



Government of Western Australia  
Department of Water

# Hopetoun Water Reserve

Drinking water source protection review

*Hopetoun town water supply*



*Securing Western Australia's water future*

Water resource protection series  
Report WRP 157  
April 2016





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ISSN 1835-3924 (online)

ISBN 978-1-922248-90-9 (online)

### **Acknowledgements**

The Department of Water would like to thank the following for their contribution to this publication: Christa Loos, Nicolie Sykora, Rachel Duffield, Andrew Maughan, Chris Qiu, Murray Gangell, Stephen Watson and Nigel Mantle (Department of Water), Hew Merrett, Michelle Vojtisek, and Katrina Burton (Water Corporation).

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## Summary

Hopetoun's drinking water comes from 10 groundwater bores, spread across three different wellfields (Appendix A, Figure A1):

- Springdale wellfield (east of the Jerdacuttup River)
- West Springdale wellfield (west of the Jerdacuttup River)
- Town wellfield.

These wellfields are proclaimed collectively as the Hopetoun Water Reserve under the *Country Areas Water Supply Act 1947*.

In 2009, the Department of Water published the *Hopetoun water reserves drinking water source protection plan*, which considered all three wellfields. This drinking water source protection review considers changes that have occurred in the Hopetoun Water Reserve since the 2009 plan. These changes are mainly evident in the Springdale wellfield. The 2009 plan and this 2015 review need to be considered jointly and are available on the Department of Water's website or by contacting us.

The Springdale wellfield is located about 15 km north-east of Hopetoun on land east of the Jerdacuttup River, and was commissioned in 1990. Increased land development associated with the Ravensthorpe Nickel project led to the upgrade of the Springdale wellfield and commissioning of the West Springdale wellfield in 2008.

Springdale wellfields' bores draw water from a mainly unconfined aquifer that is considered vulnerable to contamination from surface land uses. These bores are managed by the Water Corporation, under licence from the Department of Water.

The Department of Water has prepared this document in consultation with the Water Corporation, the Department of Health, the South Coast Natural Resource Management group and the Shire of Ravensthorpe.

The main change since the 2009 plan is that land containing four of the Springdale wellfield bores (9/88, 10/88, 14/88 and 15/88) has been purchased by the Water Corporation. This land was previously under private ownership and used for cattle grazing, which has been an ongoing concern due to pathogen contamination risks. The Water Corporation has agreed to improve the protection around the production bores. This review recommends changing the priority area of the land that surrounds the production bores and wellhead protection zones from priority 2 (P2; risk minimisation) to priority 1 (P1; risk avoidance). This recommendation is supported by the Water Corporation.

This review is consistent with the *Australian drinking water guidelines* (ADWG; NHMRC & NRMCC 2011) and State planning policy no. 2.7: *Public drinking water source policy* (Western Australian Planning Commission 2003).

The following table shows important information about the Hopetoun Water Reserve:

<b>Key information about the Hopetoun Water Reserve</b>	
Status of this report	This report has been prepared based on information for the 2014/15 financial year
Local government authority	Shire of Ravensthorpe
Location supplied	Hopetoun
Water service provider	Water Corporation
Aquifer	Bremer East – sedimentary aquifer (unconfined and semi-confined)
Licensed abstraction	225 000 kL/year from the Springdale wellfields: <ul style="list-style-type: none"> <li>• West Springdale wellfield – 75 000 kL/year</li> <li>• Springdale wellfield – 150 000 kL/year</li> </ul> (An additional 70 000 kL/year of water is sourced from the Town wellfield)
Number of existing bores	5 bores in the Springdale and West Springdale wellfields 5 bores in the Town wellfield
Bore names and GPS coordinates	Springdale wellfield (zone 51): <ul style="list-style-type: none"> <li>• 9/88 (E 245 970.62, N6 246 934.50)</li> <li>• 10/88 (E 246 446.41, N6 246 948.44)</li> <li>• 14/88 (E 246 932.24, N6 247 025.53)</li> <li>• 15/88 (future production bore)</li> </ul> West Springdale wellfield (zone 51): <ul style="list-style-type: none"> <li>• 17/05 (E 241 842.47, N6 247 593.50)</li> <li>• 18/05 (E 241 714.51, N6 247 177.52)</li> <li>• Bore H (future production bore)</li> </ul> Town wellfield (21/01, 1/05, 2/05, 3/05, and 4/05) – the details are provided in the 2009 plan.
Date of bore completion	The Springdale wellfield was commissioned in 1990, and upgraded in 2008.  The West Springdale wellfield was commissioned in 2008 (at the same time as the Springdale wellfield upgrade).
Dates of drinking water	1995 – <i>Hopetoun Water Reserve water source protection</i>

<b>Key information about the Hopetoun Water Reserve</b>	
source protection reports	<p><i>plan</i></p> <p>2004 – <i>Hopetoun Water Reserve drinking water source protection assessment</i></p> <p>2009 – <i>Hopetoun water reserves drinking water source protection plan</i></p> <p>2015 – <i>Hopetoun Water Reserve drinking water source protection review</i>(this document)</p>
Consultation	Water Corporation, Shire of Ravensthorpe, Department of Health and South Coast Natural Resource Management group
Proclamation status	<p>The Hopetoun Water Reserve (comprising of the Springdale, West Springdale and Town wellfields) was proclaimed under the <i>Country Areas Water Supply Act 1947</i> on 6 July 2001.</p> <p>The Town wellfield boundary needs to be amended under the <i>Country Areas Water Supply Act 1947</i>.</p>

# 1 Review of Hopetoun's drinking water source protection plan

This drinking water source protection review (2015) updates and amends the Department of Water's *Hopetoun water reserves drinking water source protection plan* that was published in June 2009. The main focus of this review is to provide:

- new information on the Springdale wellfield
- an update on the 2009 plan recommendations.

This 2015 review needs to be read alongside the 2009 plan. No new information on the original Town wellfield, located about 3 km north-west of the town, is provided in this review.

Hopetoun is a small town located on the Western Australian southern coast about 50 km south of Ravensthorpe (Appendix A, Figure A1). In 2011, there were 1398 people residing in Hopetoun (Australian Bureau of Statistics 2013).

## 1.1 Update on Springdale wellfield

Zoning of the land that encompasses the Springdale wellfield has not changed under the Shire of Ravensthorpe's local planning scheme with most being zoned for general agriculture and some small portions of land set aside for rural conservation and recreation (Crown land) along Jerdacuttup River. In 2012, the Water Corporation purchased a farm on which the three Springdale production bores (9/88, 10/88 and 14/88) and one future bore (15/88) are located (see Figure A3). Cattle grazing has been an ongoing concern for these bores due to the pathogen contamination risk posed to the drinking water source. In January 2013, the cattle were removed from the land surrounding the bores to avoid the contamination risk. An aerial image of the land uses is provided in Appendix A, Figure A2.

### 1.1.1 Licensing

The Water Corporation's groundwater licences for the Hopetoun Water Reserve have recently been renewed by the Department of Water. The licenced allocation for the wellfields remains at a total of 295 000 kL per year. The licence allows the Water Corporation to draw 150 000 kL of water per year from the Springdale wellfield, 75 000 kL from the West Springdale wellfield and 70 000 kL from the Town wellfield to supply drinking water to Hopetoun. The water supply is abstracted from the Bremer-East Sedimentary aquifer.

### 1.1.2 Water treatment

The water treatment process has not changed since publishing the Hopetoun water reserves drinking water source protection plan in 2009 (see section 1.2 in 2009 plan).

It should be recognised that although treatment and disinfection are essential barriers against contamination, public drinking water source area (PDWSA) management is the first step in protecting water quality and ensuring a safe drinking water supply.

This approach is endorsed by the *Australian drinking water guidelines (ADWG)* (NHMRC & NRMCC 2011) and reflects a preventive risk-based, multiple-barrier approach for providing safe drinking water to consumers. This combination of catchment protection and water treatment will deliver a more reliable, safer and lower-cost drinking water to consumers than either approach could achieve individually.

## 1.2 Update on hydrogeology

The Springdale wellfields are divided into two groundwater subareas, separated by the Jerdacuttup River. The West Springdale wellfield is west of the river, and consists of two production bores (17/05 and 18/05); while the Springdale wellfield is east of the river, and consists of three production bores (9/88, 10/88 and 14/88) and one future bore (15/88) (see Figure A3). The bores draw water from the Bremer-East Sedimentary aquifer (unconfined and semi-confined). The depth to the groundwater table is generally less than 10 m.

Bores 17/05 and 18/05 are screened at intervals intercepting shallow (Tertiary aquifer) and deeper (Werrillup aquifer) basal sands at about 20–30 m below the top of the bore casing and 40–50 m, respectively. The aquifers are overlain by clay and clayey sand, which is the dominant lithology of the Tertiary deposit, and forms local or leaky aquitards. Bore 18/05 is considered to be confined, whereas bore 17/05 is considered semi-confined (Worley Parsons and Water Corporation, 2006).

Bores 9/88, 10/88 and 14/88 are established within the basal sand deposits and are screened from about 25 m to 37 m below the top of the bore casing. The Tertiary deposits range from sand through to a base of loam and clay that unconformably overlies shale, lignite and coarse-grained sandstone of the Werillup formation.

Recharge of the groundwater source occurs by direct infiltration of rainfall, particularly where the basal sand is exposed at the surface. Recharge is highly variable over the area where clay is prevalent through the Tertiary deposits. The Werillup aquifer is recharged by downward leakage through the Tertiary deposits and Werillup formation clay, and margin of the basement ridges.

Groundwater flow in the Springdale and West Springdale wellfields is to the south-west with groundwater discharge to the Jerdacuttup River and the coastal wetlands. Local variations in groundwater flow occur around bedrock and incised drainage.

The nature of the hydrogeological setting of the wellfields means they are susceptible to water quality contamination risks from land uses at the surface.

## 1.3 Boundary, priority areas and protection zones

Drinking water is supplied to Hopetoun by the Water Corporation from the Hopetoun Water Reserve (i.e. Town, West Springdale and Springdale wellfields) which are the only sources of water for the town of Hopetoun.

No changes were proposed to the Springdale wellfield in the 2009 drinking water source protection plan. However, based on landowner (the Water Corporation) feedback, the Department of Water has agreed to reconsider the priority areas in the Springdale wellfield (Appendix A, Figure A4).

### 1.3.1 Priority area of Springdale wellfield

Past investigations showed that *Escherichia coli* (*E. coli*) counts were recorded in a number of raw water samples from the bores located in the Springdale wellfield. In response to these investigations, the Water Corporation implemented additional catchment management barriers and increased monitoring and surveillance to ensure the risks to the water source remained within the levels of the recommended ADWG. However, due to the high vulnerability of the source and increasing number of cattle, the farm on which the Springdale bores and their wellhead protection zones (WHPZs) are located, was purchased. This decision was made to address increasing concerns about pathogen contamination from increasing numbers of cattle near the bores.

This review changes the priority area of the land that surrounds the production bores and wellhead protection zones from P2 (risk minimisation) to P1 (risk avoidance). The remainder of the land will remain as a P2 area (Appendix A, Figure A4), and may be leased out for agricultural land uses that are considered 'acceptable' or 'compatible with conditions' in the Department of Water's Water quality protection note no. 25: *Land use compatibility in public drinking water source areas*. This will protect the bores, WHPZs and the immediate area around the bores from incompatible land uses that could pose a risk to the quality of this drinking water source.

### 1.3.2 Wellhead protection zones

Wellhead protection zones (WHPZs) are defined to protect the immediate area around production bores from land use contamination risks. The radius of the WHPZs surrounding the Springdale bores (9/88, 10/88, 14/88 and 15/88) will increase from 300 m to 500 m, to align with the requirements for a P1 area.

This review also provides an update on the status of bore 15/88 (see Figure 6 of 2009 plan). Bore 15/88 is not used for supplying drinking water to the Hopetoun water supply scheme; it is only used for monitoring the water quality of the source. However, the wellhead protection zones will remain, as this bore has the potential to supply drinking water to Hopetoun in the future (Appendix A, Figure A4).

The boundary, priority areas and protection zones above have been determined in accordance with current departmental policy, and will continue to provide for the protection of the water quality of this drinking water source.

The priority areas and protection zones for the Springdale and West Springdale wellfield are appropriate for the following reasons:

- Water from this source constitutes a strategic supply to the town of Hopetoun and it should be afforded a high level of protection.
- The boundary of the Springdale wellfield includes the groundwater recharge area of the current drinking water source for Hopetoun.
- The highest level of protection to a drinking water source is provided in P1 areas, where any risk to the quality of water should be avoided.
- The land located within the WHPZs is of strategic importance because it overlies mainly a shallow aquifer which is considered vulnerable to contamination from inappropriate land uses. It is desirable to minimise any potential risks to a public drinking water bore.
- Existing land uses and tenures (on farmland) are generally considered compatible with P2 objective of risk minimisation.
- The special rural subdivisions west of Jerdacuttup River (in the P2 area) were established in the early 1990s prior to finalising the original *Hopetoun Water Reserve water source protection plan* in 1995.

## 1.4 Water supply planning

The Shire of Ravensthorpe released its draft local planning strategy for comment in December 2013. This strategy includes broad, long-term, strategic planning directions for making land use decisions in the Shire of Ravensthorpe, including Hopetoun, and will influence future amendments to the existing *Town Planning Scheme no. 5*.

In this draft strategy, the Shire indicates that there is no need to rezone land for rural living at this point. Any future rural living will occur in already approved areas. The town planning scheme zoning of the land is also unlikely to change in the near future. Therefore, there is no requirement for additional water supply in the near future.

## 1.5 Enforcing by-laws, surveying the area and maintenance

This review recommends that the Water Corporation continue by-law enforcement under the existing delegation arrangement. This also includes:

- maintaining signs in accordance with *S111 Source protection signage* (Water Corporation 2013), see Appendix B, Figure B1 for an example of a sign.
- maintaining security and fencing surrounding the bore compounds and around property boundaries (Appendix B, Figure B2).
- ongoing regular surveillance and inspections and reporting of significant incidents through the Advisory Committee for the Purity of Water.

## 1.6 Update on water quality risks

As part of this review, the Department of Water has conducted an assessment of water quality contamination risks to the Springdale wellfield, in accordance with the ADWG. Table 1, at the end of this section, shows a summary of new risks that have been identified or risks that have changed since the 2009 plan.

In general, the land uses within the wellfield have not changed since 2009, and no additional risks to the quality of water from the water source have been identified. Most of the land within the water reserve is zoned for general agriculture and is used for stock grazing. The land outside the water reserve is mainly used for cereal and canola cropping and stock grazing (Appendix B, Figures B3 and B4).

However, the risks to the quality of water from the Springdale wellfield have been reduced by removing the stock grazing from the land surrounding the Springdale production bores and WHPZs (see section 1.6.2).

The Water Corporation's bores in the Springdale and West Springdale wellfields are all fenced to prevent access by people and stock.

### 1.6.1 General agriculture (broadacre cropping)

Broadacre activities provide varying risks to water quality through the application of fertilisers and pesticides. Over the last five years, the Department of Water received a number of proposals for cropping (e.g. canola) within the wellfield that required the use of pesticides. These proposals were assessed by the Department of Water with input from the Department of Health and the water service provider, and were subjected to the CSIRO's Pesticide Impact Ranking Index (PIRI) assessment. Depending on the potential risks to the drinking water source (i.e. due to factors such as mobility and toxicity of the chemical proposed to be used), these types of proposals may or may not be supported by the departments.

Landowners will not be prevented from using their land for rural agricultural purposes that are supported by the Shire of Ravensthorpe's *Town Planning Scheme no. 5*. However, best management practices should be used for any agricultural land use activities, particularly when using or storing chemicals such as fertilisers, pesticides and hydrocarbon based products (see Water quality protection note (WQPN) no. 65: *Toxic and hazardous substances - storage and use*).

### 1.6.2 General agricultural land (pastoral activities)

Pastoral activities on private land within the Springdale wellfield are typically sheep and cattle grazing. Therefore, stock management is critical in order to ensure the level of risk to a drinking water source is kept to a minimum. This includes best management practices such as maintaining pasture condition and numbers of stock (see WQPN no. 1: *Agriculture - dryland crops near sensitive water resources* and WQPN no. 35: *Pastoral activities within rangelands*).

### *Water Corporation land*

The risks to the Springdale wellfield have been significantly reduced because the Water Corporation purchased the land surrounding the production bores 9/88, 10/88, 14/88 and 15/88 in 2012 and subsequently removed the stock.

The 2009 plan states that on several occasions between January 2002 and January 2008, the bores at the Springdale wellfield tested positive for low counts of *E. coli*, which is an indicator of faecal contamination. Cattle grazing and manure in proximity to the production bores was considered to be the cause. Between 1 March 2009 and 1 March 2014, the Water Corporation did not record any positive *E. coli* counts in the drinking water production bores. This suggests that the land purchase and stock removal have been successful at reducing the risk to drinking water quality.

It is anticipated that the south to south-western portion of the purchased land will be revegetated via funding from a natural resource management program (see section 1.7). Carbon offset projects are also being investigated as an option to revegetate this property.

Table 1 Update of potential water quality risks, land use compatibility and best management practices

Land use/activity	Hazard	Management priority	Comments	Best management practice guidance <sup>1</sup>
Agricultural land uses, including pastoral grazing (cattle and sheep) and cropping at Springdale wellfield	<b>Pathogen</b> contamination from domestic animal excreta and carcasses	High	General agricultural activities are compatible with conditions in P2 areas.	WQPN no. 1: <i>Agriculture - dryland crops near sensitive water resources</i>
	<b>Nutrients</b> from excreta originating from domestic animals	Low	The land, containing production bores 9/88, 10/88, 14/88 and 15/88 has been purchased by Water Corporation for the purpose of protecting the drinking water source, and will now become a P1 area with 500 m WHPZs.	WQPN no. 35: <i>Pastoral activities within rangelands</i>  <i>Minimum construction requirements for water bores in Australia</i> (National Uniform Drillers Licensing Committee 2012)
	<b>Pesticides</b> from pest control	Low	The land immediately south-west of the bores will be revegetated as part of a natural resource management program in consultation with the Water Corporation.	Water Corporation to maintain water quality monitoring program.
	<b>Fuel and chemical spills</b> from fuel from vehicles and machinery	Low	Bores 17/05 and 18/05 are constructed in a semi-confined aquifer and are considered vulnerable to contamination.  Bores 17/05 and 18/05 have fenced compounds.  Cattle grazing may occur on private land in proximity to bores 17/05 and 18/05.	Ensure stock is fenced and kept at least 100 m away from the production bores, preferably outside the wellhead protection zones.  Farmer should maintain stock watering points, if required.  Any pesticide use should be in accordance with the Department of Health Public Service Circular 88: <i>Use of herbicides in water catchment areas</i> (PSC88).

<sup>1</sup>Water quality protection notes (WQPNs) are available [www.water.wa.gov.au](http://www.water.wa.gov.au) > publications > search.

## 1.7 South Coast Natural Resource Management and Water Corporation project

The P2 land south of bores 9/88, 10/88, 14/88 and 15/88 is being revegetated with native vegetation as part of a program funded by the South Coast Natural Resource Management group with in-kind support from the Water Corporation. The revegetation covers approximately 60 ha of the Springdale wellfield and will assist in long-term protection of the drinking water source in addition to linking strategically high-value remnant vegetation in the region. The planting commenced in June 2014 and included a mix of direct seeding and seedlings. Measures to control weeds and pests to protect the revegetated areas were considered as part of this project. This includes control of kangaroos and a weed and pesticide spraying program. The South Coast Natural Resource Management group with input from the Water Corporation undertakes land management planning as part of the revegetation program for this area.

For the long-term protection of the Hopetoun drinking water source, it should be considered if this portion of P2 land, once fully revegetated, should be changed from a P2 area (risk minimisation) to a P1 (risk avoidance). This should be further investigated as part of the next update of this review.

## 1.8 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 have been discussed in the 2009 *Hopetoun water reserves drinking water source protection plan*.

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 are two native title claims within the gazetted Hopetoun Water Reserve. These are from the Southern Noongar (WAD6134\_98) and Wagyl Kaip (WAD6286/98) people.

The Western Australian Government and the Noongar native title claimants (this includes the Wagyl Kaip people) are negotiating an agreement called an Indigenous Land Use Agreement (ILUA). This agreement will recognise the Noongar people as the traditional owners of land in the South West Settlement Area. It will allow for some types of land-based customary activities to be undertaken by Noongar people in the Hopetoun Water Reserve. The ILUA and South West Settlement Areas are available via the Department of Premier and Cabinet, see [www.dpc.wa.gov.au](http://www.dpc.wa.gov.au).

## 1.9 Other groundwater bores in the area

Bores drilled near a public drinking water supply bore (such as for irrigation or private purposes) 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 into an otherwise uncontaminated aquifer.

Therefore, it is important to ensure that any bores are appropriately located and constructed to prevent contamination of the public drinking water source. This will be assessed through Department of Water's water licensing process where applicable under the *Rights in Water and Irrigation Act 1914*. All bores should be constructed in accordance with *Minimum construction requirements for water bores in Australia* (National Uniform Drillers Licensing Committee 2012).

There is at least one licensed user within 300 m of the public production bores.

## 1.10 Water quality information

The Water Corporation has provided updated water quality information for the Springdale wellfield. This is shown in Appendix C.

Raw water sourced from the West Springdale and Springdale wellfields used to supply the Hopetoun water supply scheme has been of acceptable quality and is meeting the ADWG health levels. Only the salt concentration (e.g. sodium and chloride) is elevated in the groundwater of this wellfield and does not meet the aesthetic (non-health-related) levels recommended in the ADWG.

The 2009 plan states that on several occasions between January 2002 and January 2008, the bores at the Springdale wellfield tested positive for low counts of *Escherichia coli*. More recent data taken between 1 March 2009 and 1 March 2014 did not show any positive *E. coli* counts in the drinking water production bores at the Springdale wellfield. Refer to section 1.6.2 for more detail.

## 2 Implementation of Hopetoun's drinking water source protection plan 2009

### 2.1 Status of previous recommendations

Table 2 outlines recommendations from the 2009 plan and their current status.

*Table 2 Implementation status for Hopetoun Water Reserve (2009 plan)*

No.	Recommendation	Comments
1	Proclamation of the amended Hopetoun (Town wellfield) water reserve under the <i>Country Areas Water Supply Act 1947</i> .	The Hopetoun Water Reserve will be proclaimed with an amended boundary for the Town wellfield. The boundary of the Springdale wellfield has not changed since the original 2001 gazettal.  This recommendation will be carried forward.
2	An implementation strategy should be developed for the recommendations of the 2009 plan.	The Department of Water's regional office is implementing the strategy. This 2015 review updates the land and water factors since they were last considered in the 2009 plan.  This recommendation is complete.
3	Incorporate the water reserve into land planning strategies.	The Town and Springdale wellfields are incorporated as special control areas in the Shire of Ravensthorpe's <i>Town Planning Scheme no. 5</i> .  This recommendation is complete.
4	Liaise with landowners with properties within the wellhead protection zones to determine how water quality can best be protected in those areas. Potential purchase of strategically important P1 land may be considered.	Since 2009, the Water Corporation has purchased land in the Springdale wellfield to address contamination risks.  This recommendation is complete.

No.	Recommendation	Comments
5	Investigate the need to change some or all of the P2 land in the Springdale wellfield to P1 after consulting landowners and the Water Corporation.	<p>Following discussions with the Water Corporation, land around the bores on their recently purchased property will be changed from P2 to P1.</p> <p>This recommendation is complete.</p>
6	Subdivision guidance plans for development/rezoning proposals within the water reserve should be referred to the Department of Water for advice	<p>Subdivision guidance plans for development/rezoning proposals are referred to the South Coast regional office of the Department of Water for consideration.</p> <p>This recommendation will be carried forward.</p>
7	Future building envelopes to the north and west boundary of Lot 1 on Plan 16591 (Water Corporation's wellfield) to be 200 m away from the dividing boundary, extending north and westwards onto the adjoining properties for the purpose of water source protection.	<p>A subdivision guide plan relating to Scheme Amendment no. 12 has been endorsed by the Shire of Ravensthorpe, and a subdivision (staged approach) was approved subject to conditions by the Western Australian Planning Commission on 2 April 2013 (Application no. 147281).</p> <p>Building envelopes and a development exclusion zone along the northern boundary of Lot 1 on Plan 16591 are shown in the endorsed subdivision guide plan.</p> <p>The progress of this recommendation will be monitored and carried forward.</p>
8	<p>Referral of development proposals:</p> <ul style="list-style-type: none"> <li>• The Department of Water to provide the Shire of Ravensthorpe with guidelines for referral of development proposals.</li> <li>• Referral of development proposals.</li> </ul>	<p>Guidelines have been provided through the water quality protection note series.</p> <p>Development proposals within the water reserve are referred to the South Coast regional office of the Department of Water.</p> <p>This recommendation is ongoing and will be carried forward.</p>

No.	Recommendation	Comments
9	Emergency response: <ul style="list-style-type: none"> <li>• Develop response plan.</li> <li>• Inform Westplan-HAZMAT personnel of special requirements for the Hopetoun Water Reserve.</li> </ul>	<p>The Water Corporation has spill response procedures in place.</p> <p>Copies of the 2009 plan and maps were forwarded to the regional office of the Department of Fire and Emergency Services.</p> <p>This recommendation is complete.</p>
10	Water service provider to maintain existing groundwater monitoring program.	<p>Water Corporation monitors the quality of the groundwater at regular intervals.</p> <p>This recommendation is ongoing and will be carried forward.</p>
11	Erection of signs: <ul style="list-style-type: none"> <li>• Development of guidelines for signage.</li> <li>• Determine number and location of signs required.</li> </ul>	<p>Signs advising of the entrance to the wellfields are in place.</p> <p>Signs should be maintained in accordance with the Water Corporation's S111 <i>Source protection signage</i> (2013). This recommendation will be carried forward.</p>
12	The elevated micro-biological counts in the water samples taken from the Town and Springdale wellfields should be further investigated to determine and remove the source(s) of contamination.	<p>In 2012, the Water Corporation purchased the land containing production bores 9/88, 10/88, 14/88 and 15/88. Cattle grazing no longer occurs in proximity of these production bores or within the WHPZs.</p> <p>In the period between 1 March 2009 and 1 March 2014, no positive E. coli counts were detected in the Springdale drinking water source.</p> <p>Production bore 21/01 in the Town wellfield is no longer used as a precautionary measure due to its proximity to urban development (i.e. on-site wastewater treatment systems) and potential risk to contamination.</p> <p>This recommendation is complete.</p>

No.	Recommendation	Comments
13	Vesting should be sought for the unallocated Crown land along Jerdacuttup River for the purpose of waterways, or flora and fauna protection by the relevant government agency.	This recommendation has not been actioned and will be carried forward.
14	Liaison with the South West Aboriginal Land and Sea Council should occur prior to seeking vesting for the unallocated Crown land along Jerdacuttup River.	This action will occur when recommendation no. 13 (above) is progressed. This recommendation will be carried forward.
15	A brochure describing the Hopetoun Water Reserve, its location and main threats to water quality should be prepared.	A brochure was prepared and released on the Department of Water's website. This recommendation is complete.
16	Review of the plan and recommendations.	This has been undertaken through the preparation of this review document. This recommendation is ongoing and will be carried forward.

## 2.2 Consolidated recommendations (2015 review)

Based on the findings of this review (including the recommendations carried forward from the 2009 plan), the following recommendations will now be applied to the Hopetoun Water Reserve. The bracketed stakeholders are those expected to have a responsibility for, or an interest in, the implementation of that recommendation.

1. Proclaim the amended boundary of the Town wellfield as part of the Hopetoun Water Reserve under the *Country Areas Water Supply Act 1947* as recommended in the 2009 Hopetoun water reserves drinking water source protection plan. (Department of Water)
2. Change the priority area of the land that surrounds the production bores 9/88, 10/88, 14/88 and 15/88 and wellhead protection zones from priority 2 (P2; risk minimisation) to priority 1 (P1; risk avoidance). (Department of Water)
3. Incorporate the findings of this review, including its updated priority areas and protection zones of the Springdale wellfield in the Shire of Ravensthorpe local planning strategy and scheme in accordance with the Western Australian

Planning Commission's State planning policy no. 2.7: *Public drinking water source policy*. (Shire of Ravensthorpe)

4. Any subdivision guidance plans for development/rezoning proposals within the Hopetoun Water Reserve should be referred to the Department of Water for advice and recommendations. (Department of Planning; Shire of Ravensthorpe; and proponents of proposals)
5. Any future building envelopes to the north and west boundary of Lot 1 on Plan 16591 (Town wellfield) should be 200 m away from the dividing boundary, extending north and westwards onto the adjoining properties for the purpose of water source protection (see Figure 5 in 2009 plan). (Department of Water and Shire of Ravensthorpe)
6. Refer development proposals within the Hopetoun Water Reserve that are inconsistent or considered 'compatible with conditions' with the Department of Water's WQPN no.25: *Land use compatibility in public drinking water source areas* or recommendations in this plan to the Department of Water regional office for advice. (Department of Planning, Shire of Ravensthorpe and proponents of proposals)
7. Ensure incidents covered by Westplan–HAZMAT in the Hopetoun Water Reserve are addressed by ensuring that:
  - the Shire of Ravensthorpe LEMC is aware of the location and purpose of the Hopetoun Water Reserve
  - the locality plan for the Hopetoun Water Reserve is provided to the Department of Fire and Emergency Services headquarters for the HAZMAT emergency advisory team
  - the Water Corporation acts in an advisory role during incidents in the Hopetoun Water Reserve
  - personnel dealing with Westplan–HAZMAT incidents in the area have ready access to a locality map of the Hopetoun Water Reserve and information to help them recognise the potential impacts of spills on drinking water quality. (Water Corporation)
8. Maintain signs along the boundary of the Hopetoun Water Reserve including an emergency contact telephone number, in accordance with the Water Corporation's *S111 Source protection signage* standard (2013). (Water Corporation)
9. Ensure landowners and managers are aware of the location of the Hopetoun Water Reserve and are encouraged to adopt best management practices for protecting Hopetoun's drinking water. (Department of Water)
10. Water Corporation should continue the current regime of water quality monitoring, maintenance of fencing, inspections and by-law enforcement. (Water Corporation)
11. Revegetate the land south of bores 9/88, 10/88, 14/88 and 15/88 as part of the South Coast Natural Resource Management funded project. This should assist in the long-term protection of the drinking water source and link strategically high-

value remnant vegetation in the region. (South Coast Natural Resource Management group and Water Corporation)

12. Investigate if the revegetated land referred to in recommendation 11 should be changed from a P2 area (risk minimisation) to a P1 (risk avoidance) as part of the next review. (Department of Water)
13. Vesting should be sought for the unallocated Crown land along Jerdacuttup River for the purpose of waterways, or flora and fauna protection by the relevant government agency. (Department of Water or Department of Parks and Wildlife)
14. Liaison with the South West Aboriginal Land and Sea Council should occur prior to seeking vesting for the unallocated Crown land along Jerdacuttup River. (Department of Water or Department of Parks and Wildlife)
15. Update this report within seven years. (Department of Water)

# Appendices

## Appendix A – Figures

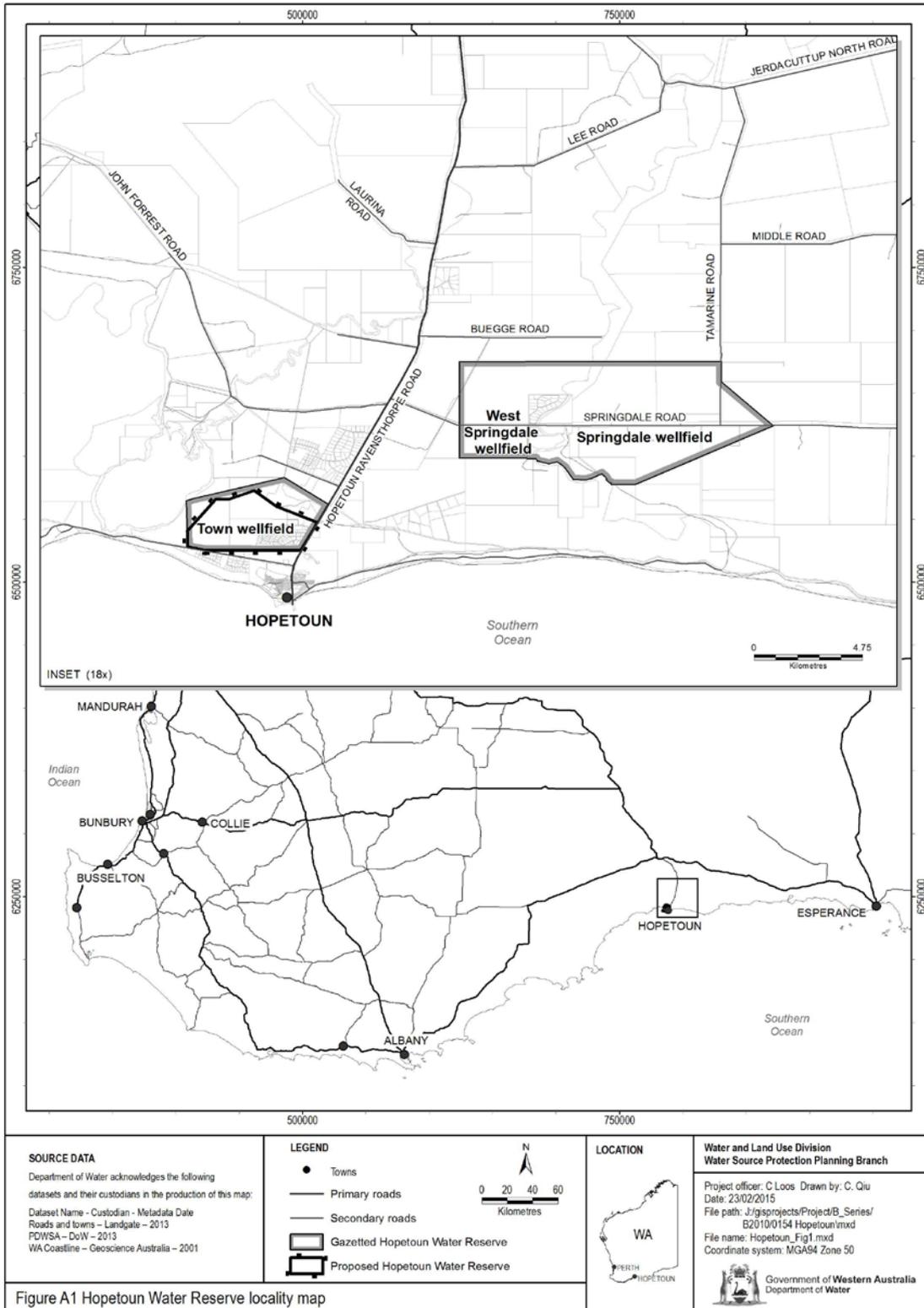


Figure A1 Hopetoun Water Reserve locality map

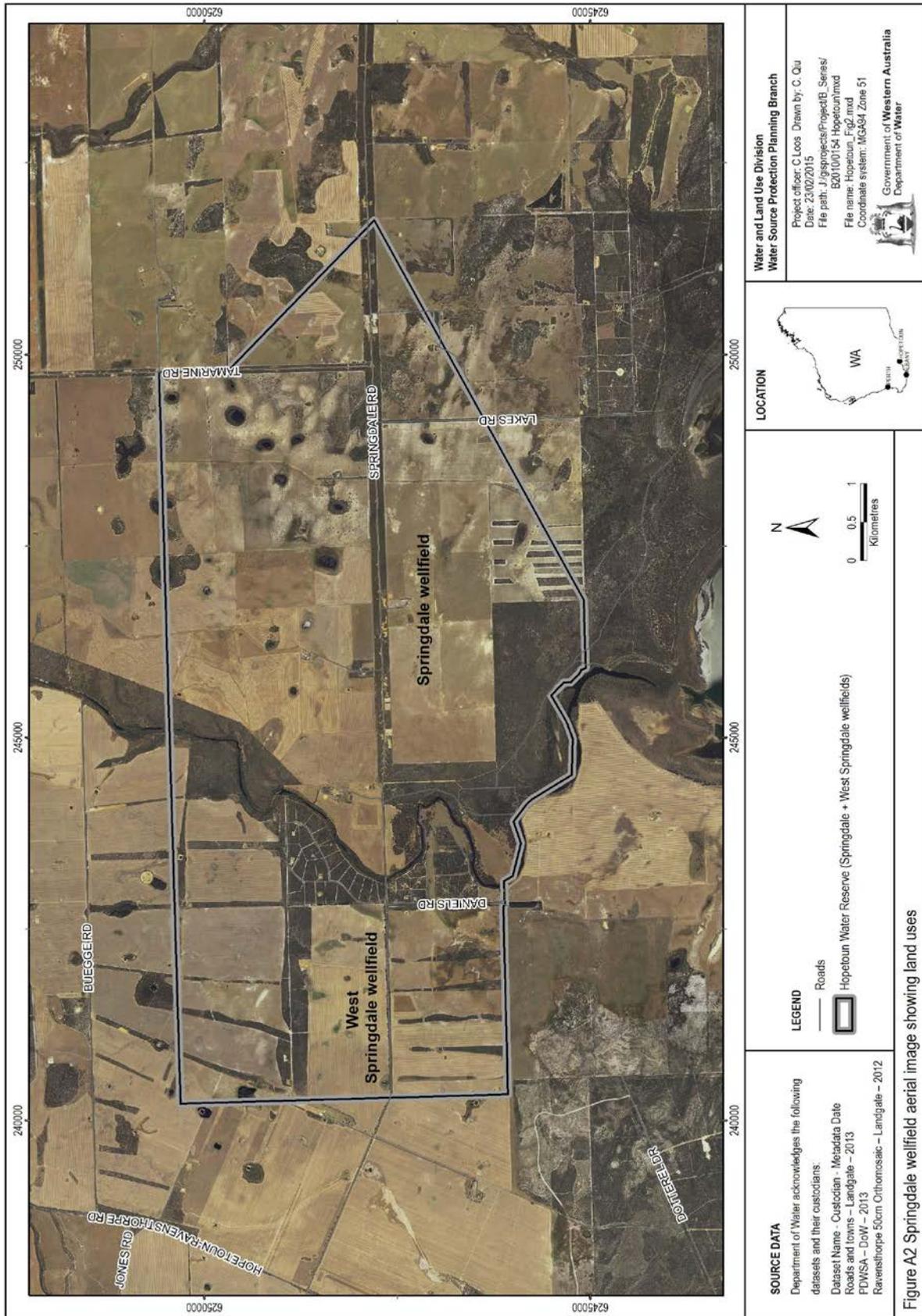


Figure A2 Springdale wellfield aerial image showing land uses

Figure A2 Hopetoun Water Reserve – Springdale wellfield aerial photo showing land uses

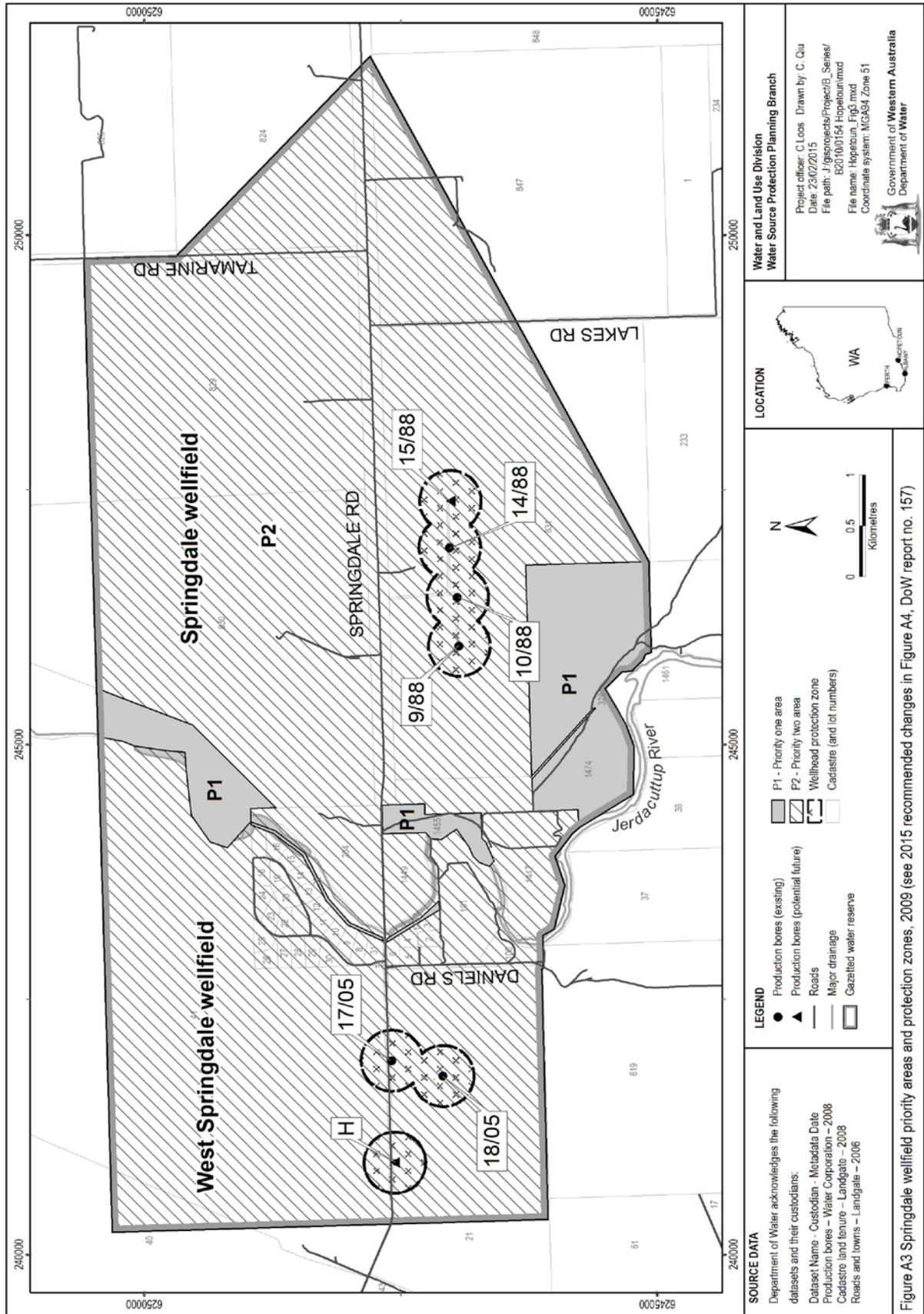


Figure A3 Springdale wellfield priority areas and protection zones, 2009 (see 2015 recommended changes in Figure A4, DoW report no. 157)

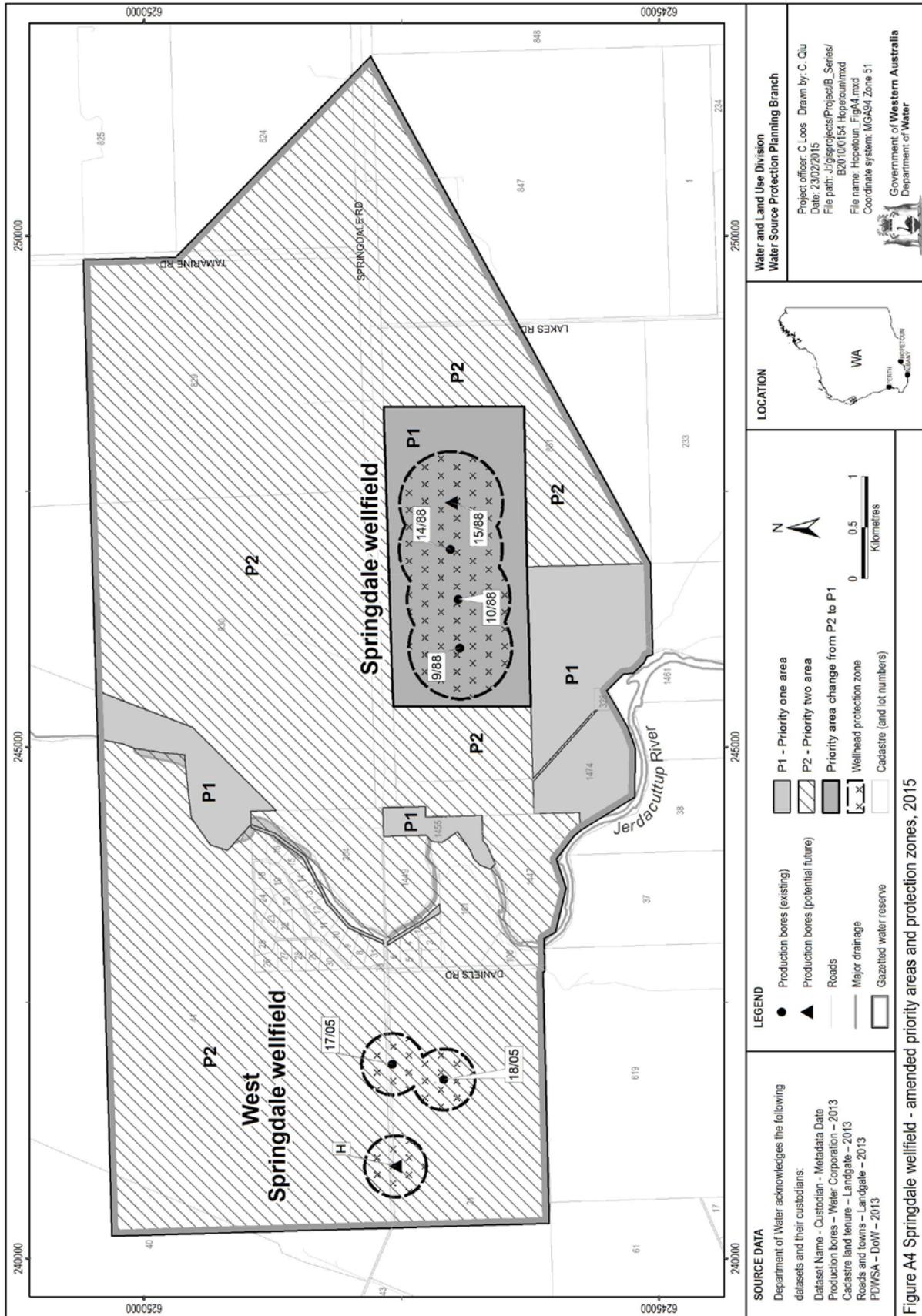


Figure A4 Springdale wellfield amended priority areas and wellhead protection zones, 2015)

## Appendix B – Photographs



*Figure B1 Signage in Springdale wellfield, photograph by M. Gangell, Department of Water*



*Figure B2 Bore compound (bore 17/05) at Springdale wellfield, photograph by K. Burton, Water Corporation, reproduced with permission*



*Figure B3 Cropping at Springdale wellfield, photograph by M. Gangell, Department of Water*



*Figure B4 Agricultural land use at Springdale wellfield, photograph by M. Gangell, Department of Water*

## Appendix C – Water quality data

**The information provided in this appendix has been supplied by the Water Corporation.**

The Water Corporation has monitored the raw (source) water quality from Hopetoun's Springdale wellfield in accordance with the requirements of the *Australian Drinking Water Guidelines* (ADWG) (NHMRC & NRMCC 2011) and interpretations agreed to with the Department of Health. This data shows the quality of water in the public drinking water source area (PDWSA). The raw water is monitored regularly for:

- aesthetic characteristics (non-health related)
- health-related characteristics, including:
  - health-related chemicals
  - microbiological contaminants.

The following data represents the quality of raw water from Hopetoun's Springdale wellfield. 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 customer's tap. Any water quality parameters that have been detected are reported; those that on occasion have exceeded the ADWG are in ***bold and italics*** to give an indication of potential raw-water quality issues associated with this source. The values are taken from ongoing monitoring for the period 1 March 2009 to 1 March 2014.

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 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 Hopetoun refer to the most recent Water Corporation drinking water quality annual report at [watercorporation.com.au](http://watercorporation.com.au) > What we do > Water quality > Water quality publications > Most recent *Drinking water quality annual report*.

### *Aesthetic characteristics*

The aesthetic water quality analyses for raw water from Hopetoun's Springdale wellfield are summarised in the following table.

#### *Aesthetic detections for Springdale wellfield*

Parameter	Units	ADWG aesthetic guideline value*	Springdale wellfield (composite)	
			Range	Median
Chloride	mg/L	250	<b>405–535</b>	<b>455</b>
Hardness as CaCO <sub>3</sub>	mg/L	200	90–130	110
Iron unfiltered	mg/L	0.3	0.05– <b>8.8</b>	0.12
Silicon as SiO <sub>2</sub>	mg/L	80	29–60	46
Sodium	mg/L	180	<b>240–340</b>	<b>280</b>
Total filterable solids by summation	mg/L	600	<b>796–1085</b>	<b>914</b>
Turbidity	NTU	5	0.2–1.6	0.8
pH measure in Laboratory	No unit	8.5	5.71–6.41	6.09
Zinc	mg/L	3	0.02–2.2	0.05

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

### *Health-related chemicals*

Raw water from Hopetoun's Springdale wellfield is analysed for chemicals that are harmful to human health including inorganics, heavy metals, industrial hydrocarbons and pesticides. Health-related parameters that have been detected in the source are summarised in the following table.

#### *Health-related detections for Springdale wellfield*

Parameter	Units	ADWG health guideline value*	Springdale wellfield (composite)	
			Range	Median
Manganese unfiltered	mg/L	0.5	0.009–0.035	0.018
Nitrate as N	mg/L	11.29	<0.05–0.46	0.25
Sulfate	mg/L	500	43–78	55
Barium	mg/L	0.7	0.017–0.045	0.025
Boron	mg/L	4	0.2–0.35	0.26
Selenium	mg/L	0.01	<0.003–0.008	<0.003

Parameter	Units	ADWG health guideline value*	Springdale wellfield (composite)	
			Range	Median
Cadmium	mg/L	0.002	<0.0002–<0.0004	0.0002
Chromium	mg/L	0.05	<0.0005–0.006	0.0013
Copper	mg/L	2	0.035–1.44	0.0575
Lead	mg/L	0.01	<0.002– <b>0.045</b>	0.003
Nickel	mg/L	0.02	0.003–0.016	0.003
Fluoride	mg/L	1.5	0.1–0.15	0.125
Iodide <sup>#</sup>	mg/L	0.1	0.03	0.03
Annual radiation dose <sup>#</sup>	mSv	1	0.089	0.089
Radon -222 <sup>#</sup>	Bq/L	100	10.6	10.6

\* 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 2011).

† The guideline value of 11.29 mg/L (as nitrogen) has been set to protect bottle fed infants less than 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.

# Only 1 sample taken during reporting period.

### *Microbiological contaminants*

Microbiological testing of raw water samples from Hopetoun's Springdale wellfield is currently conducted on a monthly basis. *Escherichia coli* (*E. coli*) counts are used as an indicator of the degree of recent faecal contamination of the raw water from warm-blooded animals.

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

During the review period, positive *E. coli* counts were not recorded in any samples.

## List of shortened forms

<b>ADWG</b>	<i>Australian drinking water guidelines</i>
<b>ANZECC</b>	Australian and New Zealand Environment Conservation Council
<b>ARMCANZ</b>	Agriculture and Resource Management Council of Australia and New Zealand
<b>HAZMAT</b>	hazardous materials
<b>kL</b>	kilolitre
<b>km</b>	kilometre
<b>km<sup>2</sup></b>	square kilometre
<b>LEMC</b>	local emergency management committee
<b>m</b>	metres
<b>mg/L</b>	milligram per litre
<b>mL</b>	millilitre
<b>ML</b>	megalitre
<b>mm</b>	millimetre
<b>mSv</b>	millisievert
<b>NHMRC</b>	National Health and Medical Research Council
<b>NRMMC</b>	Natural Resource Management Ministerial Council
<b>NTU</b>	nephelometric turbidity units
<b>PSC 88</b>	Public sector circular number 88
<b>PDWSA</b>	public drinking water source area
<b>TDS</b>	total dissolved solids
<b>WAPC</b>	Western Australian Planning Commission
<b>Westplan– HAZMAT</b>	Western Australian plan for hazardous materials
<b>WHPZ</b>	wellhead protection zone
<b>WQPN</b>	water quality protection note

# Glossary

<b>Abstraction</b>	The pumping of groundwater from an aquifer, or the removal of water from a waterway or water body.
<b>Aesthetic guideline value</b>	The concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, for example appearance, taste and odour (NHMRC & NRMCC 2011).
<b>Allocation</b>	Is the volume of water that a licensee is permitted to abstract, usually specified in kilolitres per annum (kL/a).
<b>Aquifer</b>	An aquifer is a geological formation or group of formations able to receive, store and transmit significant quantities of water.
<b>Australian drinking water guidelines</b>	The <i>National water quality management strategy: Australian drinking water guidelines 6, 2011</i> (NHMRC & NRMCC 2011) (ADWG) outlines acceptable criteria for the quality of drinking water in Australia (see this plan's References).
<b>Bore</b>	A bore is a narrow, lined hole drilled into the ground to monitor or draw groundwater (also called a well).
<b>Catchment</b>	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
<b>Confined aquifer</b>	An aquifer that is confined between non-porous rock formations (such as shale and siltstone) and therefore contains water under pressure.
<b>Drinking water source protection report</b>	A report on water quality hazards and risk levels within a public drinking water source area; includes recommendations to avoid, minimise, or manage those risks for the protection of the water supply in the provision of safe drinking water supply.
<b>Electrical conductivity</b>	This estimates the volume of TDS or the total volume of dissolved ions in a solution (water) corrected to 25°C. Measurement units include millisiemens per metre and microsiemens per centimetre.
<b>Health guideline value</b>	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 & NRMCC 2011).

<b>Hydrocarbons</b>	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.
<b>Hydrogeology</b>	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
<b>Hydrology</b>	The science dealing with water on the land, including such things as its properties, laws and geographical distribution.
<b>mg/L</b>	A milligram per litre (0.001 grams per litre) is a measurement of something (such as salinity) in a solution.
<b>Millisievert</b>	A millisievert is a measure of annual radiological dose, with a natural dose equivalent to 2 mSv/yr.
<b>Nephelometric turbidity units</b>	Nephelometric turbidity units are a measure of turbidity in water.
<b>Nutrient load</b>	The amount of nutrient reaching the waterway over a given timeframe (usually per year) from its catchment area.
<b>Nutrients</b>	Minerals, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorous (phosphate) dissolved in water which provide nutrition (food) for plant growth.
<b>Pathogen</b>	A disease-producing organism that can cause sickness and sometimes death through the consumption of water, including bacteria (such as <i>Escherichia coli</i> ), protozoa (such as <i>Cryptosporidium</i> and <i>Giardia</i> ) and viruses.
<b>Pesticides</b>	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
<b>pH</b>	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.
<b>Public drinking water source area</b>	The area from which water is captured to supply drinking water. It includes all underground water pollution control areas, catchment areas and water reserves constituted under the <i>Metropolitan Water Supply, Sewerage, and Drainage Act 1909</i> or the <i>Country Areas Water Supply Act 1947</i> .
<b>Public sector circular number 88</b>	A state government circular produced by the Department of Health providing guidance on appropriate herbicide use within water catchment areas.

<b>Recharge</b>	Recharge is the action of water infiltrating through the soil/ground to replenish an aquifer.
<b>Recharge area</b>	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.
<b>Scheme supply</b>	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.
<b>Semi-confined aquifer</b>	A semi-confined aquifer or leaky aquifer is saturated and bounded above by a semi-permeable layer and below by a layer that is either impermeable or semi-permeable.
<b>Total dissolved solids</b>	Total dissolved solids consist of inorganic salts and small amounts of organic matter that are dissolved in water. Clay particles, colloidal iron and manganese oxides, and silica fine enough to pass through a 0.45 micrometer filter membrane can also contribute to total dissolved solids. Total dissolved solids comprise sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate (and nitrite) and phosphate (NHMRC & NRMCC 2011).
<b>Total filterable solids by summation</b>	Total filterable solids by summation is a water quality test which is a total of the following ions: Na (sodium), K (potassium), Ca (calcium), Mg (magnesium), Cl equivalent (chloride), alkalinity equivalent, SO <sub>4</sub> equivalent (sulfate) or S (sulfur) in grams, Fe (iron), Mn (manganese), and SiO <sub>2</sub> (silicon oxide). It is used as a more accurate measure than total dissolved solids (TDS). The higher the value, the more solids that are present and generally the saltier the taste.
<b>Treatment</b>	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes, including drinking and discharge to the environment.
<b>Turbidity</b>	The cloudiness or haziness of water caused by the presence of fine suspended matter.
<b>Unconfined aquifer</b>	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. This is also known as a superficial aquifer.

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<b>Water quality</b>	Water quality is the collective term for the physical, aesthetic, chemical and biological properties of water.
<b>Water reserve</b>	A water reserve is an area proclaimed under the <i>Country Areas Water Supply Act 1947</i> or the <i>Metropolitan Water Supply, Sewerage, and Drainage Act 1909</i> for the purposes of protecting a drinking water supply.
<b>Watertable</b>	The upper saturated level of the unconfined groundwater is referred to as the watertable.
<b>Wellfield</b>	A wellfield is a group of bores located in the same area used to monitor or withdraw groundwater.
<b>Wellhead</b>	The top of a well (or bore) used to draw groundwater is referred to as a wellhead.
<b>Wellhead protection zone</b>	A wellhead protection zone is usually declared around wellheads in public drinking water source areas to protect the groundwater from immediate contamination threats in the nearby area.
<b>Western Australian hazardous materials emergency management scheme</b>	This is now known as Westplan–HAZMAT.

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