



WQPN 51, OCTOBER 2009

Industrial wastewater management and disposal

Purpose

Industrial sites catering for light, general and heavy industry underpin the economy of the state and provide substantial employment opportunities. Industrial waste management practices may pose a significant risk to sensitive water resources. Appropriate site location, provision of services, facilities design and best operational management practices are needed to minimise this risk.

Examples of the impacts that may occur when industrial wastes are discharged include petroleum hydrocarbons, heavy metals, surfactants, toxins and/or salts, which may pollute receiving waters rendering them unsuitable as a water supply or pose a threat to aquatic life. Some industrial wastes are volatile or release toxic gases. In receiving waters, excessive nutrients can lead to algal blooms, oxygen deficits and increase colour and turbidity.

Industrial wastes are also recorded as contaminating underground water; for example, there are several large contamination plumes within the Kwinana industrial area. The addition of industrial waste to sewers can increase the cost and risk to the community of treating sewage. Industrial pollutants such as oxygen scavengers may corrode pipes and equipment in the sewerage collection system and in treatment plants. Greases and suspended matter can cause pipe blockages and odours. For further information on the potential effects of various contaminants discharged to sewer, and the usual approaches that water utilities take in managing these impacts, refer to the *National water quality management strategy paper 12* (Reference 1).

These notes advise on environmental issues and make recommendations on best practice. Key supporting information is provided in appendices. This information includes the department's role, intended use of the note, sensitive water resources description, water resource buffers, relevant statutes and administering agencies, information for assessing development proposals and may include case studies, checklists and diagrams.

Scope

This note applies to industries as defined in the Town Planning Regulations 1967 Appendix B, schedule 1 (as amended); including:

- abattoirs

- aquaculture
- animal by product plants
- animal holding and sales yards
- animal product processing
- chemical manufacture and formulation
- energy production industries
- fertiliser production
- food processing
- hospitals and aged care homes
- laboratories
- metal production and finishing
- mineral processing
- petrochemical works
- recycling works
- vehicle and plant servicing
- water and wastewater treatment works
- wool, hide and textile processing.

Industrial wastewater includes contaminated stormwater, cooling water, process waters and wash-down waters.

This note does not apply to cottage industries or municipal wastewater treatment works or solid waste, but may offer some useful guidance on potential risks to water resources and good practice.

The Metropolitan Water Supply, Sewerage and Drainage by-laws 1981 (as amended) define industrial waste as being the liquid, solid or gaseous refuse from any business, industry, warehouse or manufacturing premises other than domestic sewage, stormwater, or unpolluted water. The wastewaters from staff amenities or offices at industrial premises are specifically excluded. The terms 'industrial waste' and 'trade waste' are used interchangeably in waste disposal publications.

This note builds on the information supplied in other water quality protection notes (WQPN), such as *General and heavy industry near sensitive waters*, *Light industry near sensitive waters*, *Extractive industries near sensitive water resources* and *Stormwater management at industrial sites* (Reference 6b).

Advice and recommendations

Planning approvals and processes

The notes described in the preceding paragraph provide recommendations on location of industrial premises for planning approvals. There are limitations discussed concerning the location of industries (and hence their wastewater facilities) near sensitive water resources areas (Appendix A).

Although waste management may seem to be an operational issue, the choice of location affects options for the disposal of treated liquid waste. The availability of adequate service infrastructure, such as emergency management, waste recycling and disposal services, sewerage services, reticulated water supply, electricity, gas, communications and transport access should be assessed when selecting a potential site. Industrial wastewaters are subject to acceptance criteria for discharge to sewer (set by local government, the Water Corporation or other water providers' systems) and may require on-site treatment.

New industrial projects should only be located on land designated for industrial use (via consultative planning schemes) by the Western Australian Planning Commission or Department of Planning, and be appropriately zoned by the local government authority/council.

Location

- 1 Industrial sites should be chosen where the wastewater would cause the least environmental and social impact. Environmental investigations should be used to assess the surrounding land usage, local climate factors, site topography, identification of sensitive water resources, soil strata, surface and groundwater movement, and the site's land-use history. Industrial wastewater facilities should not be located in areas with a near surface water table that are prone to waterlogging or may be flooded during a 100-year average recurrence interval (ARI) event. This includes land which is seasonally wet, requires artificial drainage or diversion of natural watercourses, or where construction will affect sensitive waters.
- 2 Sensitive water resources require a range of management techniques to ensure their adequate protection such as definition and community awareness, separation buffers from intensive land usage, effective containment of potentially mobile contaminants, regulation of land-use activities, appropriate waste management decisions by land-use operators, catchment surveillance/monitoring and remedial action to address historical contamination problems.
- 3 Legally established, but non-conforming, industrial wastewater sites can normally remain near sensitive water resources; however, operators should undertake regular environmental risk assessments and employ best environmental management practice to limit the risk of environmental harm.
- 4 New sites or expanded use of existing industrial wastewater sites should not occur unless the proponent can demonstrate that industry is unlikely to harm or pose significant risk to the environment during construction, operation or after closure of the premises. Risk mitigation measures may include:
 - a selection of low vulnerability settings suited to the nature of the planned industrial activity
 - b effective community consultation
 - c fail-safe containment of any facilities that could put the environment at risk
 - d adequate buffers to nearby sensitive land uses and water resources

- e access to or provision of services that ensure potential wastes are reduced, recycled or adequately treated before safe disposal, such as pre-treatment of process fluids, then discharge to sewerage scheme
 - f site drainage controls to isolate potentially contaminated areas from discharge to the environment
 - g environmental management and monitoring systems
 - h environmental training and awareness programs for site employees and contractors
 - i effective emergency response systems and land rehabilitation plans.
- 5 The location of industrial precincts and their waste treatment/disposal is likely to be of interest to the surrounding community. The proponent should adequately inform neighbours on the nature of the proposal and the safeguards to be included, then seek community feedback and respond effectively to specific issues raised relating to the local environment, community health and social concerns.

Within public drinking water source areas (PDWSA)

- 6 These areas are declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*. They provide for the management and protection of catchments used as public drinking water sources. These areas are highly vulnerable to contamination. PDWSA include underground water pollution control areas (for groundwater catchment protection), water reserves and catchment areas. Source protection by-laws require that written approval be obtained from this department for most land development. Protection areas and zones are defined in source protection plans or land-use and water management strategies, which each undergo public consultation processes.
- 7 Within designated P1, P2 and P3 areas (see Appendix A – Public drinking water source areas), wellhead protection zones and reservoir protection zones, this department may oppose wastewater infrastructure and wastewater disposal if incompatible with our risk avoidance and risk minimisation objectives (see Reference 6b, WQPN 25,). Industry may occasionally receive approval, with conditions, where the proponent demonstrates that the development will either lower the risks posed by the present land-use activity, is vital to the state’s interests and that best environmental design, construction and operational practice are used.
- 8 Where conditional approval for an industrial site is given, a vegetated separation buffer from the site boundary to the top water level margins of surface water reservoirs, their feeder streams and any water source bore compounds should be applied.
- 9 Apart from PDWSA, the location of industrial wastewater production is also limited to protect values within the other sensitive areas previously referred to in *Planning approvals and processes*.

Design and construction

- 10 During design of an industrial plant, the planner should consider and incorporate the handling, treating and removal of the industrial wastewater. Constraints to be considered include:
 - a industrial wastewaters are subject to acceptance criteria for sewer disposal
 - b landfills are allowed to accept only solid wastes.
- 11 Industrial sites should manage stormwater runoff effectively, including in the vicinity of waste treatment and storage facilities, roofs, pavements, and exterior materials storage and process areas to avoid flooding or contamination of sensitive water resources. Pollution is an offence and severe penalties apply under the *Environmental Protection Act 1986* (Appendix B). Detailed best practice advice is given in our WQPN 52 *Stormwater management at industrial sites* and *Stormwater management manual for Western Australia* (References 6b & 6d).
- 12 Industrial wastewater and material used for its treatment and disposal may degrade water resource quality if released to the environment (such as toxic chemicals). These should be stored and used within weatherproof, containment compounds. These compounds should be built using low permeability materials (such as concrete, rendered masonry, low permeability clay soil or synthetic liners). Surfaces should be chemically resistant or sealed to prevent damage by spilt chemicals. The compounds should be designed to allow recovery of any chemical spill, without discernible loss to the environment. The compound should have capacity to store at least 110 per cent of the volume of the largest contained fluid storage vessel, plus 25 per cent of the volume of all other containers within the compound, plus (if located outdoors) adequate allowance for any captured stormwater.
- 13 Treatment systems should have sufficient capacity to allow for routine maintenance or equipment breakdowns without causing the release of partly treated wastewater.
- 14 Any contaminated fluids should be contained effectively prior to draining into an internal collection sump for appropriate treatment, recovery or offsite disposal at an approved site.
- 15 Containment compounds should capture leaking tank contents effectively, plus any contaminated stormwater, jetting fluids and residues from equipment misuse. Well-maintained security barriers such as lockable buildings and fenced enclosures should surround these compounds, which need to be equipped and operated to deter intruders.
- 16 Fuelling facilities for vehicles, and machinery used for the treatment and disposal of industrial wastewater should be constructed and operated to drain any spillage into holding tanks or well-maintained fuel recovery systems. Special containment is not needed for small quantities (typically less than five litres) of chemicals used for on-site hygiene purposes, although they should be stored securely indoors.

- 17 Storage of fuels, solvents, explosives and dangerous goods should be controlled and housed in accordance with the *Dangerous Goods Safety Act 2004*, which is administered by the Department of Mines and Petroleum.
- 18 Wash-down facilities for mechanical plant or vehicles should be constructed and operated in accordance with our WQPN 68 *Wash down of mechanical equipment*.
- 19 Servicing of mechanical components containing liquids such as coolants, hydraulic oils, brake fluid or lubricants should take place within weatherproof buildings designed to contain fluid spills. The operator should install effective systems for the capture and export of waste liquids for recycling or approved disposal. All facilities and operations should be compatible with the recommendations in our WQPN 28 *Mechanical servicing and workshops*.
- 20 Where process waste (treated or otherwise) may be discharged to the environment, this department should be consulted during the project planning phase, to ensure the quality characteristics are suitable for disposal.
- 21 Any industrial wastewater treatment and disposal infrastructure proposed within 500 metres of a sensitive water resource should be referred to this department's regional office for assessment, with supporting information addressing the environmental risks.

This ensures that environmental controls, transport corridors and servicing requirements are negotiated well in advance of development approval; so the facility is suitably located, constructed, operated and maintained with an appropriate balance of environmental, as well as social and economic planning considerations.

- 22 Facilities should be constructed to ensure that contaminated wastewater is separate from uncontaminated wastewater (such as clean stormwater or cooling water and condensate) and sewage.
- 23 Uncontaminated wastewater should, where practicable, be stored for reuse on site for landscape irrigation or flushing waters.
- 24 All wastes from employee amenities (such as toilets, showers and meal rooms) should either be discharged to sewer or managed in accordance with the *Health Act 1911* and as approved by the local government's environmental health officer.

Operation and management

- 25 All waste should be managed and disposed of in accordance with the Environmental Protection (Controlled waste) Regulations 2004 and Environmental (Unauthorised discharges) Regulations 2004. Untreated wastes that may cause environmental harm should not be discharged into soakage, sewer or drains. If detected, offenders may be prosecuted under the *Environmental Protection Act 1986* and are liable for severe penalties.
- 26 Discharge of process liquids to the environment (other than uncontaminated cooling water and clean condensate) should not occur unless prior approval has been given in accord with the statutory requirements listed in Appendix B.

- 27 Indicative water quality criteria for wastewater discharge to the environment from unregulated sites are provided in Appendix E.
- 28 Industrial wastewater disposal/management options in order of preference:
- a reduce wastewater quantity
 - b recycle the wastewater for flushing (where practical)
 - c reuse the wastewater (generally after treatment) for a beneficial purpose (either onsite or on a neighbouring property) such as growing crops, gardens or turf.
 - d treat and discharge to sewer (if available)
 - e treat and discharge wastewater to soakage or lined evaporation pit (where practical)
 - f treat and discharge to drains or watercourses, meeting values.
- 29 Where practical, waste should be minimised (using cleaner production protocols and recycling techniques to a maximum practical extent) before consideration is given to allowing any discharge into the environment/disposal in the most environmentally acceptable manner. Some waste may require disposal at an authorised disposal site.
- 30 Cleaner production involves the efficient use of energy, water and material resources. A national strategy was released by the Australian Government in 1998. It is called *Towards sustainability – achieving cleaner production in Australia* and it establishes a framework for the increased adoption of cleaner production practices.
- 31 Some of the benefits for adopting cleaner production practices include a reduction in expenditure for packaging, energy, waste treatment or disposal, water and materials, increased employee environmental awareness and an improved public perception of the business.
- 32 In September 2004, an easy reference cleaner production directory, called *Environmental Management and cleaner production directory for small and medium businesses*, was prepared for the Swan River Trust as part of the Swan–Canning clean-up program. This document has useful information and covers most light industrial sectors. For online information see <www.swanrivertrust.wa.gov.au>, select *Swan–Canning cleanup program > Publications*.
- 33 Reuse of waste resources should be considered within the industrial plant process or to support other nearby land-use activities. Van Beers and van Berkel (2006) discuss Curtin University's involvement in industrial integration of recycling and reuse of industrial by-products in the Kwinana industrial area and elsewhere. Green Stamp is a motor trade's industry-specific environmental accreditation program that assists small to medium businesses to reduce, reuse, recycle or dispose of their wastes in an environmentally acceptable manner. For more information on reuse and recycling of waste, see the Centre of Excellence in Cleaner Production at Curtin University and the other programs outlined in Appendix D - Useful contacts and information.

- 34 Wastewater application to land, using best practice advice may be used to support crops or silviculture. See our WQPN 50 *Soil amendment using industrial by-products to improve land fertility*, WQPN 22 *Irrigation with nutrient-rich wastewater* (Reference 6b) and the Australian Recycled Water Guidelines web site (Appendix. D).
- 35 Wastewater disposal to land is regarded as an incompatible land use within designated P1 and P2 areas (see Reference 6b, WQPN 25).
- 36 Disposal to sewer may be an option in some areas, or for approved types/volumes of wastewaters. Wastewater systems of water utilities are primarily designed to service households with normal domestic wastewater. The Metropolitan Water Supply, Sewerage and Drainage bylaws, 1981 and Country Areas Water Supply by-laws, 1957 prohibit industrial waste being discharged into the sewer unless a written permit has been granted first, and an agreement signed by the applicant containing a covenant to comply with the conditions of the permit.
- 37 *National water quality management strategy paper 12* supplies national guidelines for the acceptance of industrial wastes by Australian sewerage authorities (Reference 1). Wastewater service authorities normally operate a 'pay for service' to enable full cost recovery tariffs and encourage waste minimisation and cleaner technology.
- 38 Where disposal is accepted to sewer, effluent quality requirements are normally set by the sewerage service provider. See, for example, the Water Corporation's IWPUB100 *Industrial waste permits* information brochure (see Appendix D - Useful contacts and information).
- 39 If wastes are only partially compatible with the provider's wastewater treatment plants, pre-treatment may be required under the terms of a trade waste permit. Treatment of waste is not detailed in this WQPN, as it is determined for the specific wastewater characteristics.
- 40 Waste treatment systems should reliably (i.e. more than 90 per cent of samples in any 12-month period) achieve their design effluent quality. In the most sensitive environments, regulatory agencies may require higher system reliability. Sufficient storage capacity should be allowed for routine maintenance and occasional system down-time, without causing release of partly treated wastewater. Performance testing of waste treatment systems should be routinely conducted, using the supplier's recommendations.
- 41 Some wastes are not compatible with the service provider's wastewater treatment plants and will not be accepted (see, for example, the Water Corporation quality parameters). Alternative disposal methods need to be used, such as waste removal by a contractor (see the resource directories in Appendix D).
- 42 Discharge of wastewater (after treatment) by release into groundwater (soakage or injection) or into surface water may be considered under some circumstances (see References 1 and 2). Wastewater injection into the ground is regarded as an incompatible land use within proclaimed public drinking water source areas designated P1, P2 and P3 areas (see WQPN 25, Reference 6b).

Employee awareness

- 43 Employees should be trained effectively and reminded via signage of the environmental risks from contaminated wastewater discharge to local drains and soakage.
- 44 Suitable training is available, such as the courses provided by the Cleaner production training program for industry within Curtin University in Perth and the industry-specific seminars and workshops provided by the Green stamp program. This training can help staff gain the necessary skills to identify site-specific risks and follow appropriate management practices.

Contingency planning, emergency response and reporting

- 45 Where the wastewater holding or treatment site handles significant quantities of toxic or hazardous chemicals, the site operator should prepare an emergency response plan to deal with events such as chemical spillage, natural disasters, fires, vandalism and equipment malfunctions. The plan should identify local sensitive water resources. It should provide management response protocols to limit the impact of foreseeable incidents. Designated employees should be trained in procedures to block chemical escape pathways and clean up spills. For more information see our WQPN 10 *Contaminant spills – emergency response* (Reference 6b).
- 46 Site staff and contractors should be made aware of practices designed to minimise the loss of contaminants in raw industrial wastewater and those used for the treatment of the wastewater.
- 47 Site operators and designated staff should be trained to supervise the response to spill incidents and, if necessary, to liaise with emergency response personnel such as the Fire and Emergency Services Authority (FESA).
- 48 Spill kits should be made available in easily accessible areas. They should include absorbent materials such as 'kitty litter', sawdust or rags and other clean up equipment such as mops, brooms and appropriate protective clothing. Hose-down of floor residues into drains should be avoided.
- 49 All wastewater and chemical spills should be responded to and contained immediately and fluids recovered or disposed of. This is for occupational health and safety reasons and to prevent contamination of the local environment. For detailed information, see our WQPN 10 *Contaminant spills – emergency response* (Reference 6b). Equipment such as absorbent litter should be available to clean up minor chemical spills.
- 50 If a chemical spill does escape into the off-site drainage system, the drainage service provider and the Department of Environment and Conservation's pollution response section should be informed immediately (see Appendix D). Effective remedial action should be taken to limit any harmful effects downstream. A responsible approach to spills can lessen the risk of adverse publicity, legal action for damages or environmental contamination.

- 51 Under section 73 of the *Environmental Protection Act 1986*, the occupier of any premises is liable for the clean-up costs of any contamination incident. The *Contaminated Sites Act 2003* and associated regulations introduced many new responsibilities relating to managing contamination in Western Australia. For more information, contact the Department of Environment and Conservation or for online data <www.dec.wa.gov.au> select *pollution prevention* > *contaminated sites*.
- 52 Drain systems should be designed so that, in the event of large fluid spills, they can be isolated until the contaminant is recovered and removed. Drain plugs or sandbags should be labelled and located where they can be deployed quickly in an emergency.
- 53 When chemicals have escaped into drains, water sampling should be arranged using the services of an analytical laboratory accredited by the National Association of Testing Authorities. Results should be compared against guideline criteria for local water values (References 1a & 1b) and necessary recovery and remedial action taken without delay.

Monitoring and reporting

- 54 Liquid waste treatment systems should be checked and maintained regularly. Where an audited permit or licence is not required under the environmental statutes (Appendix B), the site should be inspected periodically by relevant agencies to audit the site operator's conformity with project approval requirements.
- 55 Where on-site wastewater treatment is required, the site operator should routinely monitor effluent quality, assessing the concentration of potentially harmful contaminants to ensure acceptable system performance. All monitoring should be conducted in accordance with Australian Standards 2031 and 5667 by competent and experienced personnel. Detailed advice on monitoring is contained in Paper 7 *Australian guidelines for water quality monitoring and reporting 2000* (Reference 1).
- 56 Records and results of the monitoring program should be retained on-site for a minimum of two years for inspection or reporting as requested by regulators.

More information

We welcome your views on this note. All feedback is retained on our file number **WT 6076**. To comment on this note or for more information, please contact our water source protection branch as shown below, citing the note topic and version.

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This note will be updated periodically as new information is received or industry/activity standards change. Updated versions are placed online at <www.water.wa.gov.au> select *waterways health > water quality > water quality protection notes*.

References and further reading

1 Australian government – Department of Environment, Water, Heritage and the Arts,

National water quality management strategy papers available online at <www.environment.gov.au> select *water > water quality > national water quality management strategy > national guidelines*:

- a *Paper 2 - Policies and principles, 1994*
- b *Paper 3 - Implementation guidelines, 1998*
- c *Paper 4 - Australian and New Zealand guidelines for fresh and marine water quality, 2000*
- d *Paper 6 - Australian drinking water guidelines, 2004*
- e *Paper 7 - Australian guidelines for water quality monitoring and reporting, 2000*
- f *Paper 9 - Rural land uses and water quality - a community resource, 2000*
- g *Paper 12 - Guidelines for sewerage systems – acceptance of trade waste, 1994*
- h *Paper 21 - Australian guidelines for water recycling: Managing health and environmental risks (Phase 1), 2006*
- i *Paper 22 - Australian guidelines for water recycling: Managing health and environmental risks (Phase 2) Augmentation of drinking water supplies, 2008*
- j *Paper 24 - Australian guidelines for water recycling: Managing health and environmental risks (Phase 2) Managed aquifer recharge, July 2009*

To obtain copies of paper 9, see internet site <www.awa.asn.au>, request by email at <bookshop@awa.asn.au> or obtain from a library service.

2 Australian Government Environment Protection and Heritage Council (EPHC), Natural Resource Management Ministerial Council and the National Health and Medical Research Council (various dates), available at the EPHC web site <www.ephc.gov.au> select *water*.

Recycled Water Quality: A guide to determining, monitoring and achieving safe concentrations of chemicals in recycled water, 2008.

- 3 Department of Environment and Conservation (WA)
 - a Wetlands policy and guidelines available at <www.dec.wa.gov.au> select *Management and protection > wetlands > publications > wetlands position statement*

Position statement: Wetlands, WRC 2001.
 - b Waste management papers available online at <www.dec.wa.gov.au> select *pollution prevention > waste management > publications > guidelines*

Landfill waste classification and waste definitions as amended, or see web site <www.zerowastewa.com.au>
 - c Contaminated sites - guidance series available online at <www.dec.wa.gov.au> select *Pollution prevention > contaminated sites.*
- 4 Department of Health (WA) publications available online at <www.health.wa.gov.au> select *public health >water*, then search *household chemicals*.
- 5 Department of Mines and Petroleum (WA) - dangerous goods codes, guidelines and licences. For online publications see <www.dmp.wa.gov.au> select *resources safety > dangerous goods > storage and handling*.
- 6 Department of Water (WA)
 - a Water resource management policies, available online at <www.water.wa.gov.au> select *policies*
 - Foreshore policy 1 – *Identifying the foreshore area, WRC 2002*
 - State-wide policy 2 - *Pesticide use in public drinking water source areas, WRC 2000*
 - b Water quality protection notes available online at <www.water.wa.gov.au> select *waterways health > water quality > water quality protection notes*
 - WQPN 7 *Chemical blending*
 - WQPN 10 *Contaminant spills – emergency response*
 - WQPN 12 *Dairy processing plants*
 - WQPN 15 *Extractive industries within public drinking water source areas*
 - WQPN 20 *General and heavy industry near sensitive waters*
 - WQPN 22 *Irrigation with nutrient-rich wastewater*
 - WQPN 23 *Laboratories*
 - WQPN 25 *Land-use compatibility in public drinking water source areas*

- WQPN 26 *Liners for containing pollutants, using synthetic membranes*
 - WQPN 27 *Liners for containing pollutants, using engineered soils*
 - WQPN 28 *Mechanical servicing and workshops*
 - WQPN 31 *Sub-soil monitor drains and water recovery sumps*
 - WQPN 33 *Nutrient and irrigation management plans*
 - WQPN 42 *Radiator repair and reconditioning*
 - WQPN 49 *Service stations*
 - WQPN 50 *Soil amendment using industrial by-products to improve land fertility*
 - WQPN 52 *Stormwater management at industrial sites*
 - WQPN 56 *Tanks for elevated chemical storage*
 - WQPN 58 *Tanks for temporary elevated fuel and chemical storage*
 - WQPN 60 *Tanks for mobile fuel storage in public drinking water source areas*
 - WQPN 61 *Tanks for ground level chemical storage*
 - WQPN 62 *Tanks for underground chemical storage*
 - WQPN 64 *Tanks – closure of underground storage*
 - WQPN 65 *Toxic and hazardous substances - storage and use*
 - WQPN 68 *Mechanical equipment wash-down*
 - WQPN 73 *Wineries and distilleries*
 - WQPN 93 *Light industry near sensitive waters*
 - WQPN 99 *Cooling tower wastewater management and disposal*
- c Waterways water notes available online at <www.water.wa.gov.au> search *water notes*
- WN 10 *Protecting riparian vegetation*
 - WN 11 *Identifying the riparian zone*
 - WN 23 *Determining foreshore reserves.*
- d Stormwater publication available online at <www.water.wa.gov.au> select *waterways health > stormwater and drainage > stormwater management manual*
- Stormwater management manual for Western Australia*

e Water science technical series available online at <www.water.wa.gov.au>

A snapshot of contaminants in drains of Perth's industrial areas (Water Science technical series report No.12), 2009.

7 Environmental Protection Authority (WA) publications available online at <www.epa.wa.gov.au> select *guidance statements*

a Guidance statement 3 *Industrial-residential buffer guidelines*

b Guidance statement 33 *Environmental guidance for planning and development.*

8 Engineers Australia publications available for purchase at <www.engineersmedia.com.au> search *EA books*

Australian rainfall and runoff (current edition).

9 Standards Australia publications available for purchase at <www.saiglobal.com> select *publications*

AS 5667 Water quality – sampling.

10 Van Beers D & van Berkel R, for Curtin University of Technology, 2006, Regional synergy implementation and research in Australia: the case of Kwinana, Presented at the 2nd Asia–Pacific Eco-Business Forum in Kawasaki – urban and industrial symbiosis, 23–25 January 2006.

11 Waste Authority WA with Cardno consultants, 2008

Assessment of waste disposal and material recovery infrastructure for Perth – Towards 2020.

12 Western Australian Planning Commission policy available online at <www.wapc.wa.gov.au> select publications

State industrial buffer policy, draft 2004.

Appendices

Appendix A - Key supporting information

The Department of Water is responsible for managing and protecting the state's water resources. It is also a lead agency for water conservation and reuse. This note offers:

- our views on minimising impacts of land use activities and facilities on water resources
- guidance on acceptable practices employed to protect the quality of water resources
- a basis for the development of a multi-agency environmental code or guidelines that considers the views of industry, government and the community, while sustaining a healthy environment.

The note provides a general guide on issues of environmental concern, and offers potential solutions based on professional judgement and precedent. Recommendations made in this note do not override any statutory obligation or government policy statement. Alternative practical environmental solutions suited to local conditions may be considered. This note shall not be used as this department's policy position on a specific matter, unless confirmed in writing. The note may be amended at our discretion, as new data becomes available.

Regulatory agencies should not use this note's recommendations in place of site-specific conditions based on a project's environmental risks. Any regulatory conditions should consider the values of the surrounding environment, the safeguards in place and take a precautionary approach.

Where a conflict arises between our recommendations and any proposed activity that may affect a sensitive water resource, this note may be used to assist negotiations with stakeholders. The negotiated outcome should not result in a greater risk to water quality than that which would apply if our recommended protection measures were used.

Sensitive water resources

Clean water resources used for drinking, sustaining aquatic and terrestrial ecology, industry, and aesthetic values, along with breathable air, rank as the most fundamental and important needs for viable communities. Water resources should remain within specific quality limits to retain their values and therefore require stringent and conservative protection measures. Guidance on water quality parameters that are necessary to maintain water values are published in the Australian Government's *National water quality management strategy guidelines*, available online at <www.environment.gov.au> select *water > water quality > national water quality management strategy*.

The Department of Water strives to improve community awareness of catchment protection measures, for both surface water and groundwater, as part of a multi-barrier protection approach to water resource quality.

Human activity and many land uses pose a risk to water quality if contaminants are washed or leached into sensitive water resources in discernible quantities. These waters include estuaries, waterways, wetlands and unconfined groundwater accessed by water supply wells.

Sensitive water resources support one or more of the environmental values described below:

- 1 Public drinking water sources (i.e. *water reserves, catchment areas or underground water pollution control areas*) proclaimed or assigned under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, the *Country Areas Water Supply Act 1947* or the *Health Act 1911*.
- 2 Private sources, used for the following water supplies:
 - a human or stock (animal) drinking water
 - b commercial or industrial water (requiring specific qualities that support activities such as aquaculture, cooling, food or mineral processing or crop irrigation)
 - c urban irrigation (that could affect people's health or wellbeing).
- 3 Recognised ecological functions in groundwater aquifers such as soil or cave fauna.
- 4 Social values in natural waterways including aesthetic appeal, boating, fishing, tourism and swimming.
- 5 Ecological functions of waterways including:
 - a those of high conservation significance described in the Environmental Protection Authority's guidance statement 33 *Environmental guidance for planning and development* (section B5.2.2), available online at <www.epa.wa.gov.au> select *EIA > guidance statements*
 - b waterways managed by the Department of Water under the *Waterways Conservation Act 1976*, including the Avon River, Peel-Harvey Inlet, Leschenault Inlet, Wilson Inlet and Albany waterways
 - c waterways managed by the Swan River Trust under the *Swan and Canning Rivers Management Act 2006*.

Engineered drains or constructed water features are excluded, because functional and operational factors may outweigh their water quality values.

- 6 Conservation values in wetlands (assigned or recognised, excluding those highly disturbed unless actively managed to restore specified environmental values), including:
 - a Ramsar wetlands, described online at <www.ramsar.org>.
 - b High conservation significance wetlands as described in the Environmental Protection Authority's guidance statement 33 *Environmental guidance for planning and development* (section B4.2.2), available online at <www.epa.wa.gov.au> select *Environmental impact assessment > guidance statements*.
 - c Wetlands defined by the Australian government in *A directory of important wetlands in Australia*, available online at <www.environment.gov.au> select *water > water for the environment > wetlands > wetlands publications, resources and links > books, reports directories*.

- d Conservation valued and resource enhancement category wetlands identified in the *Geomorphic wetlands of the Swan coastal plain* dataset; all wetlands identified in the *South coast significant wetlands* dataset, and high value wetlands identified in the *Geomorphic wetlands Augusta to Walpole* dataset. The Augusta to Walpole wetland dataset awaits a detailed evaluation process. The Department of Environment and Conservation (DEC) is the custodian of wetland datasets and is responsible for maintaining and updating the information. The datasets can be viewed online at <www.dec.wa.gov.au> search *maps wetlands* or select *management and protection > wetlands > wetlands data*. Guidance on viewing the wetlands is provided on the same website at *water > wetlands > data* or by phoning DEC's nature conservation division for assistance on 08 9334 0333.

Many aquifers, waterways and wetlands in this state still need a detailed scientific evaluation and their value remains to be classified. Unless proven otherwise, any natural waters that are largely undisturbed by human activity, should be considered to have sensitive values.

Community support for water values, the setting of practical management objectives, providing sustainable protection strategies and effective implementation are vital to protecting or restoring water resources for current needs and those of future generations.

Public drinking water source areas

Public drinking water source area (PDWSA) is the collective name given to any area proclaimed for the management and protection of a water source used for community drinking water supplies. PDWSA include *underground water pollution control areas, water reserves* and *catchment areas* administered under the provisions of the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*. For online information on the location of PDWSA see < www.water.wa.gov.au >select *tools and data > maps and atlases >geographic data atlas > environment > public drinking water source areas*.

For land planning and development purposes within any PDWSA, three protection areas (P1, P2 and P3) have been defined based on present land use, tenure and the vulnerability of the water body to harm. These areas are each managed in a different way to provide for effective protection of water resource quality.

Protection areas are assigned in specific *drinking water source protection plans* or *land use and water management strategies*. These are prepared in consultation with government agencies, landowners, industry and community.

P1 areas are defined to ensure that there is *no degradation* of the water source. These areas are declared over land where the provision of the high quality drinking water for public use is the prime beneficial land value. P1 areas would typically include land under public ownership. P1 areas are managed in accordance with the principle of *risk avoidance* and so most land development and activity is normally opposed.

P2 areas are defined to ensure that there is *no increased risk of pollution* to the water source once the source protection plan has been published. These areas are declared over land where low intensity development (such as rural) already exists.

Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of *risk minimisation*, and so restricted intensity development (with conditions) and activity with a low contamination risk is accepted.

P3 areas are defined to *manage the risk of pollution* to the water source. These areas are declared over land where public water supply sources must coexist with other land uses such as residential, commercial and light industrial development. Protection of P3 areas is achieved through management measures defined via *management guidelines* (such as these notes) or site-specific conditions that limit the contamination risk to water resources from the land use or activity. If however the water source becomes significantly contaminated, then water supplied from P3 areas may need to be treated or an alternative water source found.

Protection zones are defined close to the point where drinking water is harvested or stored. Additional constraints apply to activities in these zones to safeguard these most vulnerable water sources. These zones are described as *well-head protection zones* and *reservoir protection zones*.

Well-head protection zones are assigned within the immediate surrounds of water production wells and special restrictions apply. In these zones groundwater moves rapidly towards wells. Any contamination leaching from the ground surface could rapidly migrate into scheme water supplies (before effective remedial action can occur). In porous soil catchments, well-head protection zones are usually circular, with 500 metres radius in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside PDWSA boundaries.

Reservoir protection zones (RPZ) are defined within the immediate surrounds of public water supply reservoirs or pipe-heads, with special access and land use restrictions applied. The aim is to restrict the likelihood of contaminants being deposited or washing into water sources following rainfall. RPZ consist of a buffer area of up to two kilometres around the top water level of a reservoir and include the reservoir itself.

For additional explanatory information on PDWSA, see our water quality protection note 25 *Land use compatibility in public drinking water source areas* and note 36 *Protection of public drinking water source areas - an overview*.

Buffers

Operational areas (where compatible) should have minimum vegetated separation distances to the full supply level of reservoirs, their primary feeder streams and production bores used as a source of drinking water. Buffers advice is provided in our water quality protection note 06 *Vegetated buffers to sensitive water resources*.

Clearing control catchments

There are special controls on vegetation clearing for salinity management purposes under part IIA of the *Country Areas Water Supply Act 1947*. These controls apply in *the Wellington Dam, Harris River Dam, Mundaring Weir and Denmark River* catchment areas and the *Kent River and Warren River* water reserves. Details on clearing controls may be obtained from our Swan-Avon, southwest and south coast regional offices.

Existing activities

We recognise that many land use activities were approved and established before publication of the source protection plan or strategy. We will negotiate with the operators of non-conforming activities to ensure that they progressively improve facilities and management practices to minimise the risk to water resources (while considering practical and economic constraints).

New or expanded activities

Any proposed new or expanded activities that may affect water resources should be referred to our nearest regional office for assessment and written response. The department may approve the proposal (with or without conditions), seek additional relevant information prior to taking a decision or reject the proposal due to inadequate protective measures to safeguard nearby environmental values. In order to gain environmental approval, operators will need to demonstrate that under both normal and abnormal operating conditions that materials and processes used on site do not pose a significant risk to the local waters.

Waterways management areas

Five *waterways management areas* have been declared via the *Waterways Conservation Act 1976* to provide special protection to estuaries and their associated waterways that are considered especially vulnerable to degradation.

These areas are the Albany Waterways, Avon River, Leschenault Inlet, Peel-Harvey Estuary, and Wilson Inlet. If a development is located within a proclaimed *waterways management area*, pre development approval in writing is needed from this department. Information on waterway values and the location of these management areas can be obtained by contacting the our local regional office (see online information at < www.water.wa.gov.au > select *Contact us*).

Appendix B - Statutory requirements and approvals relevant to this note include:

What's regulated?	Statute	Regulatory office
Licence to take surface water, groundwater or disturb waterways	<i>Rights in Water and Irrigation Act 1914</i>	Department of Water - regional office < www.water.wa.gov.au >
Discharge of waters to managed waterways	<i>Waterways Conservation Act 1976</i>	
Industrial sites in proclaimed public drinking water source areas	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909;</i> <i>Country Areas Water Supply Act 1947</i>	
Protection of the environment of the state; management and disposal of waste.	<i>Environmental Protection Act 1986</i> and its regulations Environmental Protection (Controlled waste) Regulations 2004	Environment Minister, advised by the Environmental Protection Authority < www.epa.wa.gov.au >
Statutory policies covering wetlands, drinking water catchments and estuaries	<i>Environmental Protection Act 1986, Part III</i> Environmental protection policies	
Impact of significant development proposals on the values and ecology of land or natural waters	<i>Environmental Protection Act 1986, Part IV</i> Environmental impact assessment	
Regulation of prescribed premises that could pollute	<i>Environmental Protection Act 1986, Part V</i> Environmental regulation	Department of Environment and Conservation - regional office < www.dec.wa.gov.au >
Prohibited discharge of specified contaminants	Environmental Protection (unauthorised discharges) Regulations 2004	
Provides for the identification, recording, management and remediation of contaminated sites	<i>Contaminated Sites Act 2003</i> with associated regulations	
Pollution by waste. Act promotes the most efficient use of resources, including resource recovery and waste avoidance.	<i>The Waste Avoidance and Resource Recovery Act 2007 (WARR)</i> <i>Waste Avoidance and Resource Recovery Levy Act 2007 (WARRL)</i> Waste Avoidance and Resource Recovery Regulations 2008 Waste Avoidance and Resource Recovery Levy Regulations 2008	Waste Authority WA < www.zerowastewa.com.au >

What's regulated?	Statute	Regulatory office
Discharges into the Swan-Canning Estuary	<i>Swan and Canning Rivers Management Act 2006</i>	Swan River Trust < www.swanrivertrust.wa.gov.au >
Storage of fuels, solvent, explosive and dangerous goods	<i>Dangerous Goods Safety Act 2004</i> Dangerous goods safety regulations 2007	Department of Mines and Petroleum WA < www.dmp.wa.gov.au >
Management of human wastes Community health issues	<i>Health Act 1911</i>	Local governments Department of Health WA < www.health.wa.gov.au >
Emergency response planning	<i>Fire and Emergency Services Authority of WA Act 1998</i>	Fire and Emergency Services Authority < www.fesa.wa.gov.au >
Discharge to sewer (industrial waste permit) or to main drain	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> <i>Country Towns Sewerage Act 1948</i>	Water Corporation < www.watercorporation.com.au > Designated water services provider
Ensuring that hazardous waste is disposed of safely	<i>Hazardous Waste (Regulation of Exports and Imports) Act 1989</i>	The Australian Government Department of the Environment, Water, Heritage and the Arts
Protection from pollution	<i>National Environment Protection Council Act 1994 (Commonwealth)</i>	This Act binds the Crown in right of the Commonwealth, of each of the States, of the Australian Capital Territory, of the Northern Territory, and of Norfolk Island.
Subdivision of land Land zoning and development approval	<i>Planning and Development Act 2005</i>	Western Australian Planning Commission Department of Planning < www.planning.wa.gov.au > Local government (council)

Relevant WA statutes are available from the State Law Publisher at <www.slp.wa.gov.au>.

Commonwealth statutes are available from ComLaw and SCALEplus, which are part of Australian Law Online, the legal information retrieval system of the Australian Attorney-General's Department at <www.comlaw.gov.au/> and at <scaletext.law.gov.au>.

Appendix C - Key information needed to assess development proposals

Where facilities are to be constructed or upgraded near sensitive waters, proponents should supply a notice of intent to this department, including the following details:

- 1 Site owner or operating tenant's contact name and address.
- 2 A site plan showing the location of the project relative to surrounding lots, roads and vegetation cover and water features
 - a The present land-use zoning and land-use history. Include data on any site contamination history and its remediation.
 - b Description and scale of the activities planned for the project site.
 - c Description of all materials/chemicals stored or handled in commercial quantities on site.
 - d Description of the types and quantities of waste that will be generated at the facility.
 - e Proposals for chemical containment, waste management and disposal (with design sketches).
 - f Details of any contingency measures proposed to minimise the impacts of chemical spills; and disposal of contaminated waters that may result from fire, flood or other emergency.

Appendix D - Useful contacts and information

Web links and information may change/disappear without notice and may contain unverified statements. The following is supplied merely for assistance, not as a Department of Water endorsement of any web site or its viewpoints.

Federal government:

- Environment Protection and Heritage Council (EPHC)

The EPHC is an intergovernmental Council of Environment Ministers; with an objective to protect the environment of Australia; responsibilities include the minimisation and management of hazardous and non-hazardous wastes. The EPHC incorporated the National Environment Protection Council (NEPC), a statutory Ministerial council with power to make National Environment Protection Measures (NEPMs); and the environment protection responsibilities previously managed by the Australian and New Zealand Environment Conservation Council (ANZECC). For online information see <www.environment.gov.au> select *about us* > *Councils and committees* > EPHC.

- The Natural Resource Management Ministerial Council and the National Health and Medical Research Council have developed guidelines for the safe use of recycled water, see <www.nhmrc.gov.au> select *publications* >.

- Australian Government National Water Commission

Australian guidelines for water recycling, see web page <www.nwc.gov.au> select *reuse and recycling* > *Australian guidelines for water recycling*.

- Australian Government Department of the Environment, Water, Heritage and the Arts DEWHA promotes EPHC priorities by improving waste management and recycling. DEWHA develops and coordinates a range of programs to reduce waste, either by encouraging material efficiency, reducing the generation of waste, or enabling the recovery and reuse of discarded material. For online information see <www.environment.gov.au> select *human settlements* > *chemicals management* > *hazardous waste* and *human settlements* > *waste management*.

- The National Environment Protection Council (NEPC)

The NEPC is a statutory body with law-making powers established under the *National Environment Protection Council Act 1994 (Commonwealth)*, and corresponding legislation in other Australian jurisdictions. The members of the NEPC are Ministers from the participating jurisdictions (i.e. Commonwealth, state or territory governments).

- Commonwealth Government with Horticulture Australia Limited (HAL)

The Australian recycled water guidelines web site <www.recycledwater.com.au> is funded by the HAL <www.horticulture.com.au>.

State government

- Regulatory Western Australian government departments are listed in Appendix B.
- The Waste Authority WA was **formed under the Waste Avoidance and Resource Recovery (WARR) Act 2007** and replaced the former Waste Management Board. The Waste Authority has the status, immunities and privileges of the state and makes recommendations to the WA Minister for the Environment on matters relating to the Act, including promoting a waste strategy for WA. The authority's web site <www.zerowastewa.com.au> *communications* > *publications* supplies handy links to information for the reduction, reuse and recycling of waste, such as: the Jurisdictional Projects Group (formerly the Jurisdictional Recycling Group) – responsible for developing project proposals consistent with priority funding areas for consideration by the National Projects; *Zeroing In – Official News of the Waste Authority of WA*, the Strategic Waste Initiatives Scheme; the Community Grants Scheme (CGS); the Waste Management & Recycling Fund; the '*Environmental benefits of recycling calculator*'.
- The Department of Environment and Conservation (DEC) web site pages give access to the Waste Authority WA and also contain other initiatives such as the Green Stamp program, which assists especially the motor trades, cleaning and printing industries by information sheets and guidelines on wastewater and confidential environmental assessments <www.dec.wa.gov.au> select *community and education* > *community programs* > *Green Stamp program*.

Local government

Local government has a primary role in providing information about waste management and recycling to households and industry. Individual councils provide the infrastructure to deal with waste and managing local stormwater systems; however, the way in which waste and recyclables are collected differs from one council to the next.

- The Department of Local Government and Regional Development WA

The DLGRD web site provides information on local councils, state/local government partnerships, inter-council cooperations in waste management; see online information at <www.dlgrd.wa.gov.au/localGovt/localGovtContacts/localGovtList.asp>.

- Eastern Metropolitan Regional Council (EMRC), a regional local government working on behalf of six Perth member councils; see <www.emrc.org.au> *services*> select *waste management*.

- WA Local Government Association

The WA Local Government Association advocates on behalf of the state's 141 local governments and negotiates service agreements for the sector. WALGA is not a government department or agency.

- WasteNet is a source of information for people interested in waste, and is managed by the Municipal Waste Advisory Council, a standing committee of the Western Australian

Local Government Association with delegated authority to represent the association in all matters relating to solid waste management. (Att. Waste Management Officer)
<www.wastenet.net.au>

Other agencies

- Water Corporation WA

The corporation's extensive, informative series *Industrial waste information brochures* and *Industrial waste typical design drawings* are available at
<www.watercorporation.com.au/> select *business customers* > *business wastewater*, select *Industrial waste publications*.

- The Perth Region Natural Resource Management (formerly the Swan Catchment Council)

The industry program has funding from the National Heritage Trust.
<www.perthregionnrm.com> *programs* > *industry* > *industry projects*. This web site has handy documents on best management practice (BMP) and sustainable production, *Recycling Services and Waste Contractor Database*, and *Industry Environmental Risk Assessment*.

- Curtin University: Cleaner Production information is available at the following centres, and at <www.c4cs.curtin.edu.au/> Centre of Excellence in Cleaner Production (CECP)

<cleanerproduction.curtin.edu.au/>

- Edith Cowan University: Green Advantage for Small Business is a program that can be accessed on the web site of ECU's Small and Medium Enterprise Research Centre (SMERC) which offers support for small business operators as they tackle environmental management, recycling and wastewater issues. ECU is partnered with Perth Region NRM, West Coast TAFE, and the Great Southern Area Consultative Committee to deliver the program which has been funded federally through AusIndustry. Resources can be downloaded from

<www.business.ecu.edu.au/schools/man/smerc/green-advantage/resources.htm>

- WA Sustainable Industry Group (WASIG) <www.wasig.curtin.edu.au>

- Waste recycling educational material is supplied by Waste wise site
<www.wastewise.wa.gov.au>.

- Conservation Council of WA, a non-government environment organisation.

Wastewater recycling inquiries contact the water policy officer
<www.conservationwa.asn.au/>

Other publications and resources

- Inside waste magazine: <www.insidewaste.com.au>.
- WME magazine: <www.wme.com.au/magazine> and [WME Weekly](#) e-newsletter: Published by Environment Business Media, report on the waste and recycling industry, covering waste, water, air and environment business industries.
- EnvironmentalManagementNews.net: A daily, on-line publication that also includes WME CleanTech news every Thursday. <www.environmentalmanagementnews.net>.
- Australian Environment Industry Directory (AEID); the 'yellow pages' of the environment business industry <www.aeid.com.au>.
- Australian Council of Recyclers Inc (ACOR): industry association representing companies involved in recovering secondary resources to maximize resource recovery.
- Compost WA: official web site to assist landscape industry professionals and government authorities in making the decision to use recycled organics in Western Australia.
- Inside Waste: covers a diverse range of activities, from waste collection to resource recovery.
- Waste & Resources Action Programme (WRAP) – UK

Waste & Resources Action Programme (WRAP) helps individuals, businesses and local authorities to reduce waste and recycle more; making better use of resources and helping to tackle climate change.

- Waste Management Association of Australia (WMAA) division: Compost Australia

Compost Australia is a national body for the organics processing and recycling industry.

- Waste Management Association of Australia E-News

Published bi-monthly, WMAA E-News is a digest of waste management news and information relevant to the Australian waste management sector.

Appendix E - Indicative wastewater discharge quality criteria to waterways to minimise impact

Quality indicator	Limiting criteria for receiving waters (see notes b & c)
pH	Causes the seasonal background pH to vary within ± 0.5 units (see note f below)
Colour/odour	Causes no discernible variation from seasonal background colour or odour
Dissolved solids (TDS)	Causes a maximum increase in the seasonal background TDS of 10 per cent
Dissolved oxygen (DO)	Causes a maximum decrease in the seasonal background DO concentration of 10 per cent
Floating matter/foam	Causes no visible floating oil, foam, grease, scum, litter or other objectionable matter
Non filterable residue (NFR) retained on a 45-micron filter	Causes a maximum increase in the seasonal background NFR concentration of 10 per cent Field check: a black Secchi disc should be immediately visible in daylight at bottom of 85 centimetres depth of dewater placed in a clean 200-litre drum with a white floor
Sediment/turbidity	Causes no discernible deposition of sediment that may affect aesthetic, recreational or ecological values
Micro-organisms	As accepted by Department of Health (WA) or its delegate, with reference to the relevant national water quality management strategy (NWQMS) guidelines 4 and 6 (Ref 1)
Nutrients (i.e. plant-available nitrogen or phosphorus)	Causes a maximum increase in seasonal background nutrient levels of 10 per cent; and, for conservation-valued waterways or wetlands, causes the seasonal background nutrient levels not to exceed the NWQMS guideline 4 Table 3.3.6 relevant default trigger level value for south-west Australia
Temperature	Causes a maximum seasonal variation of water temperature of \pm two degrees Celsius
Toxicants (e.g. arsenic; cyanide; endocrine disrupters; heavy metals; pesticides)	Causes a maximum increase in the seasonal background concentration of any toxicant of ten per cent; and Causes a maximum rise in the receiving water's seasonal background concentration of any toxicant to the lesser value of: 75 per cent of the NWQMS guideline 4 or 6 investigation trigger value/guideline criterion for relevant water uses; or criterion for protection of 90 per cent of existing ecosystem species guideline 4 (Reference 1)

Quality indicator	Limiting criteria for receiving waters (see notes b & c)
Radionuclides (maximum activity levels)	Non specific radiation emitters: Gross alpha (see note d) 0.1 Becquerel (Bq) litre. Gross beta (see note d) 0.5 Bq/L (after subtracting the K 40) Unspecified alpha & 0.1 milli-Sievert for an individual nuclide. beta-emitters Specified radiation emitters: Radium 226 0.5 Bq/L Radium 228 0.5 Bq/L Uranium 0.2 mg/L (equates to 0.25 Bq/L) Radium 222 100 0 Bq/L

Notes on limiting criteria for receiving waters

- a Table may be used where quality criteria are not yet available to protect specific environmental values.
- b Any variation from the seasonal background quality levels should be determined as the sum of all discharge inputs.
- c Any mixing zone should neither exceed 10 per cent of any wetland's seasonal area, nor 10 per cent of any waterway's seasonal width.
- d Applies to waters with slightly to moderately disturbed ecosystems, when influenced by human land-use activities.
- e Specific radionuclides and their activity concentrations should be identified if either the gross alpha or beta concentrations are exceeded. If more than one radionuclide is present, the total annual dose from all radionuclides (excluding the dose from potassium-40) should not exceed 0.1 milli-Sievert.
- f The alkalinity of the receiving water (milligrams per litre as CaCO₃) will influence the resultant pH after mixing.

Data sources

Australian Government, *National water quality management strategy papers 4 and 6* (Reference 1).