane Emberson (1996). This book can be purchased by telephoning the WA Naturalists Club on (08) 9228 2495 or via <www.wanats.iinet.net.au>.

- **Free Gardening Advisory Service** - Botanic Gardens and Parks Authority (08) 9480 3672 <www.bgpa.wa.gov.au> (select ‘Growing Plants’ / ‘Community Involvement’ / ‘Master Gardeners’). Volunteer Master Gardeners provide a free advisory service for home gardeners and non-commercial groups. For example, they can advise about propagation, potting, planting out, pests and pruning of native plants.

- **Designing and maintaining gardens** – Advice about how to grow local native plants, deal with pests and diseases effectively and responsibly, use less water and fertiliser, save time and money and attract Western Australian wildlife into your garden. Available via <www.greatgardens.info>.

- **Waterwise** - Waterwise gardening information on the following topics is provided on the Water Corporation website (<www.watercorporation.com.au/savingwater>): common plants, catchcup instructions, irrigation, lawns, new gardens, new lawns, watering zones, waterwise garden centres, waterwise garden designs and waterwise garden irrigators.

- The **Sustainable Living in Western Australia** website, available via <www.sustainableliving.wa.gov.au>) (Government of Western Australia, 2004-2005), contains links to Western Australian resources for gardening and growing local native plants.

Examples / Case Studies

Turf/lawn management

*Turf Sustain* (Sports Turf Technology, 2004) has Western Australian case studies on the following topics:

- Nutrient monitoring – City of Canning (page 35);
- Turf establishment study – University of Western Australia (page 37);
- Improving turf conditions with nutrition – City of Cockburn (page 39);
- Nutrient monitoring and irrigation benchmarking – Sports Turf Technology and Department of Environment (page 41);
- Irrigation scheduling using soil moisture monitoring – City of Swan (page 49);
- Irrigation scheduling based on weather averages – City of Stirling (page 49);
- Using a weather station to schedule irrigation - Burswood Park Board (page 51);
- Using soil moisture sensors to control irrigation (page 53);
- Benefits of an irrigation audit (page 55);
- Modernising irrigation systems across council parks – City of Stirling (page 57);
- Rotary and reel mowing – City of Melville (page 67).

Mowing

The Victorian Stormwater Committee (1999) documented a simple contract clause from the City of Manningham to reduce the effect of mowing activities on stormwater quality. This clause has two parts and is provided below:

‘Prior to grass cutting all loose litter, rubbish or debris is to be cleared from the mowing area.’  
(Performance criteria: absence of litter, rubbish or debris).

‘All grass clippings and other debris is to be swept or cleared from adjoining paths, gutters, paved surfaces and garden areas.’ (Performance criteria: no clippings or other debris after cutting operations).

Integrated pest management

IPM was successfully applied at the 178 ha US National Arboretum in north-west Washington in the District of Columbia. As a result, pesticide use declined by 75%, resulting in an 80% reduction in costs (Lehner et al., 1999). The program included:

- setting thresholds for pest-related plant damage (i.e. the arboretum had a higher tolerance for pest infection);
- catching pests early;
- using beneficial insects which are natural predators of the insects that harm the arboretum’s vegetation;
- handpicking insects off infected plants;
- reduced mowing of lawns;
• using biorational oils (i.e. natural soaps and oils); and
• using alternative growing methods.

References and Further Information


Department of Agriculture 2002, *Code of Practice for the Use of Agricultural and Veterinary Chemicals in Western Australia*, Bulletin 4560, Department of Agriculture, South Perth, Western Australia.


Phosphorus Action Group (undated), *Fertilise Wise Guides*. View at: <www.sercul.org.au/pag.html> or telephone (08) 9458 5564. Further information is available by telephoning the Swan River Trust on (08) 9278 0900.


