Department of
Environment and Conservation

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Environmental guidelines for organic waste recycling facilities

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Acknowledgments

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Disclaimer

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Glossary

Aeration	The process by which oxygen-rich air is supplied to compost to replace air depleted of oxygen.
Aerobic	The presence of oxygen. An organism or process that requires oxygen.
Ammonia	A gaseous compound comprised of nitrogen and hydrogen, with a pungent odour.
Anaerobic	The absence of oxygen. Processes that occur in the absence of air. (Biological anaerobic processes produce methane gas.
Bio-aerosols	Airborne particles consisting of whole or parts of biological entities, such as bacteria, viruses, dust mites, fungal hyphae, or fungal spores.
Biofilter	A pollution control technique using living material to filter or biochemically process gaseous emissions.
Biosolids	The solid residue produced as a result of sewage treatment.
Cellulose	Long chain of sugar molecules that makes up the main part of the cell walls of plants.
Composting	The biological partial decomposition and stabilisation of organic material, under conditions that are predominantly aerobic and that allow the development of biologically-produced heat. Composting results in a final product that has been pasteurised and stabilised, and can be beneficially applied to land.
Compost	Organic material which has been aerobically processed to form a stable, granular material containing valuable organic matter and plant nutrients which, when applied to land, can improve the soil structure, enrich the nutrient content of soil and enhance its biological activity.
Curing (Post-composting)	Final stage of composting in which stabilisation continues but the rate of decomposition has slowed to the point that turning or forced aeration is no longer necessary. Some microbial activity and chemical changes will continue.
Disease vector	An organism, often an insect, rodent or bird that carries disease.
Green waste	Grass cuttings, leaves and prunings from parks or gardens.
Household organic waste	Source-separated domestic waste.
In-vessel composting	A diverse group of composting methods in which the materials are contained in a building, reactor or vessel.
Leachate	The liquid that has percolated through decomposing solid material such as waste or compost and has extracted dissolved or suspended materials from it. Leachate often has a low pH (acidic) and a high concentration of organic acids.
Mature compost	Compost that has undergone the composting and curing process.
Mulch	A coarse, woody material spread over the soil surface to conserve moisture and porosity in the soil underneath and to

	suppress weed growth.
Municipal solid waste	Solid wastes arising at households, shops and offices.
Organic matter	Chemical substances of animal or vegetable origin, consisting of hydrocarbons and their derivatives.
Organics recycling facilities	A facility that uses biological or mechanical processes to produce a new product from organic wastes. This may include, but is not limited to, composting facilities, anaerobic digestion facilities and wood chipping or mulching facilities.
Pathogen	Any organism (usually a micro-organism) capable of producing disease through infection.
pH	A measure of the concentration of hydrogen ions in solution. pH below 7 = acidic, pH above 7 = alkaline.
Putrescible	Material that has some content of organic material and will biologically degrade.
Screening	Passing material through a mesh 'screen' to sieve out unwanted contaminants or oversized particles.
Soil conditioner	A soil additive that improves its structural and textural qualities reducing its susceptibility to degradation.
Source separated waste	Waste separated from general waste by the householder or waste generator.
Stabilisation	The second phase of composting, which occurs at lower temperatures than the first phase of composting.
Trommel	A rotating screened drum, used for separating material by particle size and density.
Turning	An operation that mixes and agitates material in a windrow, pile or vessel.
Vermiculture	A process that uses worms and micro-organisms to convert organic material into a nutrient-rich compost.
Volatile Organic Compound (VOC)	An organic compound which evaporates readily to the atmosphere. VOCs can contribute to photochemical smog production and certain health problems.
Windrow	Elongated pile of composting material.

Introduction

Facilities that recycle organic materials are increasingly prevalent in Western Australia. While they offer many benefits to society, organics recycling facilities can also have adverse environmental, public health and social amenity impacts if not properly managed.

These guidelines set out desired environmental outcomes and are intended to provide operators of organics recycling facilities with an overview of environmental issues that need to be addressed over the life of the facility. This includes the process from planning, development, operational management and site closure. However, it should be stressed that this guidance does not replace the need to understand and meet relevant regulatory obligations for facility design and operation.

Organic waste in Western Australia

In Western Australia, organic materials can make up to 30 per cent of putrescible waste streams (biodegradable or non-inert waste) disposed of via landfill. Organic waste generally includes garden trimmings, food, wood/timber from households and businesses, and some agricultural wastes. Although the recycling of organic waste has grown in recent years, a substantial amount of organic material still goes to landfill. Diversion of organic materials from landfills not only extends the life of landfills, but reduces greenhouse gas emissions and leachate production. As a result this can reduce the negative impacts landfills can have on climate change and their potential detrimental impacts on groundwater.

Benefits of soil amendment products

Broad environmental benefits can be delivered through the use of recycled organic products as soil amendments. The use of composts and related soil amendment products can improve the fertility, health, water retention and productivity of soils. They also slowly release nutrients and so have a lower potential than chemical soil additives for impacting on precious groundwater supplies.

Composts and related products can also reduce the need for chemical soil additives as they improve the carbon and nitrogen content of soil, increase water retention capacity and generally improve soil structure.

Purpose and scope of this document

Who should read this document?

These guidelines apply to all organics recycling facilities that use mechanical and/or biological processes to reprocess solid and semi-solid organic materials, including:

- shredding, chipping and mulching operations;
- composting (outdoor, indoor, in-vessel);
- mechanical biological treatment (a form of mixed waste composting);
- vermiculture;
- anaerobic digestion;
- any combination of the above.

Modern commercial organic recycling operations typically process large quantities of organic material. Handling, movement, storage and processing of waste organic materials can have substantial impacts on the environment unless appropriate controls are put in place. These controls include, but are not limited to, clear and effective communication with all staff and relevant stakeholders, in addition to a well-maintained and monitored operation.

What can you expect this document to tell you?

The purpose of these guidelines is to provide:

- Clear environmental performance objectives for each type of environmental impact;
- A statement of the actual or likely impacts of organics recycling operations on the environment and how these can be assessed and minimised;
- A simple guide to the optimal outcomes from a well-run organics recycling facility and the main ways to achieve these outcomes (Table 1);
- A guide to the considerations when planning a new organics recycling facility (Appendix A);
- Suggested good practice environmental measures or ways to meet performance objectives or goals, based on available experience (listed in Appendices);
- A list of items that should be included in a water management plan (Appendix B) and an environmental management plan (Appendix C) for an organics recycling facility;
- A reference to many of the relevant regulations, acts and government guidance documents;
- A list of source information regarding best practice for organics recycling facilities in Australia (Appendix D).

It is the responsibility of facility operators to ensure that environmental objectives and regulatory requirements are met by employing the most appropriate processing techniques to achieve the desired quality of final product. Facility operators are also responsible for ensuring that environmental safeguard measures most suitable to their particular site are implemented. These may be selected from the suggested good practice environmental measures which can be found in this document. Alternatively, more appropriate measures for the site may be developed by the operator, providing the required environmental outcomes are achieved.

Operators of organics recycling facilities should be aware that they are expected to:

- Conduct surveys of sites prior to selecting and opening a new facility, to choose the site with least environmental impact and to assist with formulating the various plans for their site. Surveys include:
    - Hydrological (groundwater movement and proximity of sensitive water bodies);
    - Meteorological (particularly prevailing wind direction);
    - Proximity of environmentally sensitive areas (receptors).

- Produce site-specific environmental management plans and water management plans for their site (including fire prevention and fire

management strategy). Appendices to this document outline what should be considered in each facility's plans.

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What doesn't this document cover?

It is not the intention of these guidelines to cover the efficacy of the actual process employed to recycle organic material, the level of acceptable contamination, or quality assurance of the final product. Separate guidance should be obtained to meet environmental requirements for the product, dependent upon the type of process chosen. Relevant Australian product standards include:

- Australian Standard AS 4454 (2003). Composts, Soil Conditioners and Mulches.
- Australian Standard AS 3743 (2003). Potting Mixes.
- Australian Standard AS 4419 (2003). Soils for Landscaping and Garden Use.
- Australian Standard AS/NZS 4422 (1996). Playground Surfacing.

A Good Environmental Choice Australia (GEAC) standard exists for recycled timber:

- GECA 32-2007: Recycled and Reclaimed Timber

These guidelines are not intended to replace any regulatory requirements for the facility. It is still the operator's responsibility to ensure that all relevant regulatory requirements are met. This document does, however, list some of the relevant legislation that you should be aware of (Table 2, and also Appendix E).

The guidelines are also not intended to apply to the exclusive storage and treatment of poultry manure. Separate guidelines have been developed for this, in particular the *Environmental Code of Practice for Poultry Farms in Western Australia* (Western Australian Broilers Growers Association *et al.,* 2004). However, where poultry manures are used for mixing with other materials at organics recycling facilities, these guidelines will apply.

Strategic context for this document

The Western Australian Government, through the *Strategic Direction for Waste Management in Western Australia* (Department of Environment, 2004), has set an agenda for moving towards a waste-free society, embracing the vision 'towards zero waste'.

The *Strategic Direction for Waste Management in Western Australia* identifies that any move towards achieving the 'towards zero waste' vision must target the organic fraction of the waste stream going to landfill as a priority (Waste 2020 Taskforce, 2001). A Recycled Organics Position Statement was released by the WA Waste Management Board in February 2008. This document demonstrates the board's support for recycling of organic material in Western Australia, with a focus on source-separation of material and achieving low contamination rates.

These guidelines permit and encourage innovative and effective solutions for environmental management of organics recycling facilities. They are based on previously published draft guidelines issued in WA (Department of Environmental Protection, 1997), and guidelines published in Victoria (EPA Victoria, 1996) and

NSW (NSW Department of Environment and Conservation, 2004). This document supersedes the *'Guidelines for the storage, processing and recycling of organic wastes: Department of Environmental Protection (1997)'.*

General principles

The policies and strategies contained in this document were developed using the following principles:

- Protection of public health;
- Protection of the environment;
- Highest beneficial end use;
- Sustainability best practice.

Protection of public health

Organics recycling is beneficial to human health because it assists with improving the sustainability of our soils and diverts material that can produce groundwater pollutants from landfills.

The main public health issues relating to the recycling of organic materials are:

- odour
- dust
- bio-aerosols
- fire risk
- spreading of diseases
- groundwater contamination

Processing facilities that are appropriately sited, well designed and employ best practice environmental management should not impact adversely on public health.

Protection of the environment

Two areas of environmental protection have been considered in the development of these guidelines. These are the protection of the local environment, or pollution control, and broader environmental performance.

Pollution control is the reduction of direct environmental harm or nuisance resulting from the act of collecting and processing organics. Potential pollution issues and environmental concerns include:

- odour and gases such as methane, ammonia etc
- dust and bio-aerosols
- vermin and pathogen spread
- habitat-loss and weed dispersal
- fire and smoke
- noise
- litter and illegal dumping
- surface water discharge
- leachate and waste water

Improved environmental performance relates to environmental impacts on a broader scale, such as:

- net reduction in greenhouse gas emissions
- lower water consumption
- reduced high nutrient contamination of groundwater or surface water flows
- improved air quality

Highest beneficial end use

The diversion of organics to the highest beneficial end use is facilitated by minimising cross-contamination of organic materials. To that end, source separated collection is believed to provide the most effective method for minimising cross-contamination in organic collection systems (WA Waste Management Board, 2006a).

In circumstances where source separation of organic waste is not possible, techniques for mixed waste processing or for separation of contaminants later in the process are employed. Obviously, the final product will not be as high a value or quality, but can still find beneficial applications and achieves the goal of diverting organic material from landfill.

The Australian Standard AS 4454 (2003) covers the quality requirements of composts, soil conditioners and mulches that are typically used in a range of applications, such as in home and public gardens, commercial landscaping, horticulture and agriculture. More stringent product quality requirements may be required by some markets above the criteria set out in AS 4454 (2003), to ensure the products perform to the required level in certain applications.

Compost-like outputs from the treatment of mixed municipal solid waste can contain contaminants at harmful levels which can affect the environment. Therefore, the restricted use of compost outputs from mixed municipal waste treatment plants is preferred until better information is available on the environmental risk profile of these products (WA Waste Management Board, 2006a).

Sustainability

The WA Government has made a commitment to sustainability through the release of the State Sustainability Strategy (WA Government, 2003). The main principles of sustainability are:

- the precautionary principle
- the principle of intergenerational equity
- the principle of biological diversity and ecological integrity
- principles relating to improved valuation, pricing and incentive mechanisms

For the purposes of this strategy, the definitions for these are taken to be as per Section 4A of the *Environmental Protection Act 1986.*

Issues and good practice at organics recycling facilities

Table 1 provides a summary of the required environmental outcomes and the commonly accepted good practices that will assist facility operators on an ongoing basis.

The principal environmental issues often associated with organics recycling facilities are listed in Table 2. This table also includes aims relevant to operators, the mechanisms for guarding against negative environmental impacts and the relevant regulations. The issues are discussed in more detail by impact type later in this section.

Summary of good practice measures for organics recycling operations

Addressing each of the factors listed below (Table 1) will assist a facility operator to achieve good practice. Table 1 is provided as a 'first glance' guide to good practice and the environmental benefits of implementing these measures. Environmental issues are discussed in more detail in the following section.

Table 1: Summary of good practice at an organics recycling facility.

Good practice measure	Environmental outcome
Have an *environmental management plan* and a *water management plan* that is communicated well to all staff and contractors.	Staff are able to implement appropriate measures as needed.
Aerate compost piles and leachate as needed (to at least 5% oxygen by volume). Turn compost piles regularly and keep to a reasonable size.	Minimise odour and unwanted gaseous emissions. Reduce leachate production Reduce risk of fire.
Maintain a good water balance – avoid water logging but also avoid drying out.	Water logging encourages anaerobic conditions. Drying out forms dust and bio-aerosols.
Contain run-off leachate or waste water. Put stormwater management systems in and maintain well.	Avoid contamination of local land and water.
Leachate storage tanks or pits should be aerated or the leachate should be regularly treated, recycled or disposed of appropriately.	Leachate is not anaerobic (and hence not odorous).
Contain odorous raw materials and gases intentionally produced under anaerobic conditions. Use odour control technology.	Reduce fire risk, odour and greenhouse gas emissions.
Contain and monitor stored materials. Ensure no cross contamination between final product and other materials. Carefully manage raw materials to control weed and pathogen dispersal.	Facility is not responsible for attracting vermin or spreading weeds and diseases.
Minimise noise and traffic nuisance (such as dust and congestion) to neighbours.	Nuisance to neighbours is limited.

Table 2: Summary of main issues for organics recycling operations.

Issue	Aim	Methods for avoidance	Relevant Acts / Regulations
Odour and gaseous emissions produced from anaerobic conditions or storage of certain feedstock can be odorous, toxic or contribute to climate change.	Levels of gaseous emissions are well within the levels required under legislation / regulation.	• Aerobic processes or other materials stored around the site (including leachate) should be aerated automatically or turned regularly. In aerobic processes, conditions are to be maintained to maximise aerobic bacterial activity, such as moisture levels of ~ 30% and 0_2 levels maintained at >5%. Material should also be turned regularly. • Processes designed to operate anaerobically are to be enclosed so that gases are not able to escape and any off-gases should be filtered appropriately.	*Environmental Protection Act 1986* - Section 49 Causing pollution and unreasonable emissions. Environmental Protection Regulations 1987- Schedule 1 - Category 67A. *Health Act 1911* – Part VII.

Dust from dry, light material and roads.
This can be a nuisance and cause health concerns for workers and neighbouring properties.
 	
Bio-aerosols in organic dusts.
Disease can spread and cause harmful infections for workers and/or native species.
	Dust and bio-aerosol generation on the site is kept to a minimum and well within the levels required under legislation / regulation.	• Roads should be sealed or compacted to reduce dust problems.
		• Movement of large vehicles or mechanical processing of dry material may need to be suspended on very windy days.
		• Dust suppression measures should be taken, such as:
		  • applying a light water spray to roads and stored material;
		  • covering dusty materials;
		  • enclosing fixed mechanical equipment used to process the raw and finished materials;
		  • suction sweeping machines may be needed to maintain dust-free sealed surfaces (including roadways).
		• Maintain moisture of compost at ~30%
			Environmental Protection Act 1986 - Section 49 Causing pollution and unreasonable emissions.
			Health Act 1911 - Part VII.
			Town Planning Regulations 1967
			Air Quality Modelling Guidance Notes (Department of Environment, 2006)

Vermin (such as rodents, feral animals, insects and birds) **and pathogens** can spread diseases to people or to local flora and fauna.	Site is free of vermin. Pathogens are not allowed to spread from the site.	• Raw organic materials should be physically separated from materials undergoing processing to avoid cross-contamination with weeds and pathogens. • Equipment used to move raw organic materials should not be used (unless washed) to move finished recycled organic products. This avoids cross-contamination of weeds, plants and animal pathogens. • Vermin (such as rodents, feral animals and flies) and the attraction of birds is minimised by careful containment of raw materials • Depending on the feedstock, it may be desirable to apply a covering layer of final product when constructing outdoor piles or windrows, which will reduce flies and birds. Keeping odours low is important for minimising attraction of vermin.	*Health Act 1911*. (For facilities processing biosolids): Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products (Department of Environmental Protection, 2002).

Issue	Aim	Methods for avoidance	Relevant Acts / Regulations
Habitat loss and weed dispersal – destroying local habitats or causing non-native species to compete with endemic species in surrounding areas.	Site clearing does not occur without consideration of rare native species or significance of the habitat. Weeds are not allowed to spread from the site.	• Site assessment is undertaken prior to clearing and significance of the habitat and presence of rare species is evaluated. • During transport, storage and processing, material should be contained and windblown transport of weeds and plant pathogens is minimised. • Finished recycled organic products should not be stored for excessive periods of time outdoors, as windblown weed seed can establish on the surface of piles. • Where weeds do establish on the premises of the organics recycling facility, a program should be in place to destroy weeds to prevent their further establishment on-site.	Environmental Protection (Clearing of Native Vegetation) Regulations 2004. *Health Act 1911*. *Agriculture and Related Resources Protection Act 1976*. Plant Diseases Regulations 1989
Fire and smoke caused by a build up of heat in piles and anaerobic conditions causing the formation of methane (an explosive gas).	Fires are prevented and no smoke emissions are released from the facility.	• An organics recycling facility should have a fire management plan in place (See other management issues' for more detail). • When composting, internal pile generation temperature is monitored and maintained by regular turning and aeration. This is particularly problematic for Category 1 organics, such as garden and landscaping materials (see Table 2, Appendix A) or for excessively large piles. • Piles of raw materials and compost piles should be limited in size and should be kept moist to reduce the risk of combustion occurring. • Anaerobic processes should ensure that methane management systems are in place to prevent fires.	*Bush Fires Act 1954* *Occupational Safety and Health Act 1996*
Noise - causing a nuisance to neighbouring properties	On-site machinery or traffic to/from the site does not cause a noise nuisance to neighbouring properties. Noise levels comply with limits prescribed in licence conditions and regulations. Measures taken to minimise noise will depend upon the proximity to noise sensitive premises.	• Site the facility appropriately. See Appendix A for more details on facility siting. • Choose mobile and fixed machinery with low noise outputs . • Enclose noisy equipment or install and regularly maintain noise suppression equipment (e.g. mufflers on machinery and vehicles). • Restrict operating hours. • Maintain a noise buffer to noise sensitive premises and attenuate noise by screens or earthen embankments around the site. • Drivers of vehicles should be informed of preferred routes to minimise noise nuisance and drive at low speed when entering and leaving the premises as well as use arterial route to avoid residential areas. • The exit and entry to the premises should be designed to avoid the need for vehicles to suddenly brake or accelerate. Particular attention should also be paid towards the placement of traffic control devices such as speed humps and vibration grids to avoid excess noise generation.	Environmental Protection (Noise) Regulations 1997

Issue	Aim	Methods for avoidance	Relevant Acts / Regulations
Litter and illegal dumping of organic or other wastes on or around the site.	There is no illegally dumped rubbish along the approaches to, or near to, the site.	• Site should be kept tidy and free of packaging or other wastes. Care should be taken to ensure light plastics are not a source of wind-blown litter. • Illegal dumping along the approaches to, or near to, the facility should be monitored and reported to the relevant local council. • Ensure the premises are secure and appropriate fencing is established around the perimeter of the facility. The gate of the facility should be appropriately staffed at all times during business hours to monitor the contents of organic wastes brought to the facility and to prevent unauthorised deposition of materials for recycling. This can be an issue for organics recycling facilities located at landfill sites. • The premises should be securely locked outside of business hours to prevent unauthorised access and the possibility of illegal dumping. • Where illegal dumping has occurred, regular clean ups should be performed and the waste material should be appropriately recycled or disposed of to an appropriate licensed landfill.	*WA Litter Act 1979* *Environmental Protection Act 1986* - Section 50 Discharge of waste in circumstances in which it is likely to cause pollution. Environmental Protection (Unauthorised Discharges) Regulations 2004 - Schedule 1.
Water run-off from organics recycling facilities can become contaminated and impact on the local **surface water and ground water**	Surface discharges of contaminated water from the organics recycling facility are prevented from polluting surrounding waters.	• In the facility planning stage, a detailed hydrological investigation of both the site and the surrounding groundwater and surface water bodies is required (see Appendicies A and B). • The size of outdoor operational areas should be minimised to reduce the amount of run-off requiring collection and treatment. • Outdoor operational areas should be sealed with a low permeability material (e.g. asphalt or concrete) to prevent leachate and run-off from entering soil. • Clean stormwater should be segregated from contaminated run-off – for example by the use of cut-off drains and barriers to direct it away from the main operational areas. • As part of the water management plan (Appendix B), frequent monitoring of local surface waters (such as creeks and rivers) and groundwater quality is required, particularly in cases where processing and storage is performed outdoors, or if the facility is located in areas with vulnerable groundwater tables. • Fuels, oils and hydrocarbons shall be stored in appropriate and secure above ground vessels, and be positioned on an impervious floor with bunds capable of retaining a minimum of 110 per cent of the storage facilities, in accordance with guidelines of the Department of Industry and Resources and the Department of Water	Environmental Protection (Unauthorised Discharge) Regulations 2004. Water Quality Protection Note 52 - Stormwater Management at Industrial Sites (Department of Water, 2006c). Water Quality Protection Guidelines No. 3 - Mining and Mineral Processing Liners for Waste Containment (Water and Rivers Commission, 2000). Water Quality Protection Note 30 – Groundwater Monitoring Bores (Department of Water, 2006b).

Issue	Aim	Methods for avoidance	Relevant Acts / Regulations

Leachate and **waste waters** can contaminate groundwaters, local surface waters and the land at or adjacent to the site	Leachate and process waste water should be recycled as much as possible within the organics recycling facility.
	No contaminated waste water is discharged from the site.
	The site itself does not become contaminated.
		• Outdoor areas should be bunded to prevent any migration of leachate or run-off off-site. The bund should be designed to contain all rainfall from a 1 in 100 yr rainfall event with a duration of 72 hours.
		• A leachate barrier system should be installed beneath the operational surfaces of the organics recycling facility to provide a secure barrier between the groundwater, soil and substrata and the organic materials as per the water management plan (Appendix B).
		• Indoor operational activities should have collection drains to intercept all leachate and run-off for recycling or treatment.
		• Run-off from areas where organics are processed or stored should be treated as leachate and collected in impermeable sumps, pits, holding tanks or ponds and re-used as much as possible within the organics recycling process (compliant with NHMRC, 2000).
		• A proportion of leachate may be evaporated in sealed ponds, but aeration is needed to minimise the potential for anaerobic conditions developing and odours occurring.
		• Sufficient storage capacity should be available on-site for retention and treatment of waste water, able to cope with very heavy rainfall periods without overflowing. Additional storage capacity is recommended to reduce the risk of overflows occurring.
		• If leachate or contaminated stormwater quantities exceed process needs, it must be discharged to sewer where available or to land:
		  • If discharged to sewer it must comply with Water Corporation limits;
		  • Any discharge of wastewater to land is subject to approval from the Department of Environment and Conservation.
		• Representative samples of processed waste water must be taken regularly and tested as per the water management plan (see Appendix B).
			Water Quality Protection Note 27 - Liners for Containing Pollutants, Using Engineered Soils (Department of Water, 2006a)
			National Health and Medical Research Council Guidelines for Reclaimed Water Use (NHMRC, 2000).
			Contaminated Sites Act (2003)
			Sewerage and Drainage Act 1902

Detailed discussion of issues

Each of the issues outlined in Table 2 are discussed in more detail in this section. The desired outcome is provided alongside suggested measures developed as a result of commonly accepted good practice. A number of diagrams are also provided to complement the material in the text. These provide a simplified version of the key issue, their causes and suggested solutions.

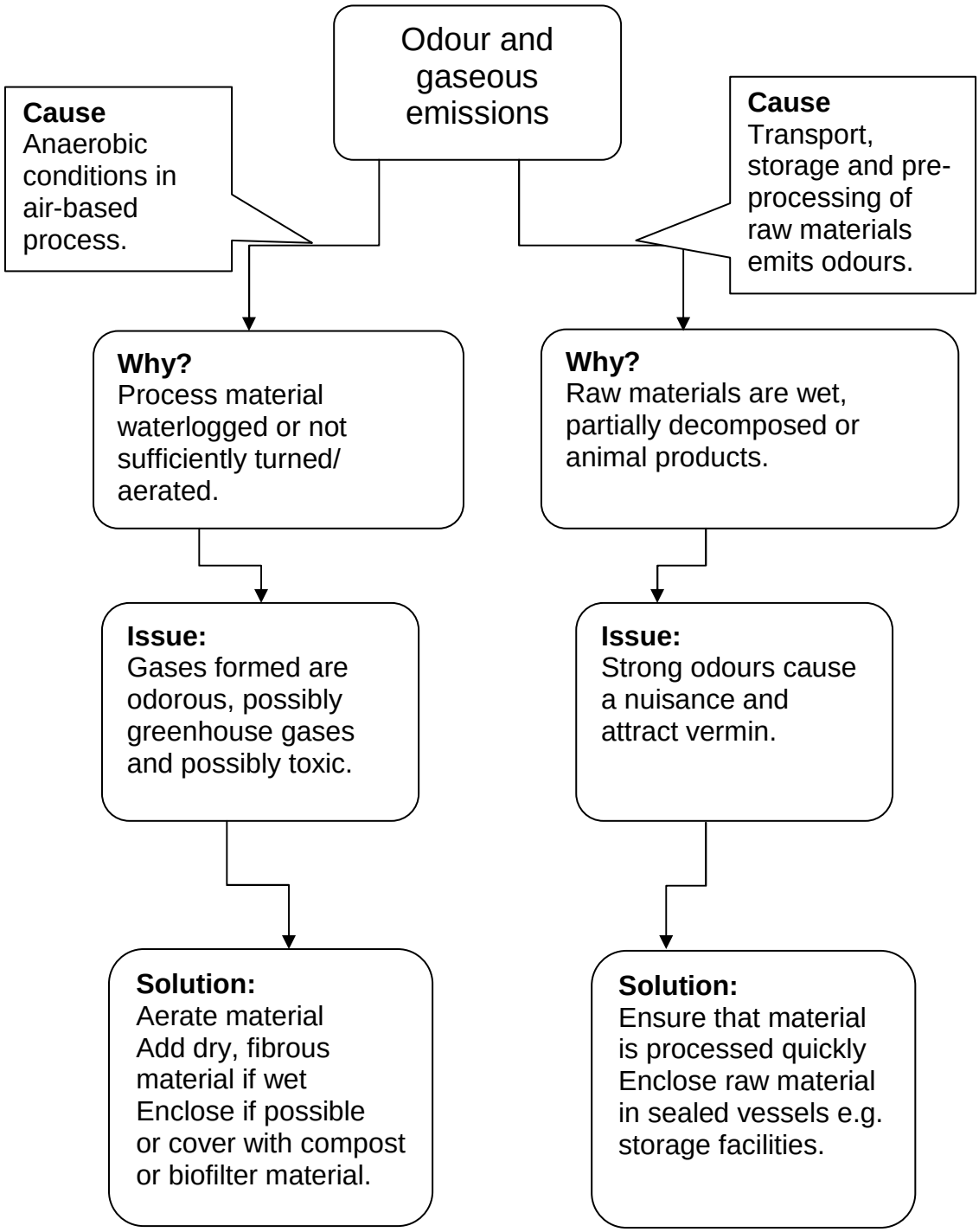
Odour and gaseous emissions

Organics recycling facilities are not permitted to make unauthorised discharges of odours, gases, dust, bio-aerosols and smoke under the Environmental Protection Act 1986 and the Health Act 1911. Discharge of smoke is regulated under the Environmental Protection (Unauthorised Discharges) Regulations 2004.

Significantly, nuisance odours tend to be the most frequent source of complaints against organics recycling facilities. Odours are mostly produced by the acceptance, processing and storage of odorous raw materials or by anaerobic biological decomposition. Process parameters such as water content, adequacy of aeration and permeability should be controlled to avoid odour generation.

A summary of the issues associated with odour and gaseous emissions, desired outcomes and key methods of achieving these outcomes is detailed below.

Issue:	Odour and gaseous emissions produced from anaerobic conditions or storage of certain feedstocks can be odorous, toxic or can contribute to climate change.
Desired outcomes:	• *No emissions of offensive odours are emitted outside the boundaries of the premises.* • *No methane or other gaseous emissions escape from the facility.* • *Levels of gaseous emissions are well within the levels required under legislation / regulation.*
Suggested measures:	• Many odour problems can be easily dealt with in good facility siting, design, operation and management. (See Appendix A.) • Care should be taken to avoid anaerobic conditions in processes not specifically designed to operate anaerobically. This means that regular aeration of the material is needed and water logging is avoided. • Processes designed to operate anaerobically are to be enclosed so that gases produced are unable to escape. Preferably the resultant gas should be used for energy production. • Where the processes are enclosed, consider treatment of exhaust air via wet scrubbing and biofiltration through an appropriately designed biofilter bed. • Recirculate air where possible when using in-vessel systems to conserve heat and reduce odour emissions.



Odour and gaseous emissions: further discussion

Odorous raw materials

Wet and potentially odorous materials should be processed on the delivery day or as soon as possible after being received. Other feedstocks should be used as quickly as possible. The amount of raw material stored on site should be limited to one week's worth of requirements where possible.

Animal manures and other potentially odorous wastes should be received and maintained in a dry state to minimise anaerobic decomposition before processing.

Very wet or fluid wastes should be contained in sealed vessels. Grinding and mixing processes involving odorous wastes should be performed indoors with appropriate odour control equipment.

Stockpiled materials

Ensure stockpiled organics are fully processed and are not going through an intensive decomposition process.

Do not store stockpiles for extended durations prior to sale and distribution.

Minimise size of stockpiles to ensure adequate aeration. If stored outdoors, they should be protected from excessive rainfall, which can decrease porosity and increase the risk of anaerobic conditions and odours forming.

Gaseous emissions

Large volumes of gases are generated during the decomposition stage of an organics recycling operation. Under aerobic conditions the principal gas generated is carbon dioxide. Under anaerobic conditions methane and other gases are also generated.

Climate change implications

Carbon dioxide from the breakdown of organic matter is not viewed as a greenhouse gas (because it is part of the natural carbon cycle). However, methane formation is considered a greenhouse gas and has an impact 21 times more powerful than carbon dioxide. Release of methane into the atmosphere should be avoided.

Where methane is produced intentionally it should be used as part of an energy generation process. All occupation health and safety considerations should be undertaken when handling methane gas, due to it being classified as an explosive gas.

Where methane is intentionally produced, it is preferable that the gas be captured and used for energy production.

Condensate from combustion of biogas should be captured and treated on site. Condensate can be treated in a similar manner as leachate, with the exception that it should not be spray irrigated because of its odour potential and acidity. (low pH)

Other gas emissions

Significant amounts of hydrogen sulphide, organic sulphides and/or volatile organic compounds are also generally emitted under anaerobic conditions. These are highly odorous gases and some are toxic. Odour may therefore indicate anaerobic conditions.

Ammonia and amines are other possible contributors to odour, and may be generated under certain processing conditions. Ammonia is particularly likely with high nitrogen feedstocks, such as manures and/or where high processing temperatures occur. Production of ammonia means that valuable nutrients (nitrogen) are being lost from the product.

When methane is generated through the anaerobic digestion of organic wastes, pollutants such as nitrogen oxides (NO_2 and NO), sulphuric acid mist (H_2SO_4), sulphur oxides (SO_3 and SO_2) and non-methane volatile organic compounds (NMVOC) can be formed when gas flare or electricity-generating equipment is used.

Run-off and leachate collection structures

Leachate drains and run-off storage ponds have the potential to generate odours. Odours from these structures are generally associated with the leachate becoming anaerobic, for example, as a result of leachate ponding in the drainage system or inadequate aeration in the storage system.

Avoiding anaerobic conditions

Compost or other stored organic material should be either mechanically aerated (using piped air through the material) or turned regularly to allow air to penetrate through the pile. Oxygen levels greater than 5 per cent by volume should be maintained in aerobic systems to avoid odour and methane gas formation.

Leachate storage tanks or pits should also be circulated or mechanically aerated to avoid anaerobic conditions developing.

Dust and bio-aerosols

Dust can arise from movement of vehicles and machinery, mixing, grinding, feedstock preparation, screening and product blending. Piles of dry, processed organic materials can generate dust on windy days, and when moved by machinery. Bare soil can also be a source of dust during windy periods. Dust can be both a nuisance and a health concern for workers on the site and for neighbouring properties. Excessive dust can also adversely affect flora and fauna in nearby bushland.

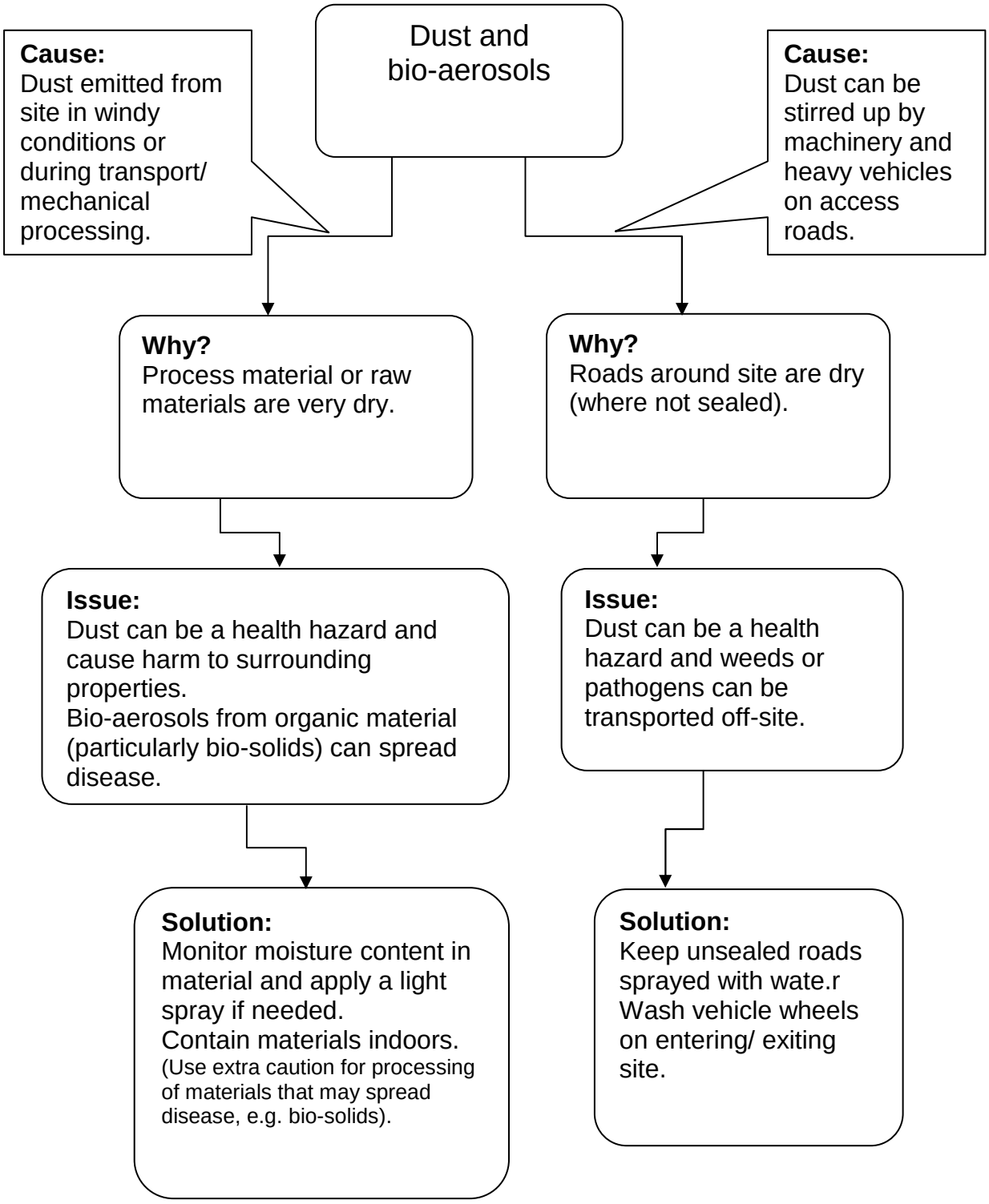
Bio-aerosols are airborne particulates that may contain bacteria, fungal spores (such as *Aspergillus fumigatus* – the agent causing 'Composter's Lung'), pathogens or other microorganisms. Bio-aerosols can have significant impacts on human health. Bio-aerosols may be generated during the movement or agitation of materials at any stage of the operation.

Bio-aerosol emissions are most likely to occur when dust is produced. The generation and dispersion of bio-aerosols should be minimised by appropriate handling and dust control procedures.

A summary of the issues associated with dust and bio-aerosols, desired outcomes and key methods of achieving these outcomes is detailed below.

Issues:	Dust from dry, light material and roads. A nuisance and health concern for workers and neighbouring properties. Bio-aerosols in organic dusts can spread disease and cause harmful infections for workers and/or native species.
Desired	*Dust and bio-aerosol generation on the site is kept to a minimum and*

outcome:	*well within the levels required under legislation / regulation*.
Suggested measures:	• Roads should be sealed or compacted to reduce dust problems. • Movement of large vehicles or mechanical processing of dry material may need to be suspended on very windy days. • Dust suppression measures should be taken. These include covering dusty materials and applying a light water spray to roads and material. • Enclose fixed mechanical equipment used to process the raw and finished materials. • Suction sweeping machines may be needed to maintain dust-free sealed surfaces (including roadways). • Dust can be an indication of insufficient moisture in the composting mass, which may require adjustment. A light spray with water before or during turning should be considered. • Establishing a vegetated buffer zone surrounding the facility and operational areas can assist in reducing wind speeds at ground level and lowering the potential for dust generation. • Minimising exposed soil and areas cleared of vegetation on the facility can also help reduce dust generation.

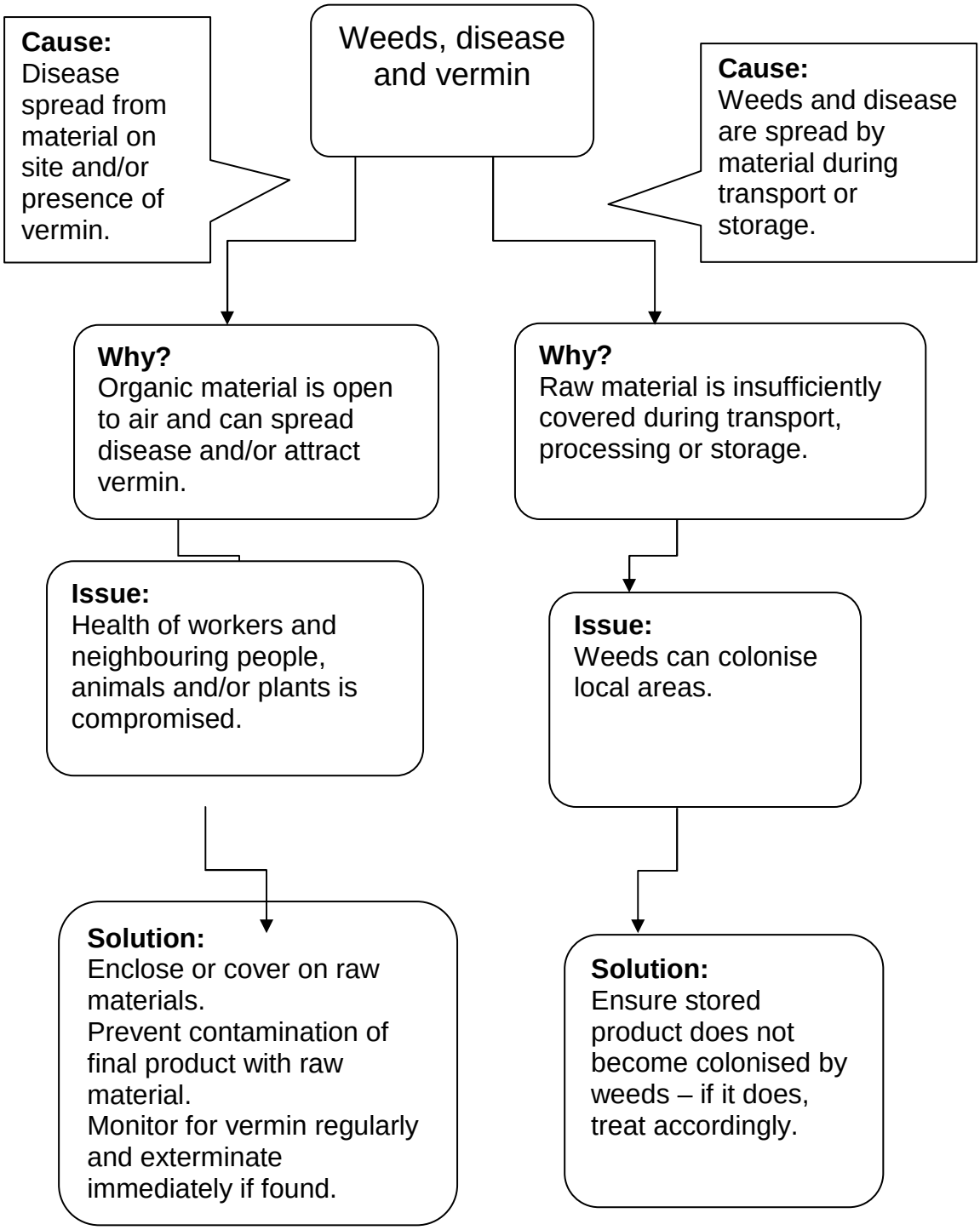

Dust and bio-aerosols
Cause: Dust emitted from site in windy conditions or during transport/ mechanical processing.
Cause: Dust can be stirred up by machinery and heavy vehicles on access roads.
Why? Process material or raw materials are very dry.
Why? Roads around site are dry (where not sealed).
Issue: Dust can be a health hazard and cause harm to surrounding properties. Bio-aerosols from organic material (particularly bio-solids) can spread disease.
Issue: Dust can be a health hazard and weeds or pathogens can be transported off-site.
Solution: Monitor moisture content in material and apply a light spray if needed. Contain materials indoors. (Use extra caution for processing of materials that may spread disease, e.g. bio-solids).
Solution: Keep unsealed roads sprayed with wate.r Wash vehicle wheels on entering/ exiting site.

Control of weeds, vermin and disease. Protection of health and of native species.

It is important for organics recycling facilities to avoid being responsible for adverse impacts upon either their workers' health or on the surrounding areas. There is a chance that disease or weeds can spread from organics recycling facilities and cause problems with nearby plants and/or animals. If a new site is to be cleared in order to establish an organics recycling facility, an assessment of the biodiversity in the area would need to be undertaken. Clearing of land should not destroy habitats for rare or protected native species.

A summary of the issues associated with weeds, vermin and disease, as well as the desired outcome and suggested methods of achieving this outcome is detailed below.

Issues:	Vermin (such as rodents, feral animals, insects and birds) can spread diseases to people and/or to local flora and fauna. Disease can also be spread by poor control of raw materials or by bio-aerosol dispersal. Weeds can disperse from the site, causing non-native species to out-compete endemic species in surrounding areas
Desired outcome:	*Site is free of vermin. Local environment is protected from spread of disease and weed species.*
Suggested measures:	• Raw organic materials should be physically separated from materials undergoing processing to avoid cross-contamination with weeds and pathogens. • Equipment used to move raw organic materials should not be used (unless washed) for the finished recycled organic products to avoid cross-contamination of weeds, plant and animal pathogens. • Vermin (such as rodents, feral animals and flies) and the attraction of birds is minimised by careful containment of raw materials. • Depending on the feedstock, it may be desirable to apply a covering layer of final product when constructing outdoor piles or windrows, which will reduce flies and birds. Keeping odours low is important for minimising attraction of vermin. • Site assessment is undertaken prior to clearing and the significance of the habitat and presence of rare species is evaluated to avoid negatively impacting on the existing habitat and/or rare species. • During transport, storage and processing, material should be contained and windblown transport of weeds and plant pathogens should be minimised. • Finished recycled organic products should not be stored outdoors for excessive periods of time, as windblown weed seed can establish on the surface of piles. • Where weeds do establish on the premises of the organics recycling facility, a program should be in place to destroy weeds to prevent their further establishment on-site. • Facilities that process biosolids should be aware that stringent conditions are in place for handling this material (see Appendix E for relevant regulations).


Weeds, disease and vermin
Cause: Disease spread from material on site and/or presence of vermin.
Cause: Weeds and disease are spread by material during transport or storage.
Why? Organic material is open to air and can spread disease and/or attract vermin.
Why? Raw material is insufficiently covered during transport, processing or storage.
Issue: Health of workers and neighbouring people, animals and/or plants is compromised.
Issue: Weeds can colonise local areas.
Solution: Enclose or cover on raw materials. Prevent contamination of final product with raw material. Monitor for vermin regularly and exterminate immediately if found.
Solution: Ensure stored product does not become colonised by weeds – if it does, treat accordingly.

Fire and smoke production

While steam is often given off by composting material, generation of smoke is not usually an issue at organics recycling facilities. However, significant smoke emissions can occur when organics combust, sometimes in poorly managed stockpiles of organic materials.

Operators of organics recycling facilities should ensure the premises are not a fire risk and that the facility is adequately prepared in the event of fire. Contact should be made with the Fire and Emergency Services Association (FESA) to ensure that measures have been taken to prevent fires and the site is sufficiently equipped in the event of a fire.

Compost fires can occur in excessively large compost windrows or piles of raw materials. Internal pile generation of heat through the microbial degradation of the organic material can build up to dangerous levels when piles are not turned and aerated. Fires are also a hazard where quantities of dry organic material are stored, and care should be taken to avoid the presence of naked flames in these areas.

Compost fires tend to occur during the composting of Category 1 organics, such as garden and landscaping materials (see Table 3, Appendix A).

Compost fires can smoulder and liberate substantial quantities of smoke that can impact on air quality, and are extremely difficult to extinguish.

A summary of the issues associated with fire and smoke, the desired outcome and the suggested methods of achieving this outcome is detailed below.

Issue:	Fire and smoke caused by a build up of heat in piles and anaerobic conditions causing the formation of methane (an explosive gas).
Desired outcome:	*No fires break out and no smoke emissions are released..*
Suggested measures:	• Regular turning can dissipate some of the heat and build up of flammable gases. • Piles of raw materials and compost piles should be limited in size and should be kept moist to reduce the risk of combustion occurring. • Regular temperature monitoring should be undertaken. • Smoking or other use of naked flames should not be permitted near operational or high risk areas of the facility. • Organics recycling facilities should have a well-communicated fire management plan approved by FESA to deal with the risk of fires and related impacts, such as smoke release.

Surface water, groundwater and site contamination

Groundwater is a precious resource that is used for drinking water and must be protected by appropriate siting, design, management and control of the organics recycling facility. Stormwater run-off from organics recycling facilities can become contaminated by nutrients, micro-organisms, organic matter, salts and/or metals. This can pose a risk of adverse environmental impact on the receiving groundwater, particularly when the facility is located on highly permeable soils.

Contamination of groundwater can occur at a distant location during its distribution by the underground water system. It is necessary to assess this risk and/or provide measures to reduce or eliminate it.

In the facility planning stage, a detailed hydrological investigation of both the site and the surrounding groundwater and surface water bodies is required (see Appendicies A and B).

This preliminary water assessment of the site establishes the characteristics of the groundwater and surface water bodies which may be at risk from the organics recycling facility. This information therefore forms the basis for ongoing management and assessment of water at the site.

A summary of the issues associated with water run-off and contamination, the desired outcome and suggested methods of achieving this outcome are detailed below.

Issue:	Water run-off from organics recycling facilities can become contaminated by toxic materials, nutrients, micro-organisms, organic matter, salts and/or metals. These can have adverse environmental impacts on the receiving surface water and groundwater.
Desired outcome:	*Prevention of surface discharges of contaminated water polluting surrounding waters.*
Suggested measures:	• In the facility planning stage, a detailed hydrological investigation of both the site and the surrounding groundwater and surface water bodies is required (see Appendices A and B). • The size of outdoor operational areas should be minimised to reduce the amount of run-off requiring collection and treatment. • Outdoor operational areas should be sealed with a low permeability material (e.g. asphalt or concrete) to prevent leachate and run-off from entering soil. • Clean stormwater should be segregated from contaminated run-off – for example by the use of cut-off drains and barriers to direct it away from the main operational areas. • As part of the water management plan (Appendix B), frequent monitoring of local surface waters (such as creeks and rivers) and groundwater quality is required. This is particularly the case where processing and storage is performed outdoors, or if the facility is located in areas with vulnerable groundwater tables. • Fuels, oils and hydrocarbons should be stored in appropriate and secure above ground vessels. These should be positioned on an impervious floor with bunds capable of retaining a minimum of 110 per cent of the storage facilities in accordance with guidelines of the

	Department of Industry and Resources and the Department of Water.

Provided that good planning and housekeeping practices are employed to keep the premises in a relatively 'clean' state, stormwater collected outside the bunded areas or from clean roofs should be acceptable as normal stormwater for off-site discharge without treatment.

Other general recommendations for management of stormwater from organic recycling facilities is given in *Water Quality Protection Note 52 - Stormwater Management at Industrial Sites* (Department of Water, 2006c).

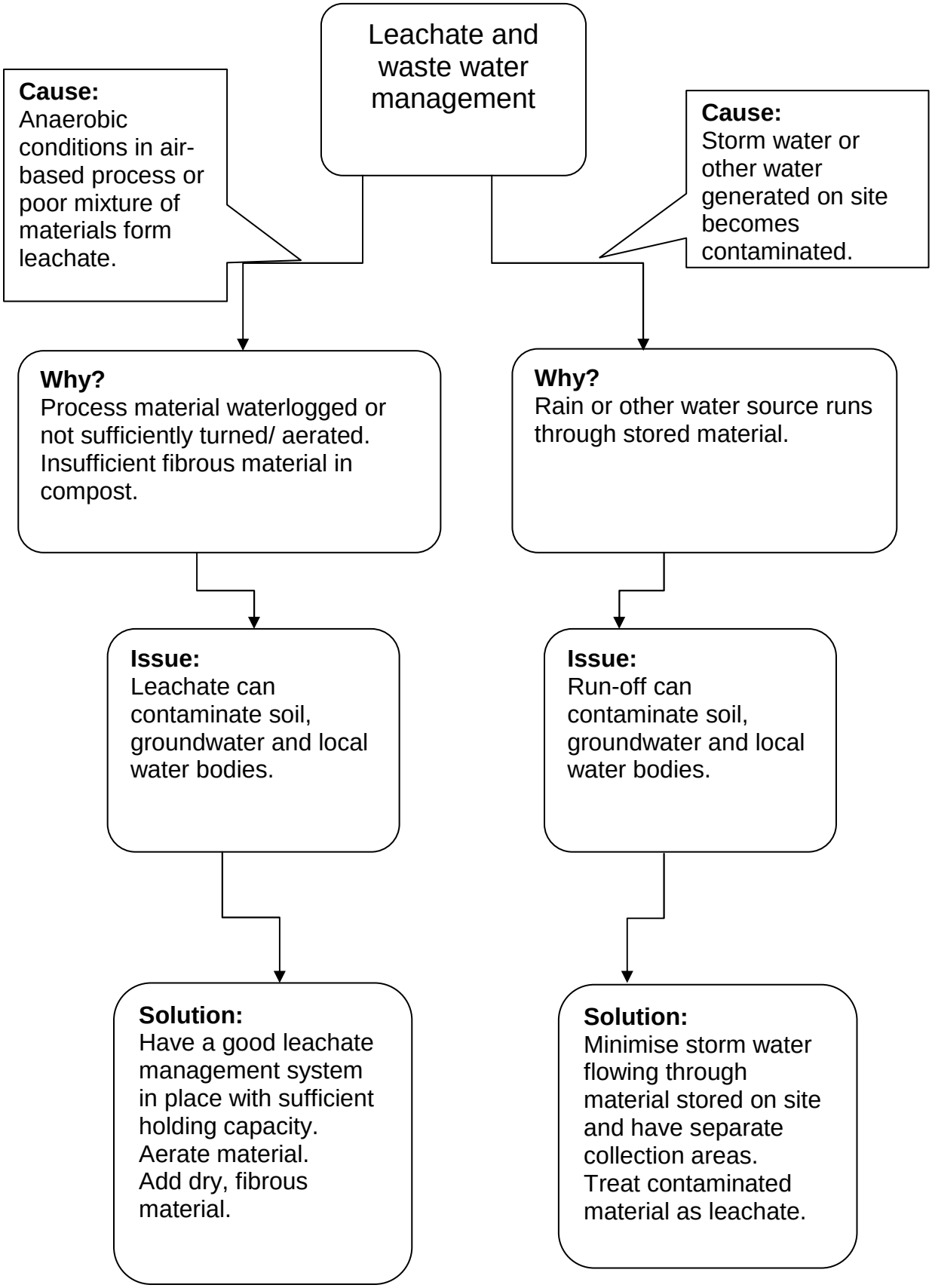
Waste water and leachate

Leachate and contaminated waste waters can be a problem at organics recycling facilities. The high nutrient content of the liquid can cause pollution of soil and local waters.

A summary of the issues associated with leachate and waste water run-off, and the desired outcomes and suggested methods of achieving these outcomes, is detailed below.

Issue:	Leachate and waste waters can contaminate groundwaters, local surface waters and the land at or adjacent to the site.
Desired outcome:	• *Leachate and process waste water should be recycled as much as possible within the organics recycling facility.* • *No contaminated waste water is discharged from the site.* • *Prevention of contamination at the site.*
Suggested measures:	• Outdoor areas should be bunded to prevent any migration of leachate or run-off. The bund should be designed to contain all rainfall from a 1 in 100 year rainfall event with a duration of 72 hours. • A leachate barrier system should be installed beneath the operational surfaces of the organics recycling facility. This provides a secure barrier between the groundwater, soil and substrata, and the organic materials as per the water management plan. (Appendix B). • Indoor operational activities should have collection drains to intercept all leachate and run-off for recycling or treatment. • Run-off from areas where organics are processed or stored should be treated as leachate. This should be collected in impermeable sumps, pits, holding tanks or ponds and re-used as much as possible within the organics recycling process (compliant with NHMRC, 2000). • A proportion of leachate may be evaporated in sealed ponds, but aeration is needed to minimise the potential for anaerobic conditions developing and odours occurring. • Sufficient storage capacity should be available on-site for retention and treatment of waste water and be able to cope with heavy rainfall periods without overflowing. Additional storage capacity is

	recommended to reduce the risk of overflows occurring.
	• If leachate or contaminated stormwater quantities exceed process needs, it must be discharged to the sewer system where available, or to land:
	  • If discharged to the sewer it must comply with Water Corporation limits;
	  • Any discharge of wastewater to land is subject to approval from the Department of Environment and Conservation (DEC).
	• Representative samples of processed waste water must be taken regularly and tested as per the water management plan (see Appendix B).


Leachate and waste water management
Cause: Anaerobic conditions in air-based process or poor mixture of materials form leachate.
Cause: Storm water or other water generated on site becomes contaminated.
Why? Process material waterlogged or not sufficiently turned/ aerated. Insufficient fibrous material in compost.
Why? Rain or other water source runs through stored material.
Issue: Leachate can contaminate soil, groundwater and local water bodies.
Issue: Run-off can contaminate soil, groundwater and local water bodies.
Solution: Have a good leachate management system in place with sufficient holding capacity. Aerate material. Add dry, fibrous material.
Solution: Minimise storm water flowing through material stored on site and have separate collection areas. Treat contaminated material as leachate.

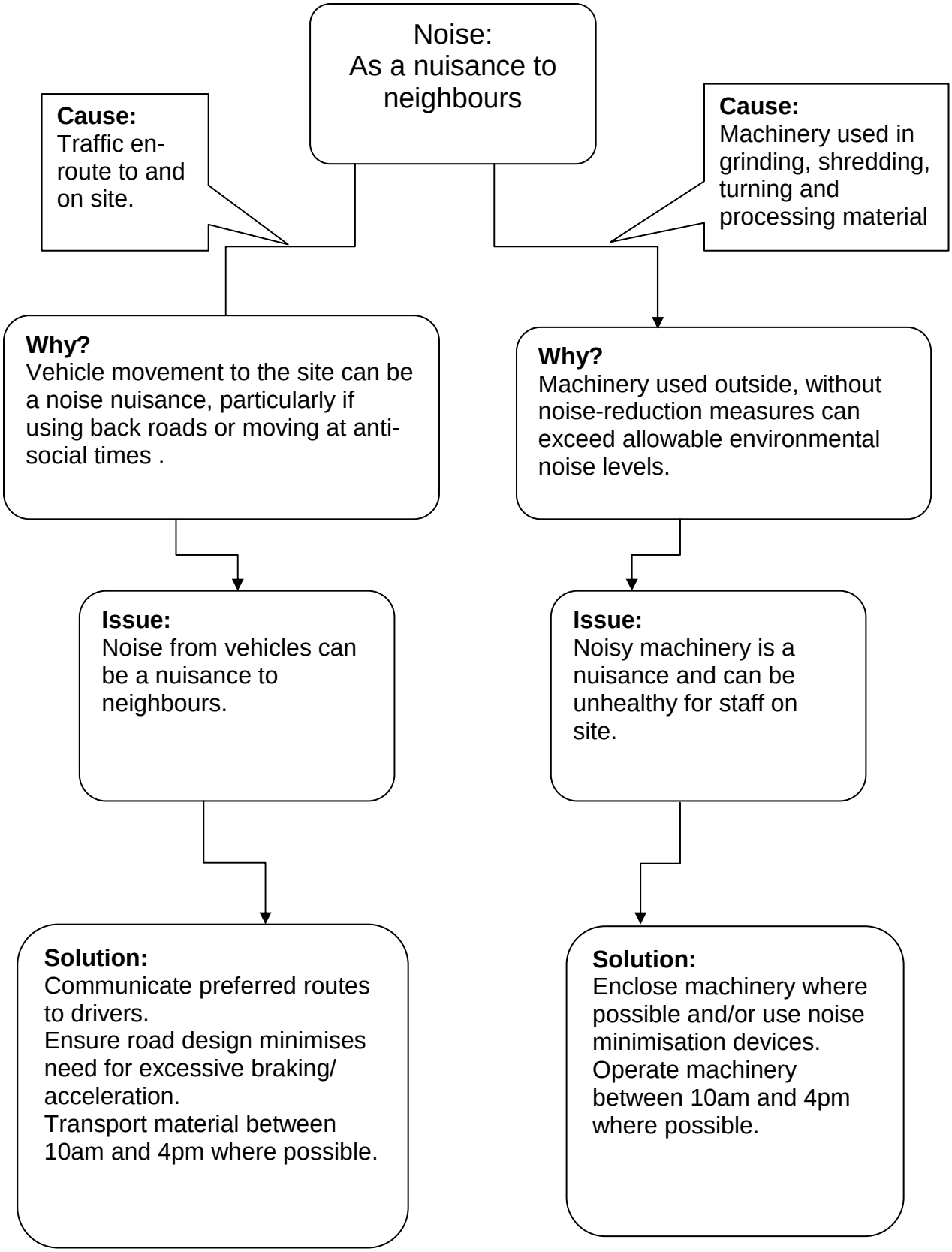
Noise issues

While noise does not represent an obvious health or environmental risk, it is an issue that can impact upon neighbouring properties. It can also cause long-term damage to the hearing of workers at the site if not managed properly. Noise may also be a concern where it impacts on the safe running of the site, owing to workers being unable to hear approaching vehicles. The assessment of future operating licences will take the number of complaints about a site into consideration.

There are well-defined guidelines and regulations for noise levels (See Table 2 and also the regulations listed in Appendix E).

A summary of the associated issues of noise, the desired outcome and suggested methods of achieving this outcome, is detailed below.

Issue:	Noise may cause a nuisance to neighbouring properties.
Desired outcome:	*On-site machinery or traffic is prevented from causing a noise nuisance to neighbouring properties. Noise levels comply with limits prescribed in licence conditions and regulations.*
Suggested measures:	• Site the facility appropriately. See Appendix A for more details on facility location. • Choose mobile and fixed machinery with low noise outputs. • Enclose noisy equipment or install and regularly maintain noise suppression equipment (e.g. mufflers on machinery and vehicles). • Restrict operating hours. • Maintain a noise buffer to noise sensitive premises and attenuate noise by screens or earthen embankments around the site. • Drivers should be informed of preferred routes to minimise noise and drive at low speed when entering and leaving the premises to avoid residential areas and use arterial routes. • The exit and entry to the premises should be designed to avoid the need for vehicles to suddenly brake or accelerate excessively. • Particular attention should also be paid towards the placement of traffic control devices such as speed humps and vibration grids to avoid excess noise generation.


Noise:
As a nuisance to neighbours
Cause:
Traffic en-route to and on site.
Cause:
Machinery used in grinding, shredding, turning and processing material
Why?
Vehicle movement to the site can be a noise nuisance, particularly if using back roads or moving at anti-social times .
Why?
Machinery used outside, without noise-reduction measures can exceed allowable environmental noise levels.
Issue:
Noise from vehicles can be a nuisance to neighbours.
Issue:
Noisy machinery is a nuisance and can be unhealthy for staff on site.
Solution:
Communicate preferred routes to drivers.
Ensure road design minimises need for excessive braking/ acceleration.
Transport material between 10am and 4pm where possible.
Solution:
Enclose machinery where possible and/or use noise minimisation devices.
Operate machinery between 10am and 4pm where possible.

Litter and illegal dumping

Litter and illegally dumped material can be unsightly, pose a health and safety risk and provide a breeding ground for insects. Regulations are in place to prevent material from being illegally dumped or littered and facilities in breach of these regulations can be prosecuted. A summary of the issues associated with waste, and the desired outcome and suggested methods of achieving this outcome, is detailed below.

Issue:	Litter and illegal dumping of organic and/or other wastes on or around the site.
Desired outcome:	*No illegally dumped rubbish on or near the site.*
Suggested measures:	• Site should be kept tidy and free of packaging or other wastes. Safeguard against light plastics becoming a source of wind-blown litter. • Illegal dumping close to the facility should be monitored and reported to the relevant local council. • Ensure the premises are secure and appropriate fencing is established around the facility's perimeter. The gate of the facility should be appropriately staffed during business hours to monitor the contents of organic wastes brought to the facility and to prevent unauthorised deposition of materials for recycling. This can be an issue for organics recycling facilities located at landfill sites. • The premises should be securely locked outside of business hours to prevent unauthorised access and the possibility of illegal dumping. • Where illegal dumping has occurred, regular clean ups should be performed and the waste material recycled or disposed of to an appropriate licensed landfill.

For more information

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Appendix A: Facility planning

Good facility planning is an important way of minimising the environmental impacts associated with organics processing facilities. It is recommended that these facilities be sited away from environmentally sensitive receptors, such as homes, agriculture, national parks, businesses, and other buildings where amenity could be affected by the release of odour, dust, noise, weeds, pathogens or contaminated water.

The following issues should be considered in the environmental impact assessment which is usually required as part of the planning and works approval process:

- quantity of organic materials processed
- size of the processing area
- the category of the organics to be processed (See Table 3, Appendix A)
- the processing technology employed
- whether the process is enclosed or open-air
- the estimated odour emission rate
- whether odour removal technology is employed
- the topography of the site
- hydrological conditions (groundwater movement) at the site
- proximity of sensitive water bodies or wetlands
- the direction and frequency of winds
- the distance of the facility from neighbouring property boundaries
- likely noise impacts from traffic and machinery.

Guidance on land use, planning and the environmental impact assessment process for organics recycling facilities is available from the Environment Protection Authority (WA) in *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA, 2005).

Guidance is also available from the Environmental Protection Authority in preparing best practice proposals for assessing the environmental impacts associated with a proposed organics recycling facilities. The publication is titled *Guidance for the Assessment of Environmental Factors (in accordance with the Environmental Protection Act 1986) No. 55: Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process* (EPA, 2003).

Site selection

A well sited and managed facility is an effective way of avoiding negative impacts on local amenity. In addition, appropriate design, good processing technology selection, emission control equipment, good site management and procedures and staff training, are other important ways of avoiding amenity problems.

Prudent planning should ensure that these facilities are located at a sufficient distance (called a buffer distance) from sensitive or special ecosystems, such as wetlands or water bodies. Buffer distances provide a safeguard against adverse environmental impacts from contaminated run-off and leachates.

Proposals for organic recycling facilities that involve composting or the storage of 'putrescible' materials will not be accepted in Priority 1 and 2 water supply areas (Department of Water, 2006d). Facilities can only be established where the depth to the annual average maximum water table exceeds one metre, provided it is sited on undisturbed earth. DEC should be consulted if the proposed site has been filled or disturbed.

Categorisation of organics

The type of organic material processed at a facility can have a big impact on the level of process, control and technology required to avoid impacting on the environment. Selection of an appropriate technology which can adequately deal with the organic materials to be processed at the chosen site is crucial.

Organic materials vary in composition, and materials with a high nutrient and moisture content can begin to decompose quickly which can lead to significant environmental impacts. Such materials have the potential to give off strong odours, to attract vermin and generate harmful leachate which could contaminate surface water, groundwater and soil.

Three categories of organic materials are presented in Table 3, which has been derived from the NSW DEC (2004). Operators of organics recycling facilities are responsible for selecting and applying the best mix of transport, storage and processing techniques suited to the category of incoming material that will enable them to meet environmental performance requirements.

Table 3. Organic material categories. Table modified from the NSW DEC (2004).

Potential to have environmental impact	**Organics category**	**Types of organics permitted in categories**[1] Categories with larger numbers may contain types from classes with smaller numbers.	
		Type	**Examples of organics**
Lowest potential environmental impact	Category 1	Garden and landscaping organics	Grass[2]; leaves; plants; loppings; branches; tree trunks and stumps
		Untreated timber	Sawdust; shavings; timber offcuts; crates; pallets; wood packaging
		Natural / fibrous organics	Peat; seed hulls/husks; straw; bagasse and other natural organic fibrous organics
		Processed fibrous organics	Paper; cardboard; paper-processing sludge; non-synthetic textiles
Some potential environmental impact	Category 2	Other natural or processed vegetable organics	Vegetables; fruit and seeds and processing sludges and wastes; winery, brewery and distillery wastes; food organics excluding organics in Category 3
		Biosolids[3] and manures	Sewage biosolids, animal manure and mixtures of manure and biodegradable animal bedding
Greatest potential environmental impact	Category 3	Meat, fish and fatty foods	Carcasses and parts of carcasses; blood; bone; fish; fatty processing or food
		Fatty and oily sludges and organics of animal and vegetable origin	Dewatered grease trap; fatty and oily sludges of animal and vegetable origin
		Mixed residual waste containing putrescible organics	Wastes containing putrescible organics, including household domestic waste that is set aside for kerbside collection or delivered by the householder directly to a processing facility, and waste from commerce and industry

1. These categories are used only to facilitate reference to these groupings of waste and organics (with different potential environmental impacts) in these guidelines.
2. Particular care should be taken when grass clippings are present in the feedstock. It is well known that careful process management is required to mitigate odour and leachate problems when processing grass clippings. High moisture content, high nitrogen levels, abundance of readily available organic matter, poor structure and tendency to mat mean that grass can easily become anaerobic and odorous.
3. Conditions applying to processing and use can be found in Environmental Guidelines: Use and Disposal of Biosolids Products (NSW EPA, 1997).

Odour buffer distances

Buffer distances from sensitive areas protect against odours and dust that may degrade residential or social amenity. Buffers surrounding organics recycling facilities are not intended to dilute emissions released by the facility. They are intended to be a safeguard against occasional odours that may occur as a result of unusual weather conditions or equipment and process failures.

These guidelines do not prescribe suitable buffer distances from sensitive receptors. The size of the buffer distance required will depend on the:

- category of the organics being processed (see Table 3, Appendix A)
- nature of the processes being operated on the site
- location of the facility with respect to population and sensitive land uses

- type of equipment, buildings and protective structures on the site
- level of expertise and training of staff operating the processes
- intensity of the around-the-clock supervision of the processes
- prevailing weather conditions at the site.

Generally, outdoor organics processing and storage facilities require substantially larger buffer distances than when activities are undertaken within an enclosed system. Enclosing the organics recycling facility and storage of organic materials helps control odours and leachates.

Guidance in terms of suitable buffer distances between organics recycling facilities (specifically composting) and potentially sensitive land uses is given in Appendix 1 of *Guidance for the Assessment of Environmental Factors (*in accordance with the *Environmental Protection Act 1986)* No. 3 Separation Distances between Industrial and Sensitive Land Uses (*EPA, 2005*).

Odour impact assessment

Facility proponents should conduct detailed odour modelling at the facility planning stage in accordance with the Air Quality Modelling Guidance Notes (Department of Environment, 2006). An understanding of meteorological conditions on the site, and how they vary from month to month, is required to determine the likelihood of odour impacting on sensitive receptor areas. Appropriate buffer distances should be set to ensure that sensitive receptors are not affected by odours.

Buffer distances from wetlands and surface water bodies

Water resources can be protected by siting organics recycling facilities at appropriate distances from sensitive wetlands and water bodies. Facilities should not be established within the secondary zone of influence (200 m) of any wetland classified for Conservation and Resource Enhancement. Facilities may be sited (with conditions) on former wetlands classified as Multiple Use (Water and Rivers Commission, 2001).

Water and Rivers Commission (2001) recommends that composting facilities be sited with a minimum buffer width of 2,000 m in the direction of groundwater flow for transmissive soils.

Facilities should not be established on land classified as P1 or P2 Public Drinking Water Source Areas (PDWSAs) (Department of Water, 2006d). Composting facilities may be established on PDWSA land classified as P3 with certain conditions.

Site water assessment

A detailed hydrological investigation of both the site and the surrounding groundwater regime needs to be conducted before site establishment. This is ideally undertaken as part of the facility planning process and is critical to inform the suitability of each potential site.

The water assessment should determine:

- groundwater flow pathways for all aquifers on site
- the vulnerability of the groundwater underneath and adjacent to the facility
- whether systems to prevent groundwater pollution need to be established.

It may be necessary to consider a water pollution remediation plan if pollution of groundwater, surface water or the subsoil is confirmed in the preliminary water assessment of the site or is identified by external monitoring.

Prevention and management of fire

Organics recycling facilities are at risk of fire. A fire management plan should be put in place and the FESA should be contacted to ensure that this plan is satisfactory.

The following measures should be considered in the development of a fire management strategy for the facility.

- Potential causes of fire at the facility
- Procedures to follow, persons responsible, and equipment to be used in the event of a fire. This will include on-site resources and external resources (such as FESA), and details of how the procedure will operate on a 24-hour-a-day basis
- The maintenance schedules for all fire-fighting equipment and facilities. At a minimum, all equipment and facilities should be visually checked for damage on a weekly basis and test operated on a quarterly basis
- Details of all the fire-fighting equipment that will be installed at the flammable store and at site buildings
- How all fire-fighting equipment will be clearly signposted and how access to it will be ensured at all times
- Details of the firebreaks to be constructed and maintained around all filled areas, stockpiles of combustibles, gas extraction equipment and site buildings
- Training of facility staff in fire-fighting techniques.

Noise impact assessment

Facility planners and designers should consider potential impacts of noise from the organics recycling facility on neighbouring land users. Existing background and ambient noise levels should be evaluated and subsequent measures designed to ensure prescribed levels set out in the *Environmental Protection (Noise) Regulations* 1997 are not exceeded.

As a part of the facility planning process, predictions should be made in relation to noise levels at the specific site, taking into account site-specific meteorological conditions (notably wind direction), which can affect noise levels. Predicted noise emissions need to be taken into account when designing noise mitigation strategies, such as those set out in this document.

Site closure and rehabilitation

Before closure of the facility, the occupier should prepare a closure plan. The following measures should be considered in closing the facility and conducting site remediation, where necessary.

- Materials, processed products, waste and chemicals must not remain on the premises
- Equipment (including appliances, bins and process areas) must be emptied, cleaned and disinfected
- Equipment must be removed from the premises, unless it can be demonstrated that it will not have the potential to cause environmental impacts and is needed for subsequent uses of the site
- The facility must be revegetated or otherwise made stable and suitable for the proposed future land use of the site. The revegetation of any exposed working areas must be started within 30 days of cessation of composting and related organics processing (weather permitting), and the final revegetation layer must be of a depth and type sufficient to support the revegetation scheme proposed
- Final surfaces prepared on the site must control surface erosion and protect local amenity
- Groundwater monitoring and monitoring of surface water bodies must be continued until the absence of any pollution that would pose a threat can be demonstrated.

Appendix B: Water management plan

A water management plan is an important part of the organics recycling facility planning and development process and is a required part of the licensing process. Information in Table 4 provides a guide to the issues that need to be addressed in the development of a thorough and well-designed water management plan.

Table 4: Considerations in the development of a water management plan for an organics recycling facility (modified from the NSW DEC, 2004).

Component	Plan requirements
Groundwater and sub-soil monitoring	+ Description of background characteristics of the groundwater. Unless the preliminary water assessment of the site (Appendix A) has established that the facility poses minimal risk to groundwater, the water assessment plan should include: • a scale drawing showing the location and depth of groundwater monitoring bores. • documentation outlining the groundwater hydraulics and the procedures used for bore development and bore security. A guide to establishment of ground water monitoring bores is available from the Department of Water (2006b).
Discharge to surface water bodies	+ A scale drawing of discharges to surface water bodies (including creeks, rivers and dams). + Documentation outlining the predicted discharge conditions (e.g. frequency and volume).
Surface water body monitoring network	+ Description of the background characteristics of the surface water bodies before organics processing or storage commences. + A scale drawing of monitoring points for all surface water bodies (such as creeks, rivers and dams), which includes: • surveyed monitoring points established upstream and downstream of the facilities. • discharges from the premises to surface water bodies, a minimum of one monitoring point per surface water body located downstream from (for flowing or perennial waters) or near (for still waters) the processing area. It is advisable, however, to locate one reference monitoring point per surface water body – upstream (for flowing waters) or distant (for still waters) from the processing area – in order to establish whether any detectable change in water quality has been caused by the processing activities.
Indicator parameters and limits for routine monitoring and assessment of waters	+ A list of indicator parameters and limits for routine monitoring and assessment of waters (including groundwater, surface water bodies such as rivers, creeks and dams) and leachate. + Documentation that gives details of how the parameters were selected and limits for the specific indicators adopted will provide an indication of all the possible types of pollution that may occur. The indicator parameters chosen should be based on the preliminary water assessment of the site (Appendix A) and the types of organics processed as the facility. The following parameters could be used in identifying and assessing waters: • alkalinity, ammonia, calcium, chloride, fluoride, iron, magnesium, manganese, nitrate, organochlorine pesticides, organophosphate pesticides, pH, total phenolics, polycyclic aromatic hydrocarbons, potassium, sodium, sulfate and total organic carbon (TOC). + Regular monitoring of electrical conductivity (EC) may be used for preliminary indication of changes in water quality. This is because EC is a measure of the ability of water to conduct an electric current and is sensitive to variations in dissolved solids, mostly mineral salts. Increases in the measured values of EC for water bodies are often good warnings of changes in the dissolved mineral salt content.

Appendix C: Environmental management plan

An environmental management plan is required as part of the works approval process for a new organics recycling facility or for an alteration to an existing facility. The plan should set out how good environmental management will be achieved to meet required performance measures.

The plan should support any works approval or licence application and should also address the following items.

- Provide a detailed site plan, including a locality map, showing the siting of the facility and location of environmentally sensitive areas, including residential zones, dwellings, agricultural properties, national parks, schools and hospitals; a ground plan of the facility, including location of monitoring points/equipment; natural characteristics of the site (local meteorology i.e. wind and rain patterns), soil morphology, geology, hydrogeology and surface waters)

- Facility environmental policy

- Procedures to minimise environmental, public health and social amenity concerns

- Proposed raw materials to be processed, storage methods, volumes and throughput of all process materials and process technology

- Procedures for effective management of leachate, storm water and waste water

- Procedures for effective management of gases and odours

- Product quality assurance, including process controls and monitoring, product testing and monitoring – physical, chemical and biological, and management of contaminated organics and products

- Environmental management measures and procedures, including training of personnel and housekeeping to manage environmental concerns

- Fire fighting and prevention strategy, including fire fighting provisions

- A program for ongoing monitoring and regular evaluation of results.

Appendix D: Better practice organics processing

A number of best practice guidelines (BPGs) for organics processing have been developed in Australia. They focus primarily on composting and its various forms. The BPGs set out recommended facility design, process management and product manufacturing to meet end-market needs.

This guideline does not list recommended techniques for better practice organics processing, though operators of existing facilities and proponents of new facilities can refer to the following BPGs for guidance on optimising process management:

- Waste Management Association of Australia (2004). Best practice guideline series – composting. Prepared by the WMAA National Technical Committee for Organics Recycling. February 2004.

- Recycled Organics Unit (2003). Guide to developing a process control system for a composting facility. Second Edition. Published by the Recycled Organics Unit, The University of New South Wales.

- Recycled Organics Unit (2002). Best Practice Guideline to managing on-site vermiculture technologies. Published by the Recycled Organics Unit, The University of New South Wales.

- EcoRecycle Victoria (1998). Best practice guide: composting green organics. Published by EcoRecycle Victoria.

Appendix E: Related legislation, regulations, licences and guidelines

The following legislation, regulations, licensing issues and guidelines should be considered by proponents in the planning, design, operation and management of organics recycling facilities in Western Australia.

Environmental Protection Act 1986

The objective of this Act is to ensure the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with a range of activities, which include organics recycling facilities.

The *Environmental Protection Act 1986* (the Act) provides powers for the Minister for the Environment to impose environmental conditions following formal assessment by DEC of proposals that may have a significant effect on the environment. The Act also proves powers to the Chief Executive Officer (CEO) of DEC to control pollution and manage waste discharges.

Some sections of the Act that are of relevance to organics recycling facilities include:

- Part 4 Environmental impact assessment
- Section 49 Causing pollution and unreasonable emissions
- Section 50A Causing serious environmental harm
- Section 50B Causing material environmental harm
- Section 79 Unreasonable noise emissions on premises.

Section 53 of the Act requires occupiers of prescribed premises who install, replace or alter equipment, raw materials, products or fuels which may cause, increase or alter the discharge of waste, noise, odour or electromagnetic radiation, to do so in accordance with a works approval and/or a licence.

Section 54 and 57 set out the procedures for an application for a works approval and licence to the CEO of DEC. An outline of the issues that need to be considered in an application for a Works Approval is given in Appendices A to C in this guideline.

The CEO may refuse or grant the works approval or licence with or without conditions. An applicant may, within 21 days, appeal a licence or works approval refusal or the conditions imposed by a works approval or licence. Breaches of conditions of works, approvals or licence is an offence.

Environmental Protection Regulations 1987

Under Schedule 1 (Category 67A) of the *Environmental Protection Regulations 1987* compost manufacturing and soil blending premises, on which more than 1,000 tonnes per year of organic material (excluding silage) or waste is stored pending processing, mixing, drying or composting to produce commercial quantities of

compost or blended soils, are defined as a scheduled premises and require a works approval and a licence to operate.

Part 8 of the regulations sets out the necessary monitoring and record keeping to demonstrate compliance with licence conditions.

Environmental Protection (Noise) Regulations 1997

Generation of unreasonable noise from a licensed premise which exceeds prescribed levels in the *Environmental Protection (Noise) Regulations 1997* is an offence and may be subject to prosecution.

A prescribed standard for noise emissions is given in Section 7 and assigned levels are given in Section 8. Part 3 of the regulation sets out the requirements for noise measurement from licensed premises.

Environmental Protection (Unauthorised Discharges) Regulations 2004

Organics recycling facilities are not permitted to make unauthorised discharges of solid or liquid waste from the premises as defined in Schedule 1 of the Environmental Protection (Unauthorised Discharges) Regulations 2004.

Schedule 2 also sets out a list of materials that must not be burnt on licensed premises.

Environmental Protection (Controlled Waste) Regulations 2004

Drivers of vehicles that transport controlled waste to organics recycling facilities may require a licence to legally transport these materials. Designated vehicles and tanks used to transport controlled waste may also require licensing under the regulations.

Schedule 1 of the regulations sets out the types of materials that are classified as controlled waste. Materials of relevance to organics recycling facilities include, but are not limited to, fly ash; residues from industrial waste treatment or disposal operations; sewage; soils contaminated with a controlled waste; tannery wastes; vegetable and food processing waste; waste from grease traps; and wool scouring wastes.

Contaminated Sites Act 2003 and Contaminated Sites Regulations 2006

The *Contaminated Sites Act 2003* requires the identification, recording, management and remediation of contaminated sites in Western Australia.

Consideration of this Act and regulations is required by proponents considering the development of an organics recycling facility which may have previously been deemed contaminated, or in the remediation and closure of facilities that have contaminated soils during their operation.

Draft Guidance Statement No. 33 (2005). Environmental Guidance for Planning and Development

The main purposes of this EPA Guidance Statement are to provide information and advice to assist participants in land use planning and development processes to protect, conserve and enhance the environment. The statement also describes the processes the EPA may apply under the *Environmental Protection Act 1986* to land use planning and development in Western Australia, and in particular describes the environmental impact assessment (EIA) process applied by the EPA.

Guidance for the Assessment of Environmental Factors **(***in accordance with the* **Environmental Protection Act 1986***) No. 55 (2003). Implementing best practice in proposals submitted to the Environmental Impact Assessment process*

This document is one in a series issued by the EPA to assist proponents, consultants and the public to gain additional information about the EPA's thinking in relation to aspects of the EIA process. The series provides the basis for the EPA's evaluation of, and advice on, development proposals subject to EIA. The guidance statements are intended to assist proponents to achieve an environmentally acceptable proposal.

Guidance for the Assessment of Environmental Factors (in accordance with the **Environmental Protection Act 1986***) No. 55 (2003). Separation Distances between Industrial and Sensitive Land Uses*

This document assists proponents, consultants and the public in addressing generic separation distances between industrial and sensitive land uses to avoid conflicts between these land uses. It takes into account protection of the environment as defined by the *Environmental Protection Act 1986*, with a focus on protecting sensitive land uses from unacceptable impacts on amenity that may result from industrial activities, emissions and infrastructure.

Dangerous Goods Safety Act 2004

The *Dangerous Goods Safety Act 2004* sets out provisions for the safe storage, handling and transport of dangerous goods and for related purposes.

Depending on the quantity of dangerous goods stored, an organics recycling facility may need a licence to store dangerous goods from the Department of Consumer and Employment Protection.

Health Act 1911

The *Health Act 1911* outlines provisions for the protection of public health in Western Australia. Numerous sections of this Act apply to the design, operation and management of organics recycling facilities to ensure public health is not affected.

A number of environmental impacts such as noise, odour, dust and bio-aerosols are dealt with in the *Environmental Protection Act 1986* and its supporting regulations. In particular, Part VII of the Health Act deals with nuisances and offensive trades, and the management of impacts from these types of operations.

Town Planning and Development Act 1928 and Town Planning Regulations 1967

The *Town Planning and Development Act 1928* and Town Planning Regulations 1967 sets out provisions for local councils to develop town planning schemes, providing a framework for managing local development across a range of land uses.

Waterways Conservation Act 1976

The *Waterways Conservation Act 1976* outlines provisions for the conservation and management of certain waters and of the associated land and environment.

Section 23 of the Act provides the authority to the Department of Water, among other functions, to preserve or enhance the quality of the environment and amenities of the waters and of the associated land to which the powers of the department apply, and to control and, wherever practicable, to prevent any act or omission which causes or is capable of causing pollution of those waters or that land.

Consideration of this Act is required by proponents of organics recycling facilities to ensure facilities are appropriately sited and are designed not to pollute waterways.

Water Quality Protection Note 76 (2006). Land Use Planning in Public Drinking Water Source Areas

The Department of Water (DOW) is responsible for managing and protecting the State's water resources. This note provides advice on the acceptability of land uses and activities within specific catchments that are the water source for schemes supplying cities and towns.

The Water Quality Protection Note can assist in informing areas unacceptable for establishment of an organics recycling facility.

Water Quality Protection Note 30 (2006). Groundwater Monitoring Bores

The DOW is responsible for managing and protecting the State's water resources. It is also a lead agency for water conservation and reuse. The note provides guidance on the construction of groundwater monitoring bores.

The note should be considered to inform the design and construction of groundwater monitoring bores as part of the Water Management Plan for an organics recycling facility, outlined in Appendix B.

Water Quality Protection Note 52 (2006). Stormwater Management at Industrial Sites

This note, published by DOW applies to light, general and heavy industrial sites throughout Western Australia, and provides a list of recommendations related to stormwater management practice that should be addressed, including proposals involving Environmental Impact Assessment.

Water Quality Protection Guidelines No. 3 (2000). Mining and Mineral Processing Liners for Waste Containment

These guidelines published by the former Water and Rivers Commission, now DOW, are designed to be used for the construction of liners required to contain chemicals, ores or waste. These guidelines can inform the design of liners for protecting underlying soils and groundwater associated with organics recycling facilities.

Water Quality Protection Note 27 (2006). Liners for Containing Pollutants, Using Engineered Soils

This note applies to constructed ponds and material holding compounds used to contain substances that present a low hazard to waters in the environment due to their nature, mobility or concentration. These substances include acidic or alkaline waters, animal wastes, brines, mineral processing residues of low toxicity, nutrient-rich organic waste, oily wastes, sewage, and turbid (soil-laden) waters. Liners are necessary where fluid leakage must be minimised to prevent a discernible impact on nearby surface water or groundwater resources, to avoid vegetation damage and to protect aquatic plants and animals.

The Water Quality Protection Note can be used to inform the design of leachate or waste water storage ponds, with sufficiently low permeability such that risk to surface and ground water quality is minimised.

Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products (Department of Environmental Protection, 2002).

Any material mixed with or produced with biosolids is regulated under the *Western Australian Guidelines for Direct Land Application of Biosolids and Biosolids Products* (Department of Environmental Protection, 2002). Whereas the Biosolids Guidelines permit the cleanest biosolids products (suitable for 'Unrestricted Use') to be used without any conditions, products containing higher concentrations of chemical contaminants or pathogens (suitable for restricted use) have stringent conditions placed on the location, method and rate of their application to land and are permitted only in non-domestic uses, such as agriculture, forestry and environmental rehabilitation.