



Water quality protection note 20

August 2013

Industry – general and heavy

Purpose

General and heavy industry underpins the economy of the state and provides substantial employment opportunities. Industrial activity incorporating storage or use of chemicals and waste management practices pose a significant contamination risk to sensitive water resources. Appropriate location, provision of services, design of facilities and best management practices are needed to minimise this risk.

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

- our current views on the establishment and environmental management of industry near sensitive water resources
- guidance on acceptable practices used to protect the quality of WA's water resources
- a basis for the development of a multi-agency code or guideline designed to balance the views of industry, government and the community, while sustaining a healthy environment.

This note advises on relevant water resource management issues and makes recommendations on best practice. It is intended to inform industry operators, government officers, environmental consultants and community members on water quality protection aspects of this activity including initial planning, design, construction, operation and potential closure.

Appendices provide additional background and technical advice as follows:

A information on sensitive water resources, note limitations and updates

B relevant statutes and administering agencies

C data needed for assessing developments

D indicative criteria for protecting receiving water quality at unregulated sites, followed by references and further reading, note disclaimer and how to provide feedback.

Scope

This water quality protection note (WQPN) applies to general and heavy industry as defined in the Town Planning Regulations – Model scheme text (Appendix B) located near sensitive water resources (Appendix A). It applies to cement, chemical and dye works, energy production, fertiliser, metal manufacturing and coating, mineral processing, pesticide manufacturers, petroleum processing works, pharmaceuticals production, pulp and paper processing, waste treatment and recycling works and any other industries involving toxic materials or those harmful to the environment. This note encompasses materials formulation, manufacturing, processing, refining and holding. The note is not intended to cover:

- cottage industries (see WQPN 93)
- extractive industry (see WQPN 15) or mining (see *Environmental guidelines for mining and mineral processing*)
- light industry (see WQPN 93)
- rural or service industries (WQPNs 1, 2, 12, 17, 35, 45, 73, 98 and 101).

However the note may offer some guidance on potential risks to the environment and good practice. The recommendations in this note do not apply within urban or commercial areas.

Advice and recommendations

Location

- 1 Industrial sites should be chosen to cause the least water resource, environmental and social impact possible. Environmental studies should be used to assess the surrounding land usage, local climate factors, site topography, sensitive water resources, soil, surface and groundwater movement, and the site's land use history. New industrial projects should only be located on land zoned for industrial use.
- 2 The location and establishment of industrial precincts is likely to be of interest to the surrounding community. The proponent should adequately inform the public on the nature of the proposal and the safeguards to be included and seek their feedback. Proponents should effectively respond to issues raised.
- 3 New sites or expanded use of existing industrial sites should only be approved by regulatory agencies if the proponent can demonstrate that the industry is unlikely to pose a significant water quality risk during construction, operation and decommissioning of the premises. Risk mitigation measures may include:
 - a selection of low-vulnerability settings suited to the nature of the planned industrial activity
 - b fail-safe containment of any facilities that could put the environment at risk
 - c adequate buffers to nearby sensitive land uses and water resources
 - d reducing, recycling or adequately treating wastes before safe disposal, (such as pre-treatment of process fluids, then discharge to a sewerage scheme)
 - e site drainage controls that isolate potentially contaminated areas from discharging into the environment

- f environmental management, monitoring and reporting systems
 - g environmental awareness programs for site employees and contractors
 - h effective emergency response systems and land rehabilitation plans.
- 4 The availability of adequate infrastructure and support services including communication, power and gas, water supply, sewerage, waste disposal, all-weather transport access and emergency services should be addressed when assessing the suitability of any site for industrial activity. Our WQPN 83 *Infrastructure corridors* provides additional information (reference 4b).
 - 5 Legally established industrial sites near sensitive water resources (that may be contrary to source protection) policies can remain. Operators should, however, undertake regular environmental risk assessments and employ best environmental management practice to minimise the risk to water resource quality.

Near sensitive water resources

- 6 Industrial development can have an impact on the local water cycle. Land use changes should be managed to minimise sediment transport and prevent mobilisation of contaminants such as toxins and nutrients from the site into waterways.
- 7 Industrial sites should not be established on land that needs to be artificially drained, where diversion of natural watercourses is needed or where construction and operation will harm waterway or wetland values. Buffer areas provide significant water quality benefits via their ability to sustain aquatic ecosystems and filter pollutants in stormwater run-off. Industrial sites therefore should be placed sufficiently high in the landscape to protect natural waterways, wetlands and their associated vegetation, and allow for the effective operation of filter zones and contaminant controls.

Within public drinking water source areas (PDWSAs)

Appendix A provides background information on the protection of PDWSAs and their priority areas and protection zones.

- 8 Within priority 1 (P1) priority 2 (P2), priority 3 (P3) areas, wellhead protection zones and reservoir protection zones, this department will normally oppose establishment or expansion of heavy and general industrial sites, as they are incompatible with our risk management objectives. Industry may occasionally receive conditional approval provided the proponent demonstrates that the development will either lower the risks posed by the present land use activity or is approved by other state or local government agency processes. Conditions may include connection to sewerage.
- 9 Where special approval with conditions for an industrial site or development 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 PDWSA bores should be applied. For more information see the section on buffers.

Near conservation value wetlands

The Department of Environment Regulation implements regulatory measures under the *Environmental Protection Act 1986* to ensure that harmful concentrations of chemicals or contaminated waters do not enter the environment (including wetlands).

- 10 Wetlands require an adequate buffer to protect them from potential adverse impacts (principally from nutrients, sediment and toxins) and to maintain ecological processes and functions within the wetland.
- 11 The width of the environmental buffer should be determined based on the values of the wetland, the threats posed by the adjacent land use and the protective management techniques used at the facility to maintain or improve wetland values.
- 12 A minimum infrastructure buffer distance of 50 m to wetlands applies. Recommended buffer distances for the Swan Coastal Plain are provided in the position statement titled *Wetlands* (Water and Rivers Commission 2001) see www.dpaw.wa.gov.au.

Additional information on identifying wetland buffers is contained in chapter B4 of the Environmental Protection Authority's guidance statement 33 *Environmental guidance for planning and development* (reference 5).

- 13 Proposed development details within 500 m of any wetland (including lakes, sump-land, damp-land and palus-plain wetland) should be forwarded to the Department of Parks and Wildlife for assessment, with supporting information addressing the environmental risks.

Within environmental protection policy areas

- 14 Under Part III of the *Environmental Protection Act 1986*, specified areas are subject to statutory constraints. These policies, such as *Environmental protection (Swan Coastal Plain lakes) policy 1992*, prohibit the unauthorised filling, mining, drainage change and effluent discharge into specified wetlands. Industrial sites must not be constructed within or otherwise harm such wetlands, unless approved by the Minister for the Environment on the advice of the Environmental Protection Authority. For more detailed information, see www.epa.wa.gov.au select *Policies and guidelines*.

Within proclaimed waterways management areas

Five waterways management areas have been declared under the *Waterways Conservation Act 1976* to provide special protection to selected estuaries and their associated waterways. These waterways are considered especially vulnerable to water contamination. These areas are the Albany Waterways, Avon River, Leschenault Inlet, Peel-Harvey Estuary, and Wilson Inlet, and their immediate environs.

- 15 If industrial development is planned within any proclaimed waterways management area, written approval is needed from this department (Appendix B). For online information, see www.water.wa.gov.au select *Managing our water > Managing our rivers and estuaries* or contact our Water and land use planning branch in Perth.

Within the Swan River Trust management area

- 16 The Swan River Trust is responsible for the protection and management of the Swan-Canning River system to safeguard its ecological and social values under the *Swan and Canning Rivers Management Act 2006*. The river system is highly vulnerable to eutrophication. Approval from the trust is needed for any land- or water-based development within the Swan, Canning, Helena or Southern rivers and their associated foreshore areas – the *Swan River Trust development control area (DCA)*.
- 17 Activities and development close to these areas are likely to have an effect on the waters of the river system. Development proposals within or abutting the DCA should be referred to the trust for comment.
- 18 Developments distant from the DCA, but near river tributaries or drainage systems, that could affect waters within the area, such as leached contaminants in the groundwater flow, should also be referred to the trust for assessment and advice. For detailed information, see online advice at <www.swanrivertrust.wa.gov.au>, phone +61 8 9278 0900 or email: planning@swanrivertrust.wa.gov.au.

Water table separation

- 19 A minimum 2 m vertical separation distance should be maintained from the finished soil surface to the top of the wet season water table to maintain free-draining soils, to allow for the installation of underground services, avoid water-logging and encourage soil filtration and aerobic microbial action to attenuate leached contaminants and facilitate cleanup of any chemical spills. Material containment structures should not intersect the wet season water table.

Floodways

- 20 Land subject to flooding should be avoided. Land that is seasonally inundated or may be flooded during a 100-year average return frequency storm event is unsuited to industrial sites. Filling of land to raise structures above predicted flood-levels is considered poor practice, as it is likely to increase the risk of upstream flooding and increase floodwater velocity leading to soil and drainage channel erosion.

Contaminated sites

- 21 The site owner should arrange an evaluation for possible soil contaminants resulting from past land uses. Should contamination be discovered, clean-up or isolation of the contaminants may be required.
- 22 Contaminated sites are regulated via the *Contaminated Sites Act 2003* and Contaminated Sites Regulations 2006. For detailed advice, contact Department of Environment Regulation.

Remnant native vegetation

Many areas of the state have been cleared of their natural vegetation for agricultural or commercial use, essential services or urbanisation. The remaining vegetation in largely cleared areas is regarded as a precious resource. It sustains native fauna and flora,

protects water quality, helps maintain air quality and soil fertility, and assists the well-being of future generations.

23 If native vegetation needs to be cleared, a clearing permit may be required from Department of Environment Regulation in accordance with the Environmental Protection (clearing of native vegetation) Regulations 2004.

Buffers to sensitive water resources

- 24 Perennial native vegetation buffers should be retained or re-established between industrial sites and bores, drainage channels, estuaries, waterways and wetlands. These natural buffers are crucial for ecological protection, help to control erosion, filter contaminants and allow response time for effective remedial action in the event of a contaminant spill.
- 25 For detailed information on establishing buffers, see WQPN 6 *Vegetated buffers to sensitive water resources* (reference 4b). The vegetated buffers may need to be supported by other protective measures, such as drainage controls to capture chemical spills.
- 26 Industrial site developers should use scientific investigations and contaminant movement modelling to define protective buffers to water resources. The models should take into account the probable extent of leakage of industrial chemicals, potential contaminants (including initial concentration, solubility and degradation potential), their method of movement and duration between the release point and arrival at the water resource. Other aspects of the model may include meteorological effects, vegetation and soil filtering, biochemical attenuation processes along the travel pathway, any synergistic effects in the environment, the receiving water quality requirements to sustain its present usage and a suitable factor of safety applied so that the model is conservative.
- 27 Modelling does not override any statutory controls or this department's policy on protecting water resources.
- 28 For detailed information on establishing buffers, see WQPN 6 *Vegetated buffers to sensitive water resources* (reference 4b).
- 29 Any proposals for industrial sites within a recommended buffer zone should be referred to our nearest regional office and Department of Environment Regulation for assessment and response. The proponent's supporting data (see Appendix C) should clearly demonstrate that industry can be established and operate within any reduced buffer without posing a significant risk to water resource values.

Consultation with government agencies during the planning stage

30 The location of sensitive water resources and their management criteria can be obtained by contacting our nearest regional office. Interactive mapping information is also available online at <www.water.wa.gov.au> select *Tools and data* > *Maps and atlases* > *Geographic data atlas* > and enable the *Environment* theme.

- 31 Proposals to significantly alter or expand industrial sites should undergo both planning and environmental impact assessment and gain approval from regulatory agencies.
- 32 Any industrial subdivision proposed within 500 m up-gradient (by groundwater or surface water flow) of a sensitive water resource should be referred to our nearest regional office for assessment, with supporting information addressing the water quality risks. This ensures that environmental controls, transport corridors and servicing requirements are negotiated well in advance of subdivision. The development should be suitably located, constructed, operated and maintained, and have an appropriate balance of environmental, social and economic considerations.

Construction of industrial facilities

Process material storage and use

- 33 Materials that may harm water resource quality if released to the environment (such as toxic chemicals or algal stimulants) should be stored and used within weatherproof containment compounds. These should be built using low-permeability materials (typically concrete, rendered masonry, low-permeability clay soil or synthetic liners).
- 34 Storage surfaces should be chemically resistant or sealed to prevent damage by chemical spills. The compounds should allow recovery of any chemical spill without discernible loss to the environment. They should have a capacity of least 110 per cent of the volume of the largest contained storage vessel, plus 25 per cent of the volume of other containers, plus allowance for any captured stormwater if located outdoors.
- 35 Containment compounds should effectively capture leaking tank contents, any contaminated stormwater, jetting fluids and residues from equipment misuse.
- 36 Well-maintained security barriers equipped and operated to deter intruders (e.g. lockable buildings and fenced enclosure) should surround these compounds.
- 37 Stored fuels and chemicals may require licensing by the Department of Mines and Petroleum.
- 38 The use of gas-powered equipment is preferred near sensitive waters in place of liquid fuels such as petrol and diesel. Gas generally poses a lesser contamination threat to water resources.
- 39 Substances that should be stored within containment compounds include:

<ul style="list-style-type: none"> – acids – alkalis – animal wastes – detergents – dyes – fertilisers – fuels 	<ul style="list-style-type: none"> – metal salts – organic solvents – poisons – pathogens – pesticides – oils and lubricants – radioactive substances.
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Note – reactive materials require separate storage compounds.

- 40 Fuelling facilities for vehicles and machinery should be constructed and operated so that any spillage drains into holding tanks or well-maintained fuel-recovery systems. Special containment is not needed for small quantities (less than 5 L) of chemicals used for on-site hygiene purposes, although they should be stored securely indoors.
- 41 For above ground chemical storage tanks and bulk materials storage, a compatible low permeability seepage barrier should be used (for fuels, this is typically high-density poly-ethylene liner protected by sand cover to prevent operational damage). Below-ground chemical storage should use monitored double-walled containment tanks and piping systems. For more information, see WQPNs (reference 4b).
- 42 Storage of fuels, solvents, explosives and dangerous goods should be controlled in accordance with the *Dangerous Goods Safety Act 2004*, which is administered by the Department of Mines and Petroleum.
- 43 Low-hazard, erosion-prone material such as soils and inert minerals, may be stockpiled in outdoor areas provided that surface drainage is diverted around the stockpile, rainfall run-off is treated by effective turbidity controls, and dust, odour and vermin are adequately managed.

Stormwater management

- 44 Stormwater run-off from roofs, covered areas, hard-stand and low-permeability soils within the site should be protected from contamination. Clean stormwater should be re-used as process water, discharged to soakage, or diverted via adequate by-pass drains around disturbed surfaces, stockpiled materials and process areas (references 4d and 9).
- 45 Any on-site drainage systems carrying uncontaminated water to waterways or wetlands should pass through a lined settling basin with a surface skimmer. This basin should have a capacity to contain a two-year average return frequency and a 72-hour duration storm event. This capacity should be calculated using methods described in the current version of *Australian rainfall and run-off* (reference 6).
- 46 Signs should be erected adjacent to stormwater drainage gully grates to inform employees that any chemicals, process wash-down water and other residues disposed to drains are likely to cause pollution in natural water bodies, resulting in harm to plants and animals. Discharges to the environment likely to cause pollution are an offence under the *Environmental Protection Act 1986* and may result in substantial penalties.
- 47 Employees should be made aware of the potential threat to any nearby sensitive water resources through adequate training and signage.

Operation and management

Premises listed in Schedule 1 of the Environmental Protection Regulations 1987 are subject to works approval, licensing or registration administered by Department of Environment Regulation (Appendix B).

Wastewater disposal

- 48 Where process waste (treated or otherwise) may be discharged to the environment, relevant agencies (Appendix B) should be consulted during the project planning phase, to ensure the quality characteristics are suitable for disposal. Production waste should be minimised, recycled or reused to the maximum practical extent before consideration is given to allowing any discharge into the environment.
- 49 Where disposal is to sewer, effluent quality requirements should be discussed with the sewerage service provider (such as the Water Corporation). Pre-treatment of industrial wastewater may be required under the terms of a permit issued by the service provider.
- 50 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 response to the statutory requirements listed in Appendix B.
- 51 Indicative water quality criteria for wastewater discharge to the environment from unregulated sites are provided in Appendix D.
- 52 Treatment systems should reliably achieve their design effluent quality (i.e. more than 90 per cent of samples in any one-year period). 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.
- 53 Performance testing of waste treatment systems should be routinely conducted, using the supplier's recommendations.
- 54 Uncontaminated wastewater (such as clean stormwater, cooling water and condensate) should be stored for reuse for landscape irrigation or flushing waters on-site (or stored off-site, subject to the site owner's permission).
- 55 All wastes from employee amenities (toilets, showers and kitchens) should be either discharged to sewer or managed in accordance with the *Health Act 1911* and as required by the local government authority's environmental health officer.

Solid waste disposal

- 56 Where practical, waste should be minimised via cleaner production protocols and recycling techniques. Information is available from the Centre for Excellence in Cleaner Production (see <<http://cleanerproduction.curtin.edu.au>> *Resources for industry and government*).
- 57 Any residual degradable, hazardous or intractable solid waste generated on the site should be contained prior to disposal at a licensed waste transfer or disposal site. Waste recycling online information is available at www.wasteauthority.wa.gov.au.

Equipment maintenance

- 58 Wash-down facilities for mechanical plant or vehicles should be constructed and operated in accordance with WQPN 68 *Wash down of mechanical equipment*.

59 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 WQPN 28 *Mechanical servicing and workshops*.

Accidents and emergency response

60 Where the site holds 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 malfunction. The plan should identify local sensitive water resources. It should provide management response protocols to limit the impact of foreseeable incidents.

61 Designated employees should be trained in procedures to block chemical escape pathways and clean up spills. For detailed information see WQPN 10 *Contaminant spills – emergency response*.

Monitoring and reporting

62 If a permit or licence is not required under legislation (see Appendix B), the site should be periodically inspected by relevant agencies to audit the site operator's conformity with project approval requirements.

63 Where on-site wastewater treatment is required, the site operator should routinely monitor effluent for potentially harmful contaminants to ensure that system performance is maintained. A typical monitoring program involving water contamination indicators is provided in Table 1.

Table 1 Typical monitoring program involving water contamination indicators

Monitored location	Monitored characteristics	Typical parameters	Frequency	Comments
Effluent discharge	Metered flow rate	kL/hr	Start up, then at weekly intervals	Measured on-site where practical
	Physical qualities	Colour, pH, EC, T and turbidity		
	Chemical contaminant concentrations	Metals, nutrients, petroleum hydrocarbons, poisons, sulfate, surfactants, trace organics	Start-up, and then monthly	Samples collected, preserved then analysed in a NATA-accredited laboratory

Monitored location	Monitored characteristics	Typical parameters	Frequency	Comments
	Microbiological concentrations	<i>E. coli</i>	Quarterly by trained staff	Analysis at Queen Elizabeth II hospital <i>Path West</i>
Monitor bores	Standing water level	pH, EC, nutrients, metals	Quarterly	Benchmarked against background or upstream quality if contamination suspected
Waterways and wetlands	Contaminant concentrations	pH, EC, DO, nutrients, turbidity		
Sediment in waterways and wetlands		pH, metals, nutrients		

Table 1 legend

BOD = biochemical oxygen demand
DO = dissolved oxygen
EC = electrical conductivity (as a measure of salinity)
NFR = non filterable residue (suspended solids)
Nutrients = Nitrogen (N) as ammonia + (N) as nitrite and nitrate; Phosphorus (P) as orthophosphate
T = temperature

Table 1 notes

- a Parameters sampled and analysed should be relevant to the nature of the industry's raw materials, products or wastes and the values of waters that could be reasonably impacted.
- b Where contamination indicator tests show a potential problem, more detailed analyses should be conducted for concentrations of specific contaminants.

64 All monitoring should be conducted in accordance with Australian Standards 2031 and 5667 (see reference 7) by competent and experienced personnel. Detailed advice on monitoring is contained in the *Australian guidelines for water quality monitoring and reporting 2000* (see reference 1e).

65 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 government agencies.

Closure of industrial sites

66 Prior to closure, industrial sites should be assessed for the presence of contaminated soils. If contamination exceeding Department of Environment Regulation criteria is found, then remedial action should be taken to restore the soil to a condition suited to the next land use.

Appendix A: Information on sensitive water resources, note limitations and updates

Sensitive water resources

Our water resources sustain ecosystems, aquatic recreation and aesthetic values as well as providing drinking, industry and irrigation supplies. Along with breathable air, uncontaminated water is essential for viable communities. Natural water resources should remain within defined quality limits to retain their ecological, social and economic values. Hence they require appropriate protection measures to minimise contamination risks.

Information on water quality parameters and processes to maintain water values are published in the Australian Government's National Water Quality Management Strategy papers. These papers are available online at <www.environment.gov.au> select *water* > *water policy and programs* > *water quality*.

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 sustain acceptable water resource quality. Human activity and many land uses pose a risk to water quality if contaminants in significant quantities are washed or leached into water resources.

Sensitive waters include estuaries, natural waterways, wetlands and groundwater. These waters support one or more of the environmental values described overleaf.

Public drinking water sources

Overview

Public drinking water source area (PDWSA) is the collective name given to any area proclaimed to manage and protect a community drinking water source. PDWSA include underground water pollution control areas, water reserves and catchment areas administered by the Department of Water 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, then open environment > public drinking water source areas.

Within PDWSA, priority areas are defined (P1, P2 or P3) via publicly consulted drinking water source protection plans or land use and water management strategies. Priority areas are used to guide land planning, rezoning and development approval processes. Priority areas are assigned considering the current local planning scheme zoning, land tenure, the water source's strategic value and its vulnerability to harm. Each priority area is managed using a specific risk-based strategy to provide for effective water resource protection. The Department of Water develops these documents in consultation with other government agencies, landowners, industry and the community.

P1 areas are defined to ensure human activity does not degrade a water source. These areas are declared over land where the provision of high-quality drinking water for public

use is the primary beneficial land value. P1 areas typically cover land controlled by the state government or one of its agencies. These areas are managed under the principle of risk avoidance, so most land development and human activity is normally opposed.

P2 areas are defined to ensure there is *no increased risk of pollution* to the water source once a source protection plan has been published. These areas are declared over land where low-intensity development exists (involving rural usage such as dry land grazing or cropping). Protection of public water supply sources is a high priority in P2 areas. These areas are managed in accordance with the principle of *risk minimisation*, and so the intensity of development should be restricted (via management conditions) and activities with a low water contamination risk are normally considered acceptable.

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 co-exist with other land uses such as residential, commercial and/or light industrial development. Protection of P3 areas is mainly achieved through land use management measures e.g. contamination barriers. Environmental guidance (such as these notes) or site-specific development approval conditions are used to limit the water resources contamination risk from the land use or activity. If, however, the water source becomes contaminated, then water supplied from P3 sources may need to be more intensively treated or an alternative water supply source commissioned.

Additional protection zones are defined close to the point where drinking water is extracted or stored. These zones are called *wellhead protection zones (WHPZ)* and *reservoir protection zones (RPZ)*. Statutory land use constraints apply to activities within these zones surrounding sources to safeguard these waters most vulnerable to contamination.

WHPZ are assigned around water production wells based on hydrological factors. Statutory land use restrictions apply within these zones as groundwater moves rapidly towards wells due to aquifer depressurisation by pumping. Any contaminants leaching from the ground surface in a WHPZ could rapidly migrate into scheme water supplies (before effective remedial action can occur).

In sedimentary basins, WHPZ are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside PDWSA boundaries.

RPZ are defined over and around public water supply storage or pipe-head reservoirs. Statutory access and land use restrictions apply in RPZ. The aim is to restrict the likelihood of contaminants being deposited or washing into water sources in any runoff. RPZ are normally within state-controlled areas encompassing land up to two kilometres measured outward from the reservoir top water-level and include the inundated area when the reservoir is full.

For additional explanatory information on PDWSA, see our Water quality protection note (WQPN) 25 *Land use compatibility in public drinking water source areas*, WQPN 36 *Protecting public drinking water source areas*, WQPN 75 *Proclaimed public drinking water source areas*, note 76 *Land use planning in PDWSA* and WQPN 77 *Risk assessment in*

PDWSA. These notes are available online at <www.water.wa.gov.au> select *publications* > *find a publication* > *series browse*.

Established activities within PDWSAs

Many land use activities were approved and established before publication of a source protection plan or land use and water management strategy.

Activity operators should ensure that modern environmental facilities and practices are progressively implemented and maintained so that the water resource contamination risk is minimised (within practicable and economic constraints).

New or expanded activities in PDWSA

Any development proposals that could affect a drinking water source should be referred to this department's local regional office with detailed supporting information for an assessment and written response.

The development proposal may be:

- approved (with or without conditions)
- delayed pending receipt of additional information before a decision is made; or
- opposed due to a statutory or policy conflict or inadequate protective measures provided to safeguard the water source.

To assist the assessment, operators should demonstrate that under all operating conditions the facilities and processes used on-site do not pose a significant water contamination risk.

Buffers to water supply sources

Native vegetation buffers should be used to separate compatible land use areas from the sources of drinking water including the full supply margins of reservoirs, their primary feeder streams and/or production bores. Advice on suitable buffer forms and dimensions is provided in our WQPN 6 *Vegetated buffers to sensitive water resources*.

Within clearing control catchments

Controls on vegetation clearing for salinity management in country areas are provided 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 of clearing controls may be obtained from our regional offices, see online information at <www.water.wa.gov.au>, select *Contact us*.

Private water supply sources

Private water sources vulnerable to contamination include:

- drinking water sources for people or domesticated animals

- commercial or industrial water supply sources (requiring specific qualities that support activities such as aquaculture, cooling, food and mineral processing or crop irrigation)
- urban or municipal irrigation sources (where water quality may affect vegetation performance or people's health and wellbeing).

Underground ecosystems

Important underground ecological functions that may be at risk of contamination include groundwater- and cave-dwelling animals and microorganisms (generally located within soils that have open pore spaces such as sand, gravel and limestone).

Waterway ecological and social values

Waterways that have high social and conservation significance are described in the Western Australian Environmental Protection Authority (EPA) Guidance statement 33 *Environmental guidance for planning and development*, section B5.2.2. This statement is available online at <www.epa.wa.gov.au> select *policies and guidelines* > *environmental assessment guidelines* > *guidance statements*.

The Department of Water manages natural waterways under Section 9 of the *Water Agencies (Powers) Act 1984* and the *Rights in Water and Irrigation Act 1914*. For online information, see <www.water.wa.gov.au> and select *managing water*. Apart from aquatic ecosystems and water sources, waterways provide social values including aesthetic appeal, drainage pathways and recreational opportunities for watercraft use, fishing, tourism, swimming and related aquatic activities.

Engineered drains and constructed water features are normally not assigned ecological values as their primary function and operational factors outweigh their ecological value.

This department also administers the *Waterways Conservation Act 1976* which defines Western Australian waterways subject to specific regulatory controls. Currently proclaimed waterways include the Avon River, Peel-Harvey Inlet, Leschenault Inlet, Wilson Inlet and Albany waterways management areas.

Within the Swan-Canning Estuary catchment

The Swan River Trust is responsible for the protection and management of the Swan-Canning River system. The trust safeguards ecological and social values under the *Swan and Canning Rivers Management Act 2006*. Written approval is needed for any land- or water-based development within the Swan, Canning, Helena or Southern rivers and their associated foreshore areas within the *Swan River Trust development control area (DCA)*. Human activity and development close to these areas are likely to have an effect on the waters of the river system. Development proposals within or abutting the DCA should be referred to the trust for assessment.

Developments outside the DCA, but near river tributaries or drainage systems, that could affect waters within the area, e.g. by leachate in groundwater flow, should also be referred to the Trust for assessment and advice. For detailed information, see online advice at

<www.swanrivertrust.wa.gov.au>, phone 9278 0900 or email: planning@swanrivertrust.wa.gov.au .

Wetland ecology

Many important wetlands have been given conservation status under the Ramsar convention (described online at <www.ramsar.org>), Japan and Australia migratory bird agreement (JAMBA), China and Australia migratory bird agreement (CAMBA), and Republic of Korea and Australia migratory bird agreement (ROKAMBA).

Wetlands are also protected under various national and Western Australian government policies. Conservation wetland data to guide land planning and development activities is provided via the following publications:

- *Directory of important wetlands in Australia* defines wetlands scheduled by the Australian Government. It is available online at <www.environment.gov.au> select *water > water topics > wetlands*.
- Wetlands with defined high conservation significance are described in the EPA (WA) guidance statement 33 *Environmental guidance for planning and development* (section B4.2.2). This statement is available online at <www.epa.wa.gov.au> select *policies and guidelines > environmental assessment guidelines > guidance statements*.

The Department of Parks and Wildlife is the custodian of the state wetland datasets, and is responsible for maintaining and updating relevant information. These datasets are available www.dpaw.wa.gov.au.

Wetlands datasets identified for conservation value or for resource enhancement include:

- Geomorphic wetlands of the Swan Coastal Plain
- South coast significant wetlands
- Geomorphic wetlands Augusta to Walpole (this dataset awaits detailed evaluation).

Wetlands that are highly disturbed by land use, or have been landscaped to provide a social amenity or drainage control function in urban settings, may not be assigned conservation values unless they are actively managed to maintain these values.

Note limitations

Many Western Australian aquifers, waterways and wetlands await detailed scientific evaluation, present data on their quality is sparse and their values remain unclassified. Unless demonstrated otherwise, any natural waters that are slightly disturbed by human activity are considered to have sensitive environmental values. Community support for these water values, the setting of practical management objectives, provision of sustainable protection services and effective implementation are vital to protecting or restoring water resources for both current needs and those of future generations.

This note provides a general guide on environmental issues, and offers solutions based on data searches, professional judgement and precedents. 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's

recommendations shall not be used as this department's policy position on a specific matter, unless confirmed in writing. In addition, regulatory agencies should not use this note's recommendations in place of site-specific development conditions based on a project's assessed environmental risks. Any regulatory conditions should consider local environmental values, the safeguards in place and take a precautionary approach.

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

Water quality protection note updates

This note will be updated as new information is received, industry/activity standards change and resources permit. The currently approved version is available online at <www.water.wa.gov.au> select *publications* > *find a publication* > *series browse* > *water quality protection notes*.

Appendix B: Statutory approvals relevant to this note include

What's regulated?	Western Australian statutes	Regulatory office
Regulation of prescribed premises that could pollute	<i>Environmental Protection Act 1986</i> , - Part V Environmental regulation and Environmental Protection Regulations 1987	Department of Environment Regulation < www.der.wa.gov.au >
Land and waters that have been contaminated by human activity	<i>Contaminated Sites Act 2003</i> , and associated regulations 2006	
Prohibited discharge of specified contaminants	Environmental Protection (unauthorised discharges) Regulations 2004	
Management of human wastes Community health issues	<i>Health Act 1911</i>	Department of Health < www.health.wa.gov.au > Relevant local government
Transport, storage and handling of fuels, solvents, explosive and other dangerous goods	<i>Dangerous Goods Safety Act 2004</i> Dangerous goods safety regulations 2007	Department of Mines and Petroleum – Resources Safety Division < www.dmp.wa.gov.au >
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 existing public drinking water source areas Clearing of native vegetation in clearing control catchments	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> <i>Country Areas Water Supply Act 1947</i>	
Emergency response planning	<i>Fire and Emergency Services Authority of WA Act 1998</i>	Department of Fire and Emergency Services < www.dfes.wa.gov.au >

What's regulated?	Western Australian statutes	Regulatory office
Statutory policies covering wetlands, drinking water catchments and estuaries	<i>Environmental Protection Act 1986</i> , - Part III Environmental protection policies	Minister for the Environment advised by the Environmental Protection Authority <www.epa.wa.gov.au>
Impact of significant development proposals on the values and ecology of land or natural waters	<i>Environmental Protection Act 1986</i> - Part IV Environmental impact assessment	
Discharges into the Swan-Canning Estuary	<i>Swan and Canning Rivers Management Act 2006</i>	Swan River Trust <www.swanrivertrust.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
Subdivision of land Land zoning Development approval	<i>Planning and Development Act 2005</i>	Western Australian Planning Commission Department of Planning <www.planning.wa.gov.au> Relevant local government

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

Appendix C: Data needed for development proposal assessments

Where facilities are to be constructed or upgraded near sensitive waters, the proponent should supply a development proposal to this department, including the following details:

- 1 Site owner/operating tenant's name and contact details.
- 2 A site plan showing the location of the project relative to surrounding lots and roads. The plan should show the topography, vegetation cover, existing and proposed infrastructure and any onsite water features or water sources.
- 3 Details of site investigation of soil strata, depth to water table (if applicable) and available quality data for local water resources.
- 4 The present local government land use zoning, current land use description, and data on any site contamination history and remediation, should be included.
- 5 Full description and scale of the activities planned for the project site, site amenities, anticipated construction and operating workforce and project operational life. Planned commissioning date, operating hours and future expansion options should be included.
- 6 Details of any proposed vegetation clearing, site earthworks, services including water supply, sewage and drainage and environmental buffers.
- 7 Description of all materials/ chemicals to be stored or handled on site in commercial quantities.
- 8 Description of the types, quantities and quality of solid and liquid waste that will be generated at the facility (if applicable).
- 9 Description of planned material containment, waste management (treatment and disposal) with design plans. Scientific modelling should be used to demonstrate that

any process effluent discharged to the land will not be detrimental to local water resource values.

- 10 Planned operational and equipment maintenance procedures.
- 11 Details of any contingency measures proposed to minimise the impacts of chemical spills and safely dispose of contaminated waters that may result from storms, fire, flood or equipment malfunction or vandalism. Information should include workforce training and emergency response facilities.
- 12 Any contractual agreements entered into progress the project or regulatory agency approvals received to date.

For major projects, development proponents should engage the services of a qualified and experienced consultant to professionally prepare their development proposal.

This should ensure that government agencies can efficiently assess and respond to the proposal without delays caused by inadequate or poorly defined information.

Appendix D: Indicative criteria for receiving water quality protection at unregulated sites

Table 2 Indicative criteria for receiving water quality protection

Indicator	Limiting criteria for receiving waters ^{a, b}
pH	Causes the seasonal background pH to vary within 0.5 units.
Dissolved solids (TDS)	Causes a maximum increase in the seasonal background TDS of ten per cent.
Dissolved oxygen (DO)	Causes a maximum decrease in the seasonal background DO concentration of ten per cent.
Non filterable residue (NFR) using 45 µm filter	Causes a maximum increase in the seasonal background NFR concentration of ten per cent.
Floating matter / foam	Causes no visible floating oil, foam, grease, scum, litter or other objectionable matter
Sediment	Causes no discernible deposition of sediment that may affect aesthetic, recreational or ecological values.
Colour / odour	Causes no discernible variation in the colour or odour.
Micro-organisms	As recommended by Department of Health WA or its delegate, with reference the national water quality management strategy guidelines 4 and 6.
Temperature	Causes a maximum seasonal variation of the water temperature of two degrees Celsius

Indicator	Limiting criteria for receiving waters ^{a, b}
Toxicants (such as cyanide, endocrine disrupters, heavy metals, pesticides)	Causes a maximum increase in the seasonal background concentration of any toxicant of ten per cent Causes a maximum rise in the receiving water's seasonal background concentration of any toxicant to the lesser value of either 75 per cent of the NWQMS 4 & 6 investigation trigger value or guideline criteria for relevant water uses, or NWQMS 4 protection of 90 per cent of existing ecosystem species.
Nutrients (i.e. plant-available nitrogen or phosphorus)	Causes a maximum increase in seasonal background nutrient levels of 10 per cent For conservation-valued waterways or wetlands, causes the seasonal background nutrient levels not to exceed NWQMS 4 Table 3.3.6 relevant default trigger value for south-west Australia.
Radionuclides (maximum activity levels)	Non specific radiation emitters: Gross alpha ^d 0.1 Becquerel (Bq) / litre Gross beta ^d 0.5 Bq / litre (Potassium 40 subtracted) (Unspecified alpha) 0.1 milli-Sievert for an individual nuclide (& beta-emitters ^{e, f}) Specified radiation emitters: Radium 226 0.5 Bq / litre Radium 228 0.5 Bq / litre Uranium 0.2 milligrams / litre (= 0.25 Bq / litre) Radon 222 100 0 Bq / litre

Source: Australian government - national water quality management strategy papers 4 & 6

Notes on limiting criteria given in Table 2

- a Any variation from the seasonal background water quality levels should be determined as the sum of all discharge inputs.
- b Any mixing zone should not exceed ten per cent of any wetland's seasonal area, or ten per cent of any waterway's seasonal width.
- c Applies to waters with slight to moderately disturbed ecosystems, influenced by human land-use activities.
- d Specific radio nuclides 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 radio nuclides (excluding the dose from potassium 40) should not exceed 0.1 milli-Sievert.

References and further reading

- 1 Australian government – national water quality management strategy, online at <www.environment.gov.au>select *water* > *water policy and programs* > *water quality*>
 - 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, 2011*
 - e *Paper 7 Australian guidelines for water quality monitoring and reporting, 2000.*
- 2 Cockburn Sound Management Council (WA) publications available online at <<http://csmc.environment.wa.gov.au>> select from menu bar
- a *State environmental protection (Cockburn Sound) policy 2005*
 - b *Environmental management plan for Cockburn Sound and it's catchment 2005*
 - c *Environmental quality criteria (Cockburn Sound) 2003 – 2004.*
- 3 Previous Department of Environment and Conservation (WA) publications:
- a Wetlands, www.dpaw.wa.gov.au
Position statement: Wetlands, June 2001.
 - b Waste management, www.wasteauthority.wa.gov.au
Guidelines for acceptance of solid waste to landfill, DEP, 2001.
 - c Contaminated sites publications, www.der.wa.gov.au
 - *Contaminated sites – new laws for Western Australia, July 2006*
 - *Contaminated sites fact sheets*
 - *Contaminated sites management series.*
- 4 Department of Water (WA) publications available online at <www.water.wa.gov.au>
- a Policies, select *Publications > Find > Series browse > State-wide policy*
Foreshore policy 1 - Identifying the foreshore area 2002
 - b Water quality protection notes (WQPN), select *publications > find a publication > series browse > water quality protection notes*
 - WQPN 1 *Agriculture –dry land crops*
 - WQPN 2 *Aquaculture*
 - WQPN 6 *Vegetated buffers to sensitive water resources*
 - WQPN 10 *Contaminant spills - emergency response*
 - WQPN 12 *Dairy processing plants*
 - WQPN 13 *De-watering of soils*
 - WQPN 17 *Floriculture*
 - WQPN 24 *Inert land fills*
 - WQPN 25 *Land use compatibility in public drinking water source areas*
 - WQPN 28 *Mechanical servicing and workshops*
 - WQPN 26 *Liners for containing pollutants, using synthetic membranes*
 - WQPN 27 *Liners for containing pollutants, using engineered soils*
 - WQPN 35 *Pastoral activities (within rangelands)*
 - WQPN 45 *Rural land use – planning and operating to protect water resources*
 - WQPN 52 *Stormwater management at industrial sites*

- WQPN 56 *Tanks for above ground chemical storage*
 - WQPN 61 *Tanks for ground level chemical storage*
 - WQPN 62 *Tanks for underground chemical storage*
 - WQPN 65 *Toxic and hazardous material storage and use*
 - WQPN 68 *Wash down of mechanical equipment*
 - WQPN 73 *Wineries and distilleries*
 - WQPN 83 *Infrastructure corridors*
 - WQPN 93 *Industry – light*
 - WQPN 98 *Abattoirs in rural areas*
 - WQPN 101 *Tropical agriculture.*
- c Waterways - water notes, select *publications*> *find a publication*> *series browse*
 Water note 23 *Determining foreshore reserves 2001*
- d Drainage management, select *publications*> *find a publication*> *series browse*
Stormwater management manual for Western Australia, 2004.
- 5 Environmental Protection Authority (WA)- Guidance statements available online at <www.epa.wa.gov.au> select *guidance statements*
- a GS 3 *Industrial - residential buffer guidelines*
 - b GS 33 *Environmental guidance for planning and development, 2005.*
- 6 Engineers Australia publication available for purchase at <www.engineersmedia.com.au> search *EA books*
Australian rainfall and runoff (current edition).
- 7 Standards Australia publications available for purchase at <www.saiglobal.com> select *publications*
- a AS 2031 *Selection of containers and preservation of water samples for chemical and microbiological analysis*
 - b AS 5667 *Water quality – sampling.*
- 8 Swan River Trust publications available online at <www.swanrivertrust.wa.gov.au>, select *Swan Canning Cleanup Program > Projects*
- a *Guidelines for de-watering activities in the Swan Coastal Plain 1994*
 - b *Environmental management and cleaner production directory for small to medium business 2005*
- 9 Western Australian Planning Commission, Departments of Planning and Infrastructure, Water; Australian Department of Environment, Water, Heritage and the Arts 2008
Better urban water management 2008.

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Feedback

We welcome your thoughts on this note. Feedback will help us prepare future versions. To comment on this note or seek any clarification, please contact our water source protection planning branch (details below), citing the note topic and version.

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