Government of **Western Australia**
Department of **Water**

Woodridge Water Reserve

Drinking water source protection review

Woodridge town water supply

Looking after all our water needs

Water resource protection series
Report WRP 121
May 2011

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Cover: Aerial photograph of Woodridge and surrounds, GIS image by Paul Gerard.

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Summary

This drinking water source protection review updates the *Woodridge Water Reserve water source protection plan* (Water and Rivers Commission, 1997). This review reports on implementation of the recommendations in the 1997 plan and puts forward new recommendations to address current water quality protection issues. This review should be read in conjunction with the 1997 plan. Both of these documents are available on our website (see inside cover for details).

Woodridge is a special-rural estate, located about 80 km north of Perth and 6 km east of Guilderton, in the Shire of Gingin. The estate is adjacent to approximately 600 ha of agricultural land used primarily for market gardening. Woodridge estate had a resident population of 565 people in 2006 (Australian Bureau of Statistics 2006).

Woodridge's drinking water was originally supplied from production bores 1/79, 1/83, 2/82 and 3/82, which drew water from the superficial aquifer. Unfortunately, a plume of contaminated water in this aquifer, originating from market gardens up-gradient of the estate, resulted in nitrate concentrations in the town water supply increasing steadily over the review period.

In August 2010 the Water Corporation commissioned production bore 1/06, with a new water treatment system, to address the increasing level of nitrate in the superficial aquifer. Woodridge's drinking water is now supplied solely by production bore 1/06, which draws water from the confined Leederville aquifer that is unaffected by the nitrate plume. The confined nature of this aquifer means that there is little risk from contamination that may occur at the surface. The water quality from Woodridge is good; water only requires treatment for the removal of naturally occurring iron, turbidity and colour, and disinfection.

The future use of the superficial aquifer for Woodridge's drinking water is undetermined. Drinking water may be temporarily supplied from the superficial aquifer by production bores 1/79 and 1/83 as a backup supply for production bore 1/06.

Only one recommendation from the 1997 plan remains outstanding, and that recommendation will be reflected in the recommendations for this review. This review recommends that the boundary of the Woodridge Water Reserve remains unchanged at this time to continue to help protect the superficial aquifer from water quality risks. Crown and freehold land managed by the Water Corporation will change from Priority 3 (P3) to Priority 1 (P1) to reflect the importance of these areas. This source will continue to provide Woodridge's drinking water needs into the foreseeable future.

Summary of key information

Woodridge Water Reserve	
Local government authority	Shire of Gingin
Locations supplied	Woodridge
Aquifer type	Confined (unconfined backup source)
Volume of water pumped	84 000 kL/year (2009-10) Licensed to take 130 000 kL/year from the Leederville aquifer
Number of bores	One confined aquifer bore (two unconfined aquifer backup bores)
Bore numbers and GPS coordinates	1/06 (365663 E, 6531795 N) 1/79 (365705 E, 6531873 N) backup bore 1/83 (366260 E, 6532030 N) backup bore
Date of bore completion	2006 for confined bore; backup bores 1979 and 1983
Date of DWSP reports	1997 *Woodridge Water Reserve water source protection plan* 2011 *Woodridge Water Reserve drinking water source protection review*
Proclamation status	Proclaimed in 1999 under the *Country Areas Water Supply Act 1947* (WA)

1 Review of the Woodridge drinking water source protection plan

1.1 Public drinking water source area boundary, priority areas and protection zones

The Woodridge Water Reserve was proclaimed in 1999 under the *Country Areas Water Supply Act 1947* (WA). This water reserve covers the immediate recharge area up-gradient of the superficial aquifer water supply bores, including areas of the Woodridge estate and market gardens east of the bores. A priority 3 (P3) area was designated over the entire water reserve in 1997, with 300 m wellhead protection zones (WHPZ) around the three production bores.

While Woodridge's drinking water is now supplied from the Leederville aquifer, two of the original production bores (1/79 and 1/83) may be used to supply drinking water from the superficial aquifer as a backup for production bore 1/06. The existing water reserve boundary has been retained to help protect the superficial aquifer from water quality contamination risks. The boundary of the Woodridge Water Reserve can be reviewed again after the Water Corporation finalises source planning for the Woodridge town water supply.

Figure 1 shows the revised Priority 1 (P1) areas and the WHPZs for production bores 1/79 and 1/83. The WHPZs extend 300 m around production bores 1/79 and 1/83 to protect the superficial aquifer from contamination risks in the vicinity of the bore. Bore 1/06 does not require a WHPZ because it draws water from the confined Leederville aquifer and is therefore not subject to surface-based water quality contamination risks. Land managed by the Water Corporation for public water supply will change from P3 to P1 to reflect the importance of these areas. This includes Lot 48 (privately held by the Water Corporation) and Crown Reserves 44023, 38326 and 44024 (vested in the Water Corporation).

The decisions about the priority areas and protection zones above are in accordance with current departmental policy.

If you require more information on the background to and support for the protection of public drinking water source areas (PDWSA), please refer to Water quality protection note (WQPN) no.36: *Protecting public drinking water source areas* and Appendix C.

1.2 Update on water supply scheme

1.2.1 Water supply system

Woodridge's drinking water is supplied from the Water Corporation wellfield within the Woodridge estate (Figure 1). The wellfield previously comprised three production bores (1/79, 2/82 and 1/83) that drew water from the superficial aquifer at depths between 43 and 73 m below ground level. In 2005, bore 2/82 began pumping sand

and was decommissioned. Monitoring bore 3/82 was refitted and subsequently operated as a production bore.

Production bore 1/06 was commissioned in August 2010 to draw water from the confined Leederville aquifer at depths greater than 200 m below ground level. Woodridge's drinking water is now supplied solely by production bore 1/06, with production bores 1/79 and 1/83 potentially acting as a back-up source. Production bore 3/82 has been decommissioned.

Woodridge is located in the Guilderton sub-area (superficial aquifer) and Sub-Area 3 (Leederville aquifer) of the Gingin Groundwater Area. The Water Corporation has a groundwater allocation licence to draw up to 130 000 kL of water from the Leederville aquifer for the town water supply.

1.2.2 Water treatment

A new water treatment system was commissioned in 2010 to reduce naturally occurring high levels of iron and colour in the water drawn from the Leederville aquifer. The raw water is initially chlorinated to oxidise iron and manganese. Alum and anionic polymer are used to coagulate and flocculate the iron and colour. Dynasand filtration (a continuous up-flow backwash system) removes the iron, colour, manganese and turbidity. The treated water is then chlorinated for disinfection before storage in a 1 000 kL ground-level tank. A splash-plate located at the inlet of the tank strips carbon dioxide from the water and increases the dissolved oxygen content. The treated water is then pumped into an elevated tank before being gravity fed into the town's reticulation.

1.2.3 Hydrogeology of the superficial and Leederville aquifers

Superficial aquifer

The wellfield is located on the northern edge of the unconfined superficial aquifer spanning from Gingin Brook to the Swan River, known as the Gnangara Mound. The superficial aquifer occurs in the shallow, very porous and permeable Tamala Limestone Formation. The shallow, permeable nature of the superficial aquifer makes it vulnerable to contamination from land uses and activities on the surface. The aquifer is recharged directly by rainfall over both the water reserve and the Gnangara Mound to the East. Groundwater flows in a westerly to north-westerly direction and discharges to the ocean.

Leederville aquifer

The Leederville aquifer is a major confined aquifer spanning the Perth region, consisting of a multilayer groundwater flow system. The aquifer is confined above by Kardinya Shale and below by South Perth Shale. The upper confining layer of shale separates the Leederville aquifer from the superficial aquifer above. This protects the Leederville aquifer from potential contamination that may occur at the surface.

At Woodridge, the Leederville aquifer is more than 200 m below ground level. The aquifer is recharged about 15 km east of Woodridge where the Leederville formation

subcrops beneath the superficial formations, forming a hydraulic connection with a downward hydraulic gradient (Davidson, 1995). Groundwater flows in a westerly direction and discharges to the ocean via the superficial formations.

1.3 Aboriginal sites of significance and Native title claims

Aboriginal sites of significance are those areas that Aboriginal people value as important and significant to their cultural heritage. These sites are significant because they link Aboriginal culture and tradition to place, land and people over time. These areas form an integral part of Aboriginal identity and the heritage of Western Australia. The *Aboriginal Heritage Act 1972* (WA) protects all Aboriginal sites in the state. The single Aboriginal site of significance within the Woodridge Water Reserve is the Gingin Brook Waggyl site.

Native title is the recognition in Australian law that some Aboriginal people continue to hold Native title rights to lands and water arising from their traditional laws and customs. There is one registered native title claim within the Woodridge Water Reserve. This is the Yued claim (WAD6192/98).

The Department of Water is committed to working with Aboriginal people in its planning and management activities. The department recognises that Native title provides an important framework for water management.

1.4 Update on water quality risks

As part of this review we have conducted a new assessment of water quality contamination risks to the Woodridge drinking water source, in accordance with the *Australian Drinking Water Guidelines* (ADWG) (NHMRC & NRMMC 2004). As Woodridge's drinking water is now drawn from a confined groundwater source, there is little potential for contamination from surrounding land uses. However, surface land uses in the recharge area for the superficial aquifer must also be assessed because production bores 1/79 and 1/83 may be used as backup bores to supply drinking water. Table 1 shows an assessment of the risks to water quality.

The Woodridge Water Reserve is located mainly over privately-owned rural land and the Woodridge rural-residential estate (Figure 2). Small areas of Crown reserve within the water reserve are managed for recreational purposes or public water supply. Current land uses and activities are outlined below.

1.4.1 Rural-residential estate

Rural-residential estate

The wellfield is located within the Woodridge estate (Figure 2). The density of residential lots within the estate remains unchanged since the 1997 drinking water source protection plan, with most of the lots generally covered by native vegetation. Approximately 1.5 ha of orchards exists on a rural-residential property less than 70 m

up-gradient of production bore 1/06 and backup bore 1/79. The orchard is within the WHPZ for bore 1/79.

Risks to water quality in the superficial aquifer include:

- pathogens and nutrients from septic tanks and domestic animals
- chemicals from household storage, use and disposal
- hydrocarbons from roads and fuel storage
- hydrocarbons and chemicals from vehicle use and maintenance
- nutrients from fertilisers and pesticides from gardens and the orchard.

Water-quality monitoring for the superficial aquifer (Appendix B) indicates that activities within the rural-residential estate have not impacted on groundwater quality in the vicinity of the town water supply bores.

Recreational areas

Several areas of Crown land within the estate are vested in the Shire of Gingin for recreational purposes. These recreation areas are covered by native vegetation and contain informal walk trails. No recreational facilities exist on these sites.

1.4.2 Rural land (market gardens)

Market gardening has expanded within the Woodridge Water Reserve since the 1997 plan. Market gardens covered over 350 ha in 2010 (Figure 2), compared to approximately 60 ha in 1997. Sun City Farms is the largest market garden in the area with approximately 300 ha under irrigation, mainly for carrot production. Carrot processing, packaging and storage facilities are also located on site. Sun City Farms has a total groundwater allocation of about 4.1 million kL for the market gardens; 2.6 million kL from the superficial aquifer and 1.5 million kL from the Leederville aquifer. Most of the available horticultural land within the water reserve is now developed and there is little scope for expansion.

Water quality risks to the superficial aquifer include:

- nutrient leachate from fertiliser use
- pesticides and chemicals from storage and use
- hydrocarbons and chemicals from vehicle and farm machinery maintenance and use
- hydrocarbons from fuel storage and refuelling
- chemicals and hydrocarbons from on-site disposal of agricultural machinery, containers and drums.

Nutrient leachate is the primary risk to groundwater quality due to the intensive nature of market gardening activities and the porous, sandy soils which have little capacity to hold nutrients. Water quality monitoring of the superficial aquifer, undertaken by the Water Corporation and Sun City Farms, indicates that the nitrate

plume has continued to move westwards under the Woodridge estate. The plume currently extends at least 500 m west of Wanneroo Road. Residential bores, irrigation bores and two of the original Water Corporation production bores (decommissioned bore 3/82 and backup bore 1/83) are now affected by the nitrate plume. The department has worked cooperatively with market gardeners in developing and implementing nutrient and irrigation management plans to monitor and improve water quality in the superficial aquifer. Sun City Farms now draws water from the superficial aquifer down-gradient of their farming activities to reuse nutrients that have leached into the groundwater and reduce nutrient or potential pesticide contamination of the aquifer.

A farm disposal area is located on Lot 66, adjacent to Croot Place. The area contains general bulk refuse, metals, machinery, drums and containers. Leachate from the refuse may contaminate the superficial aquifer with fuels, lubricants, pesticides or chemicals.

1.4.3 Drinking water treatment plant and production bore compounds

Drinking water treatment plant

The drinking water treatment plant is located on Crown land vested in the Water Corporation for the purpose of public water supply. Risks associated with the operation of the treatment plant and management of the site include chlorine spills or leaks and applications of pesticides for weed control in the vicinity of production bores.

Production bore compounds

The production bores are located near land uses and activities within the Woodridge estate. Potential sources of contamination exist within the WHPZ, many within 100 m of the bores. The Water Corporation inspects and maintains the seals and capping on production bores to prevent potential inflow of contaminated surface waters from nearby land uses.

The Water Corporation compound containing production bores 1/06 and 1/79, the water treatment plant and water storage tanks has been the subject of vandalism. The compound is fenced and locked, and staff conduct regular inspections of the water supply infrastructure. Security lighting and structures to prevent unauthorised access to the elevated tank are currently being installed to deter vandalism.

Vandalism of water supply infrastructure poses risks to water quality in the town water supply from:

- foreign objects or contaminants being thrown or inserted into water storage tanks or pipes
- damage to the water treatment plant
- potential pathogen contamination from human contact with the water supply
- damage to bore capping and sealing, water supply pipes or water tanks, creating potential pathways for contaminants to enter the water supply system.

1.4.4 Proposed land uses and activities

An *additional use* site in the Shire of Gingin's *Town Planning Scheme* No. 8 (Department of Planning 1991) provides for a proposed service station on Lot 52 Croot Place. Service stations and associated activities may pose contamination risks to the superficial aquifer through:

- leakage or spillage of fuels and chemicals
- wastewater disposal from vehicle washdowns
- inappropriate containment or disposal of wastes from vehicle servicing and maintenance
- pathogens and nutrients from toilet facilities
- heavily loaded wastewaters from food premises
- contaminated wastewater from car parks.

No new land uses or activities are anticipated within the Woodridge Water Reserve. The existing rural and rural-residential areas are not proposed to be rezoned for higher intensity developments.

1.4.5 Bores for residential, agricultural or other water supplies

Private bores drilled near a public drinking water supply bore can cause contamination of the drinking water source. For example, a poorly constructed bore may introduce contaminants from surface leakage down the outside of the bore casing directly into an aquifer.

Poorly constructed bores in confined aquifers may create a connection between the confined and superficial aquifer across the protective confining layer. Contaminants in the superficial aquifer, such as nitrates, may then be introduced into the confined aquifer along this potential pathway.

It is therefore important to ensure that any new bores are appropriately located and constructed to prevent contamination of this public drinking water source. This will be assessed through the Department of Water's water licensing process (where applicable) under the *Rights in Water and Irrigation Act 1914* (WA). All bores should be constructed in accordance with *Minimum construction requirements for water bores in Australia* (National Minimum Bore Specifications Committee 2003).

Table 1 Land use and potential water quality risks

Land use /activity	Hazard	Management priority	Comments	Best management practice guidance
Drinking water treatment plant and bore compounds (Leederville and superficial aquifer)				
Drinking water treatment plant and bore compounds	• chemicals from storage and use • pesticides from weed/pest control • contaminants from surface flows entering the bores and/or aquifer due to damaged bore capping or sealing • vandalism.	Low	There are fenced, locked compounds around each bore and the treatment system. The treatment system is fully enclosed with automated alarms for system faults.	Water Corporation operating procedures Public sector circular no. 88: *Use of herbicides in water catchment areas* Regular inspection and maintenance of bore capping, seals and water supply infrastructure.
Private bores (Leederville and superficial aquifer)				
Private bores	• potentially pathogens, nutrients, hydrocarbons and chemicals.	Medium	New bores require a licence from the Department of Water for anything other than domestic use.	*Minimum construction requirements for water bores in Australia* (National Minimum Bore Specifications Committee, 2003).
Rural-residential estate (superficial aquifer only)				
Private properties, recreation areas and shire facilities	• pathogens and nutrients from septic tanks and domestic animals • nutrients from fertilisers • pesticides and chemicals from storage, use and disposal • hydrocarbons from roads, fuel storage and vehicle use and maintenance.	Low*	Rural-residential developments are *compatible with conditions* in P3 areas. Wanneroo Road traverses the water reserve. No water quality issues have arisen from the estate to date.	Water quality protection note (WQPN) no. 70: *Wastewater treatment and disposal: domestic systems* Various Department of Water pamphlets.

Land use /activity	Hazard	Management priority	Comments	Best management practice guidance
Horticulture – market gardening (superficial aquifer only)				
Market gardening	• nutrients from fertilisers • pesticides and chemicals from storage and use.	Low*	Sun City Farms manage and monitor nutrient applications.	WQPN no. 33: *Nutrient and irrigation management plans* Statewide policy no. 2: *Pesticide use in public drinking water source areas*.
Vehicles and farm machinery	• hydrocarbons and chemicals from vehicle maintenance and use.	Low*		WQPN no. 28: *Mechanical servicing and workshops* WQPN no. 68: *Mechanical equipment washdown*.
Farm disposal area	• potential pesticides, chemicals or hydrocarbons.	Low*	Only authorised Class I landfills for inert waste and clean fill are *compatible with conditions* in P3 areas.	WQPN no. 24: *Landfilling with inert materials* WQPN no. 111: *Landfills for disposal of putrescible materials*.

Low* - If the superficial aquifer bores are confirmed by the Water Corporation as ongoing backup bores into the future, the management priority of these land uses and activities will be reviewed.

1.5 Water quality information

The Water Corporation has provided updated water quality information for the Woodridge wellfield between February 2006 and March 2011. This is shown in Appendix B.

Superficial aquifer

The raw water supplied from the Woodridge wellfield during the review period exceeded the ADWG aesthetic guidelines for total filterable solids by summation (TFSS), colour, hardness and iron. A new water treatment plant was installed in 2009 to provide treatment for iron, manganese, colour and turbidity.

Nitrate levels in the town water supply have steadily increased during the review period. By managing the abstraction of water from affected bores, the nitrate

concentration in the town water supply has not exceeded the ADWG health guidelines to date. Drinking water supplied from the backup bores will need to be managed to ensure nitrate levels in the town water supply remain below the ADWG health guideline value.

Production bore 1/79 was taken offline in 2003 due to trace level detections of naturally occurring arsenic. The arsenic detections were managed by installing a smaller pump, reducing abstraction levels and monitoring water quality. Production bore 1/79 was back online in 2004.

Leederville aquifer

The raw water drawn from the Leederville aquifer exceeds the ADWG aesthetic guidelines for colour, TFSS and iron. The high colour and iron levels are typical characteristics of the Leederville aquifer. The new water treatment plant provides treatment for colour, iron and TFSS levels.

2 Implementation of Woodridge's drinking water source protection plan

2.1 Status of previous recommendations

Table 2 Status of recommendations from the 1997 Woodridge Water Reserve water source protection plan

No.	1997 plan recommendation	Status	Comments
1	Gazettal of water reserve.	Completed	Gazetted in 1999 under the *Country Areas Water Supply Act 1947* (WA).
2	Incorporation into land planning strategies.	Incomplete	The water reserve is not incorporated in the Shire of Gingin's local planning scheme.
3	Referral of development proposals: • Department of Water (formerly Water and Rivers Commission) to provide the Shire of Gingin with guidelines for referral of development proposals • referral of development proposals.	Completed	Guidelines have been provided through the water quality protection note series. Development proposals within the water reserve are referred to our Swan Avon Region office. This recommendation will be carried forward into the next review period.
4	Erection of signs: • development of guidelines for signage • determine number and location of signs required • erect signs.	Completed	Water Corporation signs are displayed on each bore compound. Water Corporation have provided guidelines for signage and the signs were ordered as part of a joint project between Water Corporation and Department of Water.The signs are currently being erected.
5	Emergency response: • develop response plan • inform WAHMEMS personnel of special requirements for the Woodridge Water Reserve.	Completed	Emergency response protocols have now changed to the jurisdiction of the local emergency management committee, managed by the Shire of Gingin.

No.	1997 plan recommendation	Status	Comments
6	Surveillance program: • develop guidelines for the surveillance of water reserves • implement the surveillance program.	Completed	The Water Corporation undertakes surveillance of water supply infrastructure and land uses within the water reserve. Water Corporation has a corporate standard and *Source protection operations manual* (Water Corporation 2006) to guide catchment management.
7	Monitoring program: • monitor production wells six monthly for nutrients in addition to the standard program • incorporate monitoring requirements as conditions on groundwater well licence.	Completed	Water Corporation's water quality monitoring program includes nutrient monitoring in Woodridge. Fulfilment of monitoring requirements was achieved without licence conditions.
8	Review of the plan and recommendations.	Completed	The 1997 recommendations were reviewed in this 2011 drinking water source protection review, following significant changes to the drinking water supply system. This recommendation will be carried forward into the next review period.

2.2 Consolidated recommendations

Based on the findings of this review the following recommendations will now be applied to the Woodridge Water Reserve. The bracketed stakeholders are those expected to have a responsibility for, or an interest in the relevant recommendation being implemented.

1 Develop an implementation strategy for this plan's recommendations showing responsible stakeholders and planned timeframes. (Department of Water with applicable stakeholders)

2 Incorporate this plan and reflect the Woodridge Water Reserve boundary and priority areas in the Shire of Gingin's local planning scheme in accordance with the Western Australian Planning Commission's Statement of planning policy no. 2.7: *Public drinking water source policy*. (Shire of Gingin)

3 Development proposals within the Woodridge Water Reserve that are inconsistent with our WQPN no.25: *Land use compatibility in public drinking water source areas* or recommendations in this plan should be referred to us for advice and recommendations. (Department of Planning, Shire of Gingin, proponents of proposals)

4 Incidents covered by Western Australian plan for hazardous materials (WESTPLAN–HAZMAT) in the Woodridge Water Reserve should be addressed by ensuring that:

- the Shire of Gingin's local emergency management committee is aware of the location and purpose of the Woodridge Water Reserve
- the locality plan for the Woodridge Water Reserve is provided to the Fire and Emergency Services Authority headquarters for the HAZMAT emergency advisory team
- the Water Corporation acts in an advisory role during incidents in the Woodridge Water Reserve
- personnel dealing with WESTPLAN–HAZMAT incidents in the area have ready access to a locality map of the Woodridge Water Reserve and information to help them recognise the potential impacts of spills on drinking water quality. (Water Corporation)

5 Delegate by-law enforcement and surveillance to the Water Corporation. (Department of Water)

6 Review the boundary of the Woodridge Water Reserve after the bore requirements for the Woodridge Water Reserve are finalised. If necessary, amend the water reserve boundary under the *Country Areas Water Supply Act 1947* (WA). (Department of Water, Water Corporation)

7 Erect signage for the Woodridge Water Reserve following the review of the boundary in Recommendation 6. (Water Corporation)

8 Investigate the potential for groundwater contamination from the farm disposal area on Lot 66 Croot Place. Carry out any remediation works necessary to

prevent contamination of the drinking water resource. (Department of Water, Department of Environment and Conservation)

9 Review this plan after five years. (Department of Water)

Appendices

Appendix A — Figures

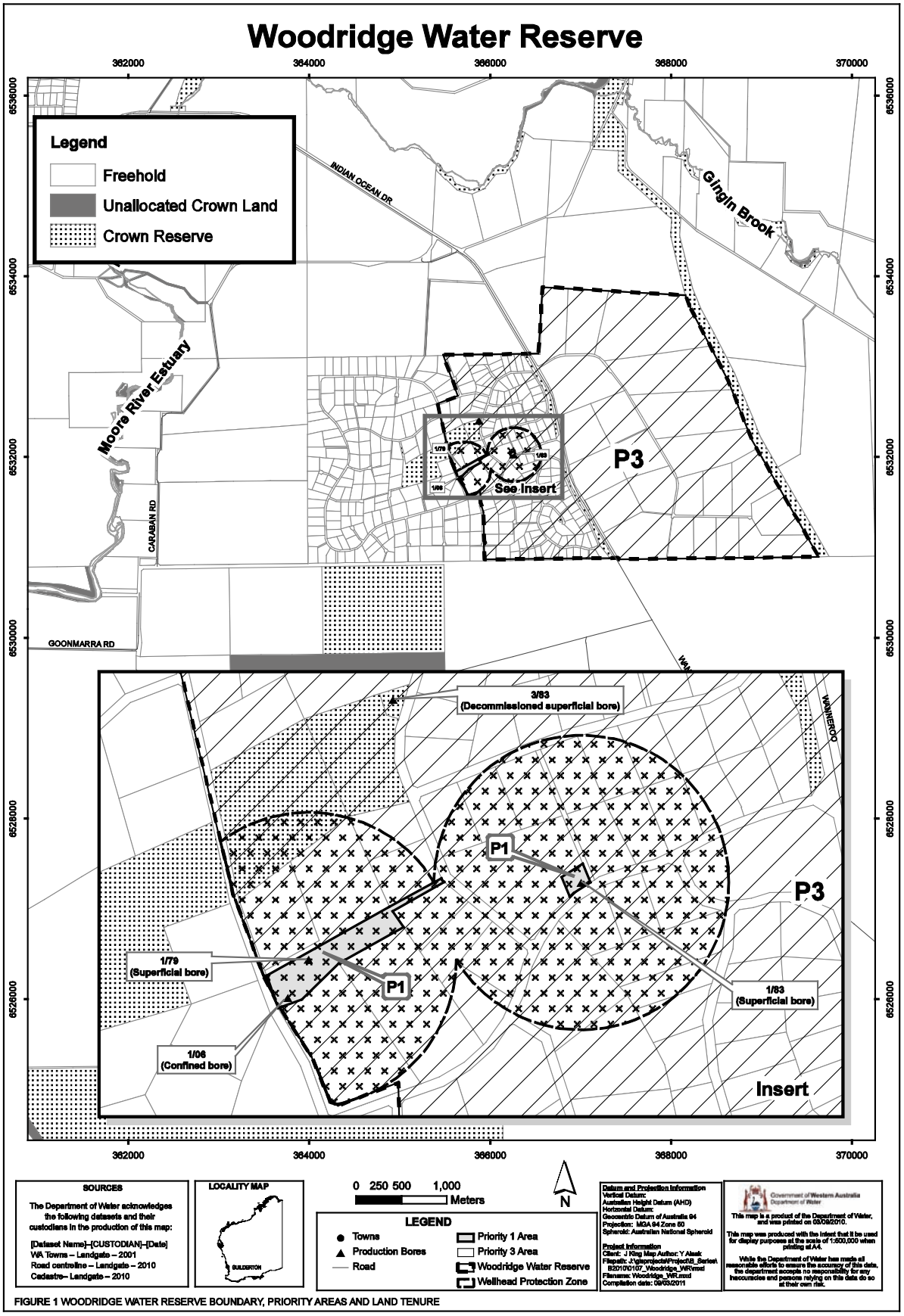

FIGURE 1 WOODRIDGE WATER RESERVE BOUNDARY, PRIORITY AREAS AND LAND TENURE

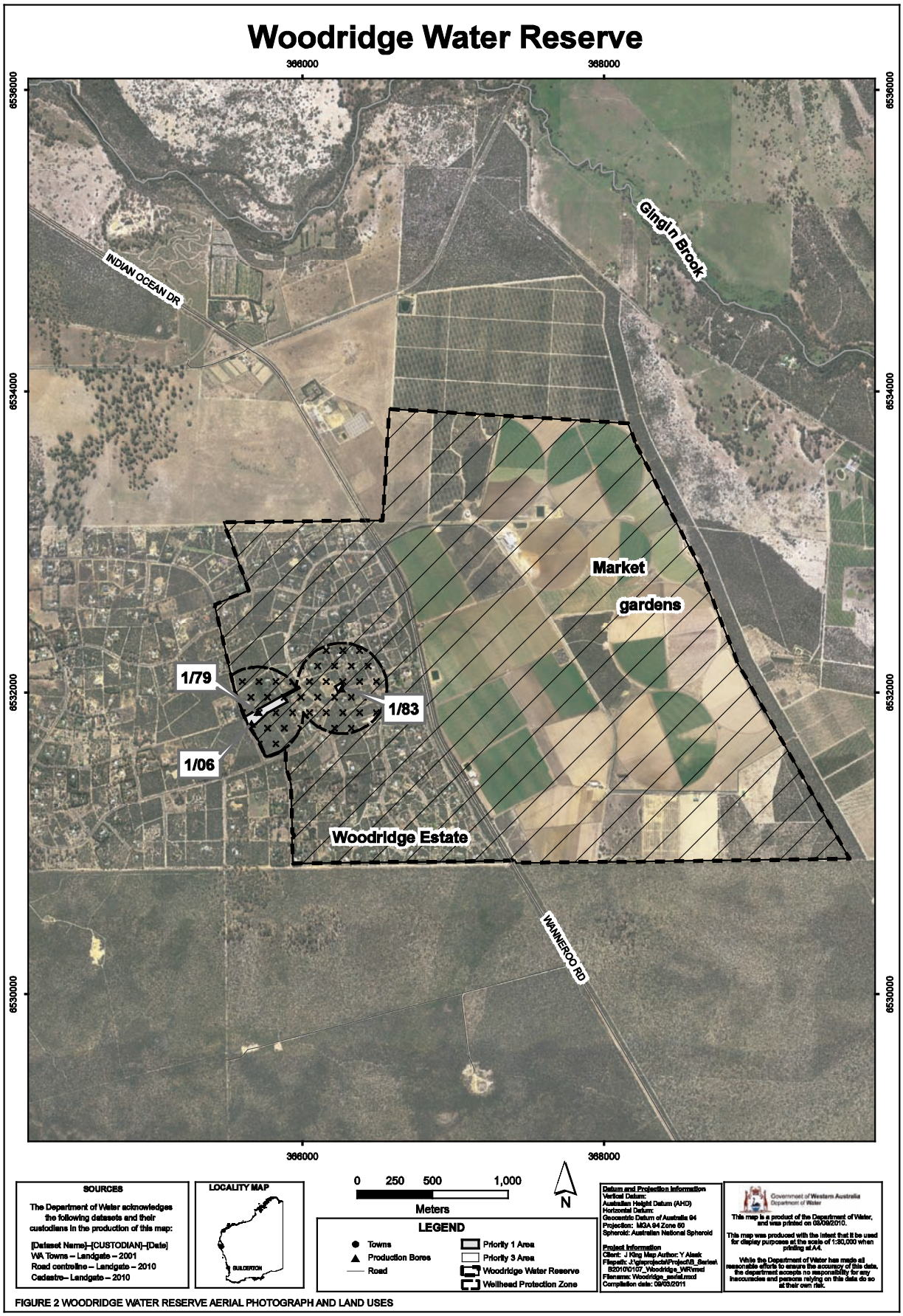

FIGURE 2 WOODRIDGE WATER RESERVE AERIAL PHOTOGRAPH AND LAND USES

Appendix B — Water quality data

The Water Corporation has monitored the raw (source) water quality from the Woodridge bore field in accordance with the *Australian drinking water guidelines* (ADWG) and interpretations agreed to with the Department of Health. The raw water is regularly monitored for:

a. **Aesthetic-related characteristics** (non-health related)

b. **Health-related characteristics**

- Health-related chemicals
- microbiological contaminants

Following is data representative of the quality of raw water from the Woodridge bore field. In the absence of specific guidelines for raw water quality, the results have been compared with the ADWG values set for drinking water, which defines the quality requirements at the customers tap. Results that exceed the ADWG have been shaded to give an indication of potential raw water quality issues associated with this source.

It is important to appreciate that the raw water data presented does not represent the quality of drinking water distributed to the public. Barriers such as storage and water treatment, to name a few, exist downstream of the raw water to ensure it meets the requirements of the ADWG. For more information on the quality of drinking water supplied to Woodridge refer to the most recent Water Corporation *Drinking water quality annual report* at www.watercorporation.com.au/W/waterquality_annualreport.cfm

Aesthetic Related Characteristics

Aesthetic water quality analyses for raw water from the Woodridge bore field are summarised in Tables 1 and 2.

The values are taken from ongoing monitoring for the five year period from February 2006 to March 2011. Any water quality parameters that have been detected are reported, those that have on occasion exceeded the ADWG are shaded.

A water treatment facility was installed in 2009 to provide treatment for iron, manganese, colour and turbidity. Furthermore, a new confined Leederville aquifer bore was commissioned in October 2010 as the sole production bore for the Woodridge community.

Table 1 Aesthetic-related detections for Woodridge bore field – superficial bores

Parameter	Units	ADWG aesthetic guideline value*	Woodridge bore field raw water sample point	
			Range	Median
Chloride	mg/L	250	110 - 115	120
Colour – true	TCU	15	<1 - 15	<1
Hardness as CaCO3	mg/L	200	229 - 251	230
Iron unfiltered	mg/L	0.3	<0.003 – 0.5	0.006
Sodium	mg/L	180	56 - 64	59
Total filterable solids by summation	mg/L	500	499 - 531	509.5
Turbidity	NTU	5	<0.1 – 1.6	<0.1
pH measured in laboratory	No Unit	6.5 – 8.5	7.01 – 7.82	7.59

* An aesthetic guideline value is the concentration or measure of a water quality characteristic that is associated with good quality water.

Table 2 Aesthetic-related detections for Woodridge bore field – confined bore

Parameter	Units	ADWG aesthetic guideline value*	Woodridge bore field raw water sample point	
			Range	Median
Chloride	mg/L	250	190**	190**
Colour – true	TCU	15	15-20	16
Hardness as CaCO3	mg/L	200	45**	45**
Iron unfiltered	mg/L	0.3	0.58 – 1	0.81
Sodium	mg/L	180	140**	140**
Total filterable solids by summation	mg/L	500	493**	493**
Turbidity	NTU	5	0.4 – 1.1	0.85
pH measured in laboratory	No Unit	6.5 – 8.5	6.86 – 7.29	6.94

* An aesthetic guideline value is the concentration or measure of a water quality characteristic that is associated with good quality water.

** Results based on one sampling occasion only

Health-related characteristics

Health-related chemicals

Raw water from Woodridge bore field is analysed for health-related chemicals including inorganics, heavy metals, industrial hydrocarbons and pesticides. Health-related water quality parameters that have been measured at detectable levels in the source between February 2006 and March 2011 are summarised in Tables 3 and 4. Any parameters that have on occasion exceeded the ADWG are shaded.

Table 3 Health-related detections for Woodridge bore field – superficial bores

Parameter	Units	ADWG health guideline value*	Woodridge bore field raw water sample point	
			Range	Median
Nitrate as nitrogen	mg/L	11.29†	1.5 – 14.4	8.85
Nitrite as nitrogen	mg/L	0.91	<0.002 – 0.009	<0.002
Nitrite plus Nitrate as N	mg/L	11.29†	6.6 – 14.4	9.3
Manganese unfiltered	mg/L	0.5	<0.002 – 0.016	<0.002
Sulphate	mg/L	500	9 - 11	9.5
Arsenic	mg/L	0.007	<0.002 – 0.006	<0.002
Barium	mg/L	0.7	0.045 – 0.055	0.05
Boron	mg/L	4	<0.02 – 0.06	0.02
Iodide	mg/L	0.1	<0.02 – 0.03	<0.02

* A health guideline value is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption (NHRMC & ARMCANZ, 1996).

† The guideline value of 11.29 mg/L (as nitrogen) has been set to protect bottle fed infants under three months of age. Up to 22.58 mg/L (as nitrogen) can be safely consumed by adults and children over three months of age.

Table 4 Health-related detections for Woodridge bore field – confined bore

Parameter	Units	ADWG health guideline value*	Woodridge bore field raw water sample point	
			Range	Median
Manganese unfiltered	mg/L	0.5	0.018 – 0.03	<0.022
Sulphate	mg/L	500	24**	24**
Barium	mg/L	0.7	0.045**	0.045**
Boron	mg/L	4	0.07**	0.07**
Iodide	mg/L	0.1	0.04**	0.04**

* A health guideline value is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption (NHRMC & ARMCANZ, 1996).

** Results based on one sampling occasion only.

Approximately 25 per cent of raw water samples from the unconfined bores exceeded the infant health guideline value for nitrate; however water supplied to customers did not exceed the guideline value. A bore field operating strategy existed to prevent elevated arsenic or nitrate water entering the system. This included blending water from individual bores in the large storage tank, altering pump outputs and adjusting pumping times. Elevated levels of arsenic or nitrate have not been experienced since the commissioning of the new confined Leederville aquifer production bore.

Microbiological contaminants

Microbiological testing of raw water samples from Woodridge bore field is currently conducted on a monthly basis. *Escherichia coli* counts are used as an indicator of the degree of recent faecal contamination of the raw water.

A detection of *Escherichia coli* in raw water abstracted from any bore may indicate contamination of faecal material through ingress in the bore, or recharge through to the aquifer (depending on aquifer type).

During the review period of February 2006 to March 2011, a positive *Escherichia coli* counts was recorded in 1 sample at low count, indicating the source did not have microbiological contamination issues.

The new confined Leederville aquifer bore commissioned in October 2010 as the production bore for Woodridge offers even greater protection from microbiological contamination risk.

Appendix C — How do we protect public drinking water source areas?

The *Australian drinking water guidelines* (ADWG) (NHMRC & NRMMC 2004) outlines how we should protect drinking water in Australia. The ADWG recommends a 'catchment to consumer' framework that uses a preventive risk-based and multiple-barrier approach. A similar approach is recommended by the World Health Organization.

The 'catchment to consumer' framework applies across the entire drinking water supply system – from the water source to your tap. It ensures a holistic assessment of water quality risks and solutions to ensure the delivery of a reliable and safe drinking water to your home.

A preventive risk-based approach means that we look at all the different risks to water quality, in order to determine what risks can reasonably be avoided and what risks need to be minimised or managed. This approach means that the inherent risks to water quality are as low as possible. A multiple-barrier approach means that we use different barriers against contamination at different stages of a drinking water supply system.

The first and most important barrier is protecting the catchment. If we get this barrier right, it has a flow-on affect that can result in a lower cost, safer drinking water supply. Other barriers against contamination include storage of water to help reduce contaminant levels, treating the water (e.g. chlorination to destroy pathogens), maintenance of pipes and testing of water quality. Another community benefit of catchment protection is its complementary nature to conservation initiatives.

Research and experience shows that a combination of catchment protection and water treatment is safer than relying on either barrier on its own. That's why this drinking water source protection plan is important. We should not forget that ultimately it's about protecting your health, and about protecting the catchment's water quality now and for the future.

In Western Australia, the Department of Water protects public drinking water source areas (PDWSAs) by putting the ADWG into practice, writing plans, policies and guidelines, and providing input into land-use planning.

The *Metropolitan Water Supply Sewerage and Drainage Act 1909* (WA) and the *Country Areas Water Supply Act 1947* (WA) provide us with important tools to protect water quality in proclaimed PDWSAs. These Acts allow us to assess and manage the water quality contamination risks from different land uses and activities. We work cooperatively with other agencies in the implementation of this legislation.

An important step in maximising the protection of water quality in PDWSAs is to define priority areas and protection zones to help guide land use planning and to identify where legislation applies. There are three different priority areas. Priority 1 (P1) areas are defined and managed to ensure there is no degradation of the quality of the drinking water source using the principle of risk avoidance. Priority 2 (P2)

areas are defined and managed to maintain or improve the quality of the drinking water source using the principle of risk minimisation. Priority 3 (P3) areas are defined and managed to maintain the quality of the drinking water source for as long as possible using the principle of risk management. Protection zones surround drinking water extraction points, so that the most vulnerable areas may be protected from contamination.

If you would like more information about the ADWG and how we protect drinking water in Western Australia, go to <http://drinkingwater.wa.gov.au.>

List of shortened forms

ADWG	*Australian drinking water guidelines*
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
DWSPP	drinking water source protection plan
HAZMAT	hazardous materials
kL	kilolitre
km	kilometre
m	metres
mg/L	milligram per litre
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NTU	nephelometric turbidity units
PDWSA	public drinking water source area
P1	priority 1 area
P3	priority 3 area
TCU	true colour units
WAHMEMS	Western Australian Hazardous Materials Emergency Management Scheme
WAPC	Western Australian Planning Commission
WESTPLAN–HAZMAT	Western Australian plan for hazardous materials
WQPN	water quality protection note

Glossary

Abstraction	The pumping of groundwater from an aquifer, or the removal of water from a waterway or water body.
Aesthetic guideline value	The concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, e.g. appearance, taste and odour (NHMRC & NRMMC 2004).
Allocation	The quantity of water that a licensee is permitted to abstract is their allocation, usually specified in kilolitres per annum (kL/a).
Aquifer	An aquifer is a geological formation or group of formations able to receive, store and transmit significant quantities of water.
Australian drinking water guidelines	The *National water quality management strategy: Australian drinking water guidelines 6, 2004* (NHMRC & NRMMC 2004) (ADWG) outlines acceptable criteria for the quality of drinking water in Australia (see this plan's Bibliography).
Bore	A bore is a narrow, lined hole drilled into the ground to monitor or draw groundwater (also called a well).
Bore field	A group of bores to monitor or withdraw groundwater is referred to as a bore field (also see *wellfield*).
Catchment	The physical area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Confined aquifer	An aquifer that is confined between non-porous rock formations (such as shale and siltstone) and therefore contains water under pressure.
Health guideline value	The concentration or measure of a water quality characteristic that, based on current knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption (NHMRC & NRMMC 2004).
Hectare	A measurement of area, equivalent to 10 000 square metres.
Hydrocarbons	A class of compounds containing only hydrogen and carbon, such as methane, ethylene, acetylene and benzene. Fossil fuels such as oil, petroleum and natural gas all contain hydrocarbons.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.

Leaching/ leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater. The material washed out is known as leachate. Leachate can pollute groundwater and waterways.
mg/L	A milligram per litre (0.001 grams per litre) is a measurement of a total dissolved solid in a solution.
Nephelometric turbidity units	Nephelometric turbidity units are a measure of turbidity in water.
Nutrients	Minerals, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorous (phosphate) dissolved in water which provide nutrition (food) for plant growth.
Pathogen	A disease-producing organism that can cause sickness and sometimes death through the consumption of water, including bacteria (such as *Escherichia coli*), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
pH	A logarithmic scale for expressing the acidity or alkalinity of a solution. A pH below seven indicates an acidic solution and above seven indicates an alkaline solution.
Pollution	Water pollution occurs when waste products or other substances (effluent, litter, refuse, sewage or contaminated runoff) change the physical, chemical or biological properties of the water, adversely affecting water quality, living species and beneficial uses.
Public drinking water source area	Includes all underground water pollution control areas, catchment areas and water reserves constituted under the *Metropolitan Water Supply Sewerage and Drainage Act 1909* (WA) and the *Country Areas Water Supply Act 1947* (WA).
Public sector circular number 88	A state government circular produced by the Department of Health providing guidance on appropriate herbicide use within water catchment areas.
Recharge	Recharge is the action of water infiltrating through the soil/ground to replenish an aquifer.

Recharge area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
Scheme supply	Water diverted from a source or sources by a water authority or private company and supplied via a distribution network to customers for urban and industrial use or for irrigation.
Stormwater	Rainwater that has run off the ground surface, roads, paved areas etc., and is usually carried away by drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes, including drinking and discharge to the environment.
True colour units	True colour units are a measure of degree of colour in water.
Turbidity	The cloudiness or haziness of water caused by the presence of fine suspended matter.
Unconfined aquifer	An aquifer in which the upper surface of water is lower than the top of the aquifer itself. The upper surface of the groundwater within the aquifer is called the watertable.
Wastewater	Water that has been used for some purpose and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water quality	Water quality is the collective term for the physical, aesthetic, chemical and biological properties of water.
Water reserve	A water reserve is an area proclaimed under the *Country Areas Water Supply Act 1947* (WA) or the *Metropolitan Water Supply Sewerage and Drainage Act 1909* (WA) for the purposes of protecting a drinking water supply.
Watertable	The upper saturated level of the unconfined groundwater is referred to as the watertable.
Wellfield	A wellfield is a group of bores located in the same area used to monitor or withdraw groundwater.

Wellhead	The top of a well (or bore) used to draw groundwater is referred to as a wellhead.
Wellhead protection zone	A wellhead protection zone (WHPZ) is usually declared around wellheads in public drinking water source areas to protect the groundwater from immediate contamination threats in the nearby area.

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