Water quality protection note no. 70

Securing Western Australia's water future

March 2016 (interim update)

Wastewater treatment and disposal - domestic systems

Important information as at March 2016

The Department of Planning is currently revising and consolidating the *Government sewerage policy – Perth metropolitan region* (1996) and the *Draft country sewerage policy* (2003). This water quality protection note (WQPN) will be reviewed and updated when the new policy is released.

This WQPN provides updated advice for on-site wastewater treatment and sewage disposal systems servicing a single dwelling or non-residential development that is located in a public drinking water source area (PDWSA) or near other sensitive water resources.

If you require additional information, please contact the Department of Water on +61 8 6364 7600 or drinkingwater@water.wa.gov.au.

Background

Domestic wastewater is derived from bathrooms, kitchens, laundries and toilets. It includes human waste (containing pathogens), paper, soap, detergent residues and food scraps suspended in around 150 litres of wastewater daily for each person in a household.

The *Government sewerage policy – Perth metropolitan region* (1996) and the *Draft country sewerage policy* (2003) (references 4e and 4f) were prepared to guide sewage management services. They define the minimum acceptable development density and lot size and water resource buffers for subdivision or development without a reticulated sewerage scheme connection. Where properties cannot be connected to a reticulated sewer scheme, domestic wastewater is normally treated and disposed of on-site. This wastewater (commonly termed sewage effluent) may pose a contamination risk to water resources when discharged.

Depending on the type of treatment, sewage effluent may still contain:

- pathogens, which can include disease-causing organisms (e.g. bacteria, viruses, intestinal worms and protozoa)
- degradable organic matter that depletes dissolved oxygen in water and can cause foul odours
- suspended solids and sediment
- household chemical residues such as cleansers and disinfectants

- nutrients such as nitrogen and phosphorus, that foster algae blooms in waterways and wetlands
- detergent residues (which can harm aquatic plants and animals)
- trace metals and organics from plumbing fittings
- any substance flushed into the waste management system.

Wastewater treatment is normally designed to remove gross solids, stabilise degradable organic material and settle out other solids as sludge. Because of the presence of pathogens, disinfection is required if the effluent discharge could contact food crops, people or water supplies.

Some treatment systems are also designed to reduce phosphorous levels (reference 4). Phosphorous-removing systems may be needed where local soils are poor at absorbing phosphorous and where runoff or groundwater may move this nutrient into a surface water body at risk of algae blooms. In some locations, natural soils (such as loam) are rich in iron and aluminium oxides and have an ability to bind phosphorous, so phosphorous-removing systems are generally not necessary.

Currently, there are no effective domestic wastewater treatment systems approved as nitrogen-removing systems in WA. Excessive nitrate-nitrogen poses a health risk to drinking water sources and contributes to algal blooms in surface waters.

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 current views on domestic wastewater management in PDWSAs and near other sensitive water resources
- guidance on acceptable practices used to protect the quality of Western Australian 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.

The note has been produced to inform landowners, government officers, environmental consultants and community members of our views on domestic wastewater treatment and disposal; from initial planning, through construction, operation and replacement with a reticulated sewer connection.

Scope

This note applies only to on-site wastewater treatment and effluent disposal systems servicing up to ten people in a single dwelling or workplace and located near sensitive water resources (see Water quality protection note no. 4 *Sensitive water resources,* reference 6a). This note provides advice in separate sections on conventional septic tank systems and alternative wastewater treatment and disposal systems.

The most common types of domestic wastewater treatment systems used in Western Australia are described and recommendations are provided for their location and maintenance. Detailed information about the design, function, maintenance and

operation of the systems may be obtained from the environmental health section of local governments, equipment suppliers or the Department of Health's Wastewater management branch (reference 4). All wastewater systems for sale must be approved by the Department of Health (WA).

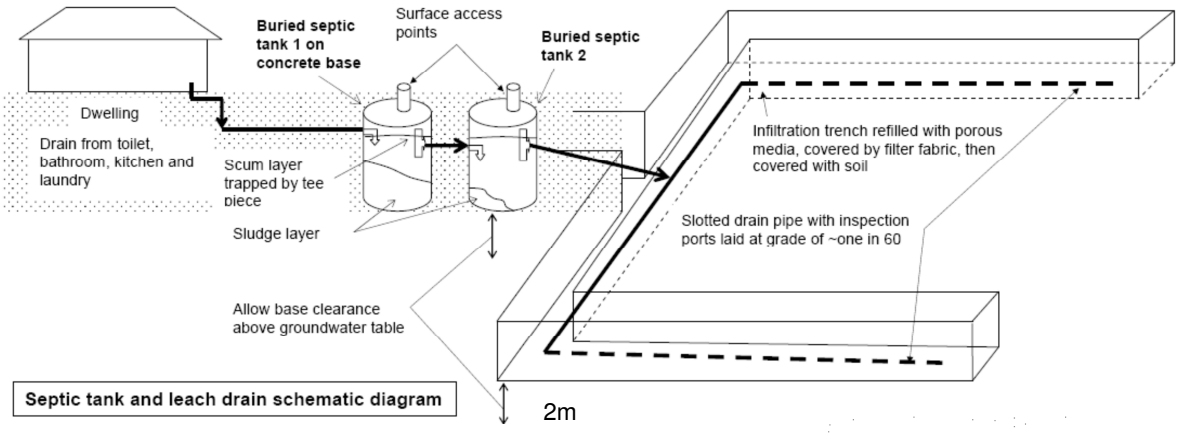
The note is not intended to cover wastewater facilities servicing connected groups of dwellings, such as mining camps, holiday resorts, remote communities, or municipal and industrial wastewater treatment from reticulated sewerage schemes.

Standard information to be read in conjunction with this note can be found in WQPN no. 3: *Using water quality protection notes*.

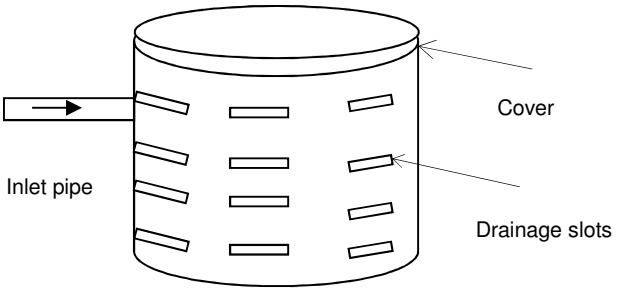
Conventional domestic wastewater treatment and effluent disposal systems

These systems generally consist of watertight cylindrical tanks (septic tanks) followed by one or two sets of effluent soakage wells that have holes in their sides and no base (soakwells) or horizontal leach drains (Figure 1). Septic tank systems treat domestic wastewater by sedimentation and anaerobic decomposition of sludge. This reduces the degradable organic content (measured as biochemical oxygen demand), suspended solids and grease levels prior to the effluent entering the surrounding soil.

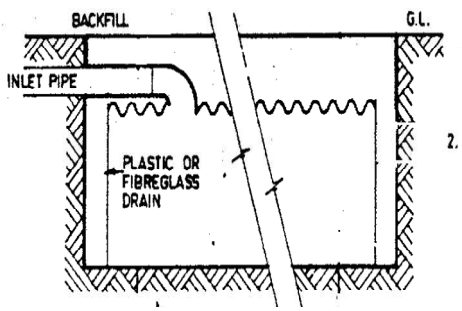
Septic tank systems do not significantly reduce micro-organisms or nutrient concentrations; however these may be reduced by movement through the natural soil. Contaminant reduction depends on the soil's properties; travel time and the local environmental conditions surrounding the leach drain or soakwell. For more information, see the Department of Health's Environmental health information sheet *Understanding septic tank systems* (reference 4a).



Septic tank and leach drain schematic diagram



Concrete soak well diagram



Side view of a leach drain

Figure 1: Conventional domestic septic tank and effluent disposal systems

Alternative wastewater treatment and effluent disposal systems

Alternative systems that have received the approval of the Department of Health (WA) in addition to septic tank and subsoil effluent drainage systems include:

- Aerobic treatment units (ATUs) use the activated sludge process or fixed biological film filtration, followed by irrigation or subsoil disposal (Figure 2). For more detailed online information, see the Department of Health's information sheet *Aerobic treatment units* (reference 4b)
- Split treatment systems involve composting toilets (non-flush) and greywater management systems.
- Septic tanks with an alternative to leach drains, such as amended soil infiltration systems, reduce phosphate in discharged effluent.

For a list of currently approved systems, see the Department of Health (WA)'s website (reference 4).

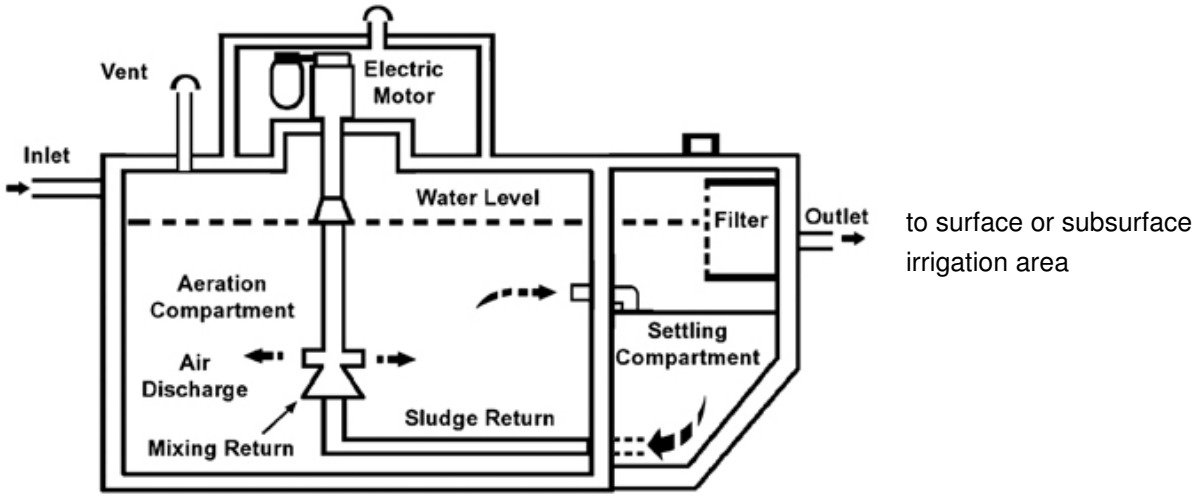


Figure 2: Diagram of typical aerobic treatment unit (without effluent disinfection)

Recommendations

Conventional wastewater treatment systems

These recommendations apply to septic tanks with soakwells or leach drains.

1 The soil characteristics at the disposal site should allow for effective soakage of treated wastewater in accordance with the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 and the *Australian/New Zealand Standard 1547:2012 On-site domestic wastewater management* (reference 11).

Information on soil permeability and suitability for liquid waste disposal for the Perth metropolitan region (Yanchep to Serpentine) is shown on the *Metropolitan environmental geology* map series produced in the 1980s by the Department of Mines' Geological survey, and on the Department of Agriculture and Food (WA) land resources mapping series (references 3 and 5).

Within proclaimed public drinking water source areas (PDWSAs)

The locations of PDWSAs, priority areas (priority 1 (P1), priority 2 (P2) and priority 3 (P3)), and wellhead or reservoir protection zones are shown:

- in Department of Water's drinking water source protection reports (<www.water.wa.gov.au>)
- in land use and water management strategies published by the Western Australian Planning Commission (<www.planning.wa.gov.au>)
- in the Department of Water's *Geographic data atlas* (<www.water.wa.gov.au>).

2 Tables 1 and 2 show the constraints that apply to the location of conventional domestic wastewater treatment systems in proclaimed PDWSAs. For more information on appropriate land uses in PDWSAs, see our Water quality protection note no. 25: *Land use compatibility tables for public drinking water source areas* (reference 6a).

Table 1: Buffers within PDWSAs for conventional wastewater treatment systems

Feature	Recommended minimum buffer [a]	Comments
Wellhead protection zone (WHPZ)	Outside the defined WHPZ; or 100 m minimum buffer to well (if no WHPZ defined).	WHPZ normally have a 500 m radius around wellheads in P1 areas and 300 m in P2 and P3 areas. A 100 m buffer from wellheads is a requirement of source protection by-laws.
Reservoir protection zone (RPZ)	Outside the defined RPZ; or 100 m minimum buffer to reservoir high water mark or feeder stream edge (if no RPZ defined).	RPZ are defined up to 2 km from the reservoir high water mark for state controlled land (upstream side of the dam wall only).
Wetlands and waterways (outside defined WHPZ or RPZ)	100 m [b] from the outer edge of damp land vegetation fringing the waterway or wetland.	Conventional systems for new developments will normally be opposed, especially within the buffer. Site soil conditions should be investigated and soil found to be suitable for limiting water contamination risk.
Groundwater table in sedimentary soils	2 m vertical clearance.	Measured from the base of facilities to the top of the highest known water table.

Foot notes for tables 1, 2, 3, 4 and 5:

a Unless otherwise specified in applicable environmental protection policies, state planning policies, approved local planning scheme or relevant statutory document.

b Measured from the wetland boundary or the outer edge of riparian vegetation around waterways and their estuaries or reservoirs. Where fringing vegetation no longer exists, measured from the high water mark of waterways and their estuaries or reservoirs.

c The extent of flooding is the area where floodwaters will rise to during a ten year average return interval flood event when calculated in accordance with the recommendations in *Australian rainfall and runoff* (reference 9).

3 The Department of Water may approve the use of alternative wastewater treatment and effluent disposal systems with reduced buffer distances where they are demonstrated to lower the pre-existing water contamination risk from conventional domestic wastewater treatment and effluent disposal systems.

Table 2: Land subdivision constraints within PDWSAs

Feature	Minimum lot size [a]	Comments
Within P1 areas	Subdivision is not supported. It is incompatible with source protection objectives, due to increased contamination risks.	
Within P2 areas	4 ha	Within rural zones
	2 ha	Within special rural/ rural residential zones
Within P3 areas	1 ha	
	Urban lot (less than 1 ha)	Connection to a reticulated sewerage scheme required
	Industrial and commercial	

Note: Only one on-site domestic wastewater treatment and effluent disposal system is accepted per lot.

Near natural waterways and wetlands (sensitive water resources)

4 Limitations should be applied to the location of wastewater treatment systems near sensitive water resources, as described in Table 3.

Table 3: Sensitive water resource buffers for wastewater treatment systems (outside proclaimed PDWSAs)

Feature	Recommended minimum buffer [a]	Comments
Waterways	100 m [b] Outside the flooded area resulting from a ten year average recurrence interval flood event [c]	If the ten year average recurrence interval flood event is not available, the wastewater disposal area buffer should be measured from the edge of the dampland vegetation or by default, the waterway channel. Setbacks less than 100 m may be considered on a case-by-case basis (i.e. in low risk situations such as a small subdivision (5 lots or under) in consultation with the Department of Water. A developer may be required to demonstrate that site factors (such as soil type, permeability, vegetation cover) and system design have been investigated and proven to have a low risk of contamination to waterways. Secondary treatment with nutrient removal may be required.
Wetlands	100 m [b] from edge of dampland vegetation	Buffer in accordance with Department of Parks and Wildlife and Environmental Protection Authority policies on the minimum buffer required for development near a wetland.

5. Subdivision near sensitive waters (outside proclaimed PDWSAs) should be in accordance with the *Government sewerage policy – Perth metropolitan region* (1996) and the *Draft country sewerage policy* (2003) (references 4d and 4f), or as amended.

Approved wastewater treatment and effluent disposal systems

A list of currently approved systems is provided on the Department of Health (WA) website (reference 4).

Aerobic treatment units (ATUs)

ATUs are electrically driven units that rely on aerobic microbes to degrade sewage in the presence of excess air. They consist of a series of treatment chambers, including an aeration chamber and a solids settling chamber (see Figure 2).

Treated sewage effluent is disposed of by irrigation (if adequately disinfected) or otherwise via an underground soakage system. These systems normally reduce

degradable organic matter, sediment, suspended solids and grease to concentrations significantly less than conventional septic tank treatment systems.

The removal of pathogens (e.g. bacteria and viruses that cause disease) by ATUs without disinfection is not well documented. Microbe removal (express as logarithmic reductions) can be highly variable. Reports suggest that pathogen values can be two orders of magnitude lower than in septic tank effluent. If the effluent is disposed of by above-ground spray irrigation, it must also be effectively disinfected (using chlorine or other Department of Health approved disinfection system).

Some ATUs are also approved by the Department of Health as phosphorous-reduction systems. These systems may achieve phosphorous removal by:

- Soakage through an approved, amended soil mix (that retains phosphorous on fine soil particles) in an effluent disposal area. The amended soil has a finite operational life before becoming saturated with phosphorous and will need replacing when phosphorous breakthrough occurs.
- Treatment system removal, where alkali dosing or microbial controls precipitate phosphorous and it settles out with biosolids for later removal.

For more information, see the Department of Health (WA) environmental health information sheet *Aerobic treatment units* and the *Code of practice for the design, manufacture, installation and operation of aerobic treatment units* (references 4a and 4c).

Septic tanks with amended soil effluent disposal systems

This type of system consists of two conventional septic tanks in series, followed by leach drains surrounded by a permeable amended soil blend that removes phosphorous. One approved soil amendment material is a by-product of alumina processing known as Alkaloam ™ (i.e. red mud and red sand). This type of system reduces concentrations of biochemical oxygen demand, suspended solids, micro-organisms and phosphorous in effluent.

Other approved domestic waste treatment systems

Some on-site sewerage systems are designed to separately treat toilet waste and greywater (wastewater from the shower, bath, laundry and kitchen). Composting toilets are commonly used to treat toilet waste without bowl flushing. For information about the requirements for composting toilets and greywater systems, contact the environmental health section of your local government.

6. For ATUs, composting toilets, greywater systems and septic tanks with amended soil in proclaimed PDWSAs and near other sensitive water resources:
    a The recommended minimum buffer distances and lot sizes in proclaimed PDWSAs are given in tables 1 and 2; and near waterways and wetlands are given in Table 3.
    b Lesser buffer distances may be occasionally accepted by this department if a developer demonstrates that site factors (such as soil type, permeability, vegetation cover) and system design have been investigated and proven to

have a lower risk of contamination to public water supply sources, waterways and wetlands.

c All greywater systems should be operated and maintained as recommended by the Department of Health (WA) and the equipment manufacturer (reference 4b).

7. Chemical toilets may be used at construction sites and occasional entertainment venues. All wastewater should be regularly removed for disposal at a government-approved waste disposal facility.

Operation and maintenance

8. All wastewater should undergo effective treatment before release to the environment. This involves operating the systems as recommended by the manufacturer (such as preventing disposal of inappropriate items in the toilet such as non-degradable materials and chemicals) and maintaining the systems to achieve optimum treatment performance.
9. Septic tanks and biosolids settling vessels should undergo regular pump-out by licensed waste contractors to remove accumulated sediment.
10. ATUs should undergo maintenance servicing by a provider approved by the Department of Health at minimum three-monthly intervals. For more information, see the Department of Health's Environmental health information sheets or the Department of Health's website (reference 4b).

Replacement of on-site systems with connection to reticulated sewerage

11. Where a reticulated sewerage scheme is provided to service subdivided or rezoned land, all dwellings should be connected as soon as practicable in accordance with national plumbing standards and by-laws. The on-site wastewater system should be decommissioned, pumped out, and removed from the site. All wastewater should be disposed of at a government-approved waste disposal facility.
12. Where approved, the landowner may connect outlets from bathrooms and laundries to a greywater system accepted by the Department of Health.

References and further readings

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 publication > *water* > *water quality* > *national water quality management strategy:*

   a Document 2 - *Policies and principles*, 1994
   b Document 3 - *Implementation guidelines*, 1998
   c Document 4 - *Australian and New Zealand guidelines for fresh and marine water quality*, 2000
   d Document 6 - *Australian drinking water guidelines*, 2011
   e Document 7 - *Australian guidelines for water quality monitoring and reporting*, 2000
   f Document 9 - *Rural land uses and water quality - a community resource*, 2000
   g Document 11 - Guidelines for sewerage systems - effluent management, 1997
   h Document 21 – *Australian guidelines for water recycling: Managing health and Environmental risks (phase1)*, 2006
   i Document 23 – *Australian guidelines for water recycling: Managing health and Environmental risks (phase2), Stormwater harvesting and reuse*, 2009.

2 Burns and Roe Worley Pty Ltd, *Evaluation of Alternative Wastewater Treatment Systems,* desktop study and report to the Water and Rivers Commission, 1999.

   Department of Agriculture and Food (WA) publication available online at <www.agric.wa.gov.au> Tools and support > Maps and data, search *land resources mapping* or *soil characteristics mapping,* Technical report 280 *Soil – landscape mapping in south western Australia*.

3 Department of Health (WA) publications available online at <www.public.health.wa.gov.au> select *water* > *wastewater management:*

   a Environmental health information sheet – *Understanding septic tank systems*
   b Environmental health information sheet – Aerobic treatment units, 2011
   c *Code of practice for reuse of grey water in Western Australia,* 2010
   d *Code of practice for the design, manufacture, installation and operation of aerobic treatment units,* 2001
   e Government sewerage policy – Perth metropolitan region, 1996
   f Country sewerage policy – draft for public comment, 2003
   g *Supplement to regulation 29 and schedule 9 – Wastewater system loading rates, November 2015.*

4 Department of Mines and Petroleum (Western Australia) publication available Information Centre for viewing or sale, phone 9222 3459, Gozzard, JR, *Geological Survey of Western Australia*, 1986, 1 map colour, 56 x 73 cm, Perth, Western Australia.

5 Department of Water (WA) publications available <www.water.wa.gov.au>:

a Water quality protection notes:
- WQPN no. 3 *Using water quality protection notes*
- WQPN no. 4 *Sensitive water resources*
- WQPN no. 8 *Further reading*
- WQPN no. 18 *Information the Department of Water requires to assess a proposed development or activity*
- WQPN no. 25 *Land use compatibility tables for public drinking water source areas*
- WQPN no. 41 *Private drinking water supplies*
- WQPN no. 48 *Water supplies for rural lots (non-potable use)*
- WQPN no. 51 *Industrial wastewater management and disposal*
- WQPN no. 54 *Rezoning and subdivision of land in public drinking water source areas*
- WQPN no. 89 *Remote indigenous community water supplies*

b *Water facts 1: Water words*, 1998.

c Operational policy 4.3: *Identifying and establishing waterways foreshore areas*.

6 Environmental Protection Agency (United States of America) publication available online at <www.epa.gov> search <*topic title*>, *Decentralized systems technology fact sheet – Aerobic treatment,* Office of Water Washington D.C. September 2000.

7 Environmental Protection Authority (Western Australia) publication available online at <www.epa.wa.gov.au> select *guidance statements* or *environmental protection policies:*

a Guidance statement no. 33 *Environmental guidance for planning and development*, June 2005
b Guidance statement no. 3 *Separation distances between industrial and sensitive land uses*, 2005.

9 Engineers Australia publication available for purchase at <www.engineersmedia.com.au> search *EA books, Australian rainfall and runoff* (current edition).

10 Gerritse, R. *Movement of Nutrients from Wastewater Systems in Soils*, Geoprocc Pty Ltd. July 2001.

11 Standards Australia publication available for purchase at <www.saiglobal.com> select *publications:*

a AS/NZS 1546.1:1998 *On-site domestic wastewater treatment units – septic tanks*
b AS/NZS 1547:2012 On-site *domestic wastewater management*
c AS/NZS 1546.3: 2001 *Onsite domestic wastewater treatment units – aerated wastewater treatment systems*
d AS/NZS 1546.2:2008 *Waterless composting toilets*
e AS 5667 *Water Quality – Sampling*
f Australian Technical Standard (ATS) 5200:460 *Technical specification for plumbing and drainage products – greywater.*

12 Western Australian Planning Commission publication available online at <www.planning.wa.gov.au> select *publications, Guideline for determination of wetland buffer requirements(draft),* Essential Environmental Services, 2005.

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