



Katanning Catchment Area

drinking water source protection plan



Katanning town water supply

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Department of Water and Environmental Regulation

Water resource protection series

Report no. 177

February 2018

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ISSN 1835-3924 (online)

ISBN 978-1-925524-25-3 (online)

Acknowledgements

The Department of Water and Environmental Regulation would like to thank the following for their contribution to this publication: Vivien Claughton, Brendan Kelly, Daniel Wong, Andrew Watson and Stephen Watson (Department of Water and Environmental Regulation), Louise Holbrook and Gareth Evans (Water Corporation).

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Cover photograph: Aerial photo of Katanning Catchment Area

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Contents

Tables	1
Summary	3
1 Katanning Catchment Area	5
1.1 The drinking water supply system	5
1.2 Water management	5
1.2.1 Licence to take water	5
1.2.2 Water planning	6
1.2.3 Future water needs	6
1.3 Characteristics of the catchment	6
1.3.1 Physical environment	6
1.3.2 Climate	6
1.4 How is this drinking water source currently protected?	7
1.4.1 Enforcing by-laws, surveying the area and maintenance	8
2 Contamination risks in this drinking water source	9
2.1 Water quality information	9
3 Land uses and activities	10
3.1.1 Roads and tracks	10
4 Contamination risks	12
5 Recommendations	13
Appendices	14
Appendix A — Figures	14
Appendix B — Water quality data	20
Appendix C — Photographs	23
Appendix D — Land uses, potential water quality risks and recommended protection strategies	27
Appendix E — Typical contamination risks in surface water sources	30
Appendix F — How do we protect public drinking water source areas?	33
Appendix G — Understanding risks to drinking water quality	37
Shortened forms	39
List of shortened forms	39
Units of measurement	40
Volumes of water	40
Glossary	41
References	44
Further reading	46

Tables

Table 1	<i>Key information about the Katanning Catchment Area</i>	1
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Table 2 *Summary of potential water quality risks, land use compatibility and best management practices.....9*

Summary

This drinking water source protection plan is for the Katanning Catchment Area which is the catchment area of the Pinwernying Dam.

Katanning is a large town and agricultural hub for surrounding wheatbelt areas. It is about 250 km south-east of Perth in the Shire of Katanning (see Figure A1). Water Corporation supplies public drinking water to the town.

Previously, drinking water for Katanning was sourced from the roaded and natural catchment area of Pinwernying Dam. However, since drainage diversions were built around the dam, water is now sourced from the Great Southern Towns Water Supply Scheme. This water is often stored in the Pinwernying Dam prior to being supplied to the town. In winter, the dam can be by-passed and water can be supplied directly from the scheme. However, this is not possible during summer due to higher water demand.

This plan proposes that:

- the existing Katanning Catchment Area boundary be reduced to better reflect the catchment of Pinwernying Dam
- the catchment area is assigned a priority 1 (P1) area
- a reservoir protection zone (RPZ) is established around the dam.

The former Department of Water (now the Department of Water and Environmental Regulation) prepared this document in consultation with key stakeholders, including the Water Corporation and the Shire of Katanning.

This plan helps implement the *Australian drinking water guidelines* (ADWG; NHMRC & NRMCC 2011), State planning policy no. 2.7: *Public drinking water source policy* (Western Australian Planning Commission 2003) and Strategic policy: *Protecting public drinking water source areas in Western Australia* (Department of Water 2016a).

Important information about the Katanning Catchment Area is in Table 1.

Table 1 Key information about the Katanning Catchment Area

Katanning Catchment Area	
Local government authority	Shire of Katanning
Location supplied	Katanning
Water service provider	Water Corporation
Dam capacity	251.4 ML
Date of dam completion	1962 Remedial works in 2004

Katanning Catchment Area	
Constitution history	<p>First constituted as 'Catchment Area for Katanning water supply' on 7 September 1917 under section 36 of the <i>Water Boards Act 1904</i></p> <p>Constituted on 28 June 1957 under section 9 of the <i>Country Areas Water Supply Act 1947</i></p>
Reference documents	<p><i>Australian drinking water guidelines</i> (NHMRC & NRMCC 2011)</p> <p>State planning policy no. 2.7: <i>Public drinking water source policy</i> (Western Australian Planning Commission 2003)</p> <p><i>Katanning-Pinwernying catchment management strategy</i> (Water Corporation 2010)</p>

1 Katanning Catchment Area

1.1 The drinking water supply system

Katanning's drinking water is sourced from Water Corporation's Great Southern Towns Water Supply Scheme. This water is piped to and stored in the Pinwernying Dam prior to being supplied to the public. The dam is about 4 km north of Katanning, see figures A1 and C6. In winter, the dam can be by-passed and water can be supplied directly from the scheme. However, this is not possible during summer due to higher water demand.

Previously, Katanning's water was sourced from a combination of Pinwernying Dam's natural and roaded catchment and the Great Southern Towns Water Supply Scheme. However, drainage diversions were built around the dam so that rainfall runoff no longer enters the dam. This was done to address water quality issues and the poor state of the roaded catchment. The roaded part of the catchment (which was bitumen) was ripped up and revegetated (see Figure C1).

Pinwernying Dam and its old catchment are fenced and gated, on land owned by the Water Corporation (see Figure A3). In the future, the Water Corporation may need to remove the drainage diversions and use this catchment area once again to capture rainfall runoff in the dam. Therefore, we recommend that this land should be retained within the Katanning Catchment Area for future protection (see section 1.4).

Water from the Great Southern Towns Water Supply Scheme is piped from Harris Dam to Katanning, and is either stored in the Pinwernying Dam or supplied directly to the town (Water Corporation 2010).

Water pumped from the Pinwernying Dam is chlorinated before being transferred to a storage tank (see Figure C3). From there, the water is re-chlorinated prior to supply to the town via a gravity-fed pipe network.

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 an approach based on risk prevention and multiple-barriers 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 Water management

1.2.1 Licence to take water

The Katanning Catchment Area is not located within a constituted surface water area under the *Rights in Water and Irrigation Act 1914*, therefore a licence is not required for abstraction.

1.2.2 Water planning

The *Great Southern regional water supply strategy, A long-term outlook of water demand and supply* (Department of Water 2014) includes Katanning and aims to ensure timely planning and establishment of sustainable water supplies that support long-term regional development.

1.2.3 Future water needs

The *Great Southern regional water supply strategy* (Department of Water 2014a) discusses Katanning's future water needs. It states that Katanning is one of nine south-west towns included in the state government's regional centres development plan (SuperTowns) and is aimed to take advantage of the state of Western Australia's expected doubling in population over the next 30 to 40 years.

Therefore, Katanning's water demand could increase to 1 GL/year by 2043. This increase will need to be met by the Great Southern Towns Water Supply Scheme.

In addition, the Water Corporation may choose to re-establish local catchment drainage into the Pinwernying Dam to help meet this demand. For this reason, we recommend to retain the Water Corporation land within the constituted Katanning Catchment Area to ensure its future protection (see section 1.4).

1.3 Characteristics of the catchment

1.3.1 Physical environment

The Katanning Catchment Area is in the Great Southern region of Western Australia. The landscape is dominated by agricultural land with small areas of scattered native vegetation.

The topography within the catchment is very gently sloped. The drainage in the area is non-perennial, flowing after rainfall and following the slope of the land in a southerly direction.

The catchment area includes a combination of native vegetation, revegetated land and a wetland environment which is located at the top of the dam (see Figure C5). The original native vegetation is sparse, low woodlands and open shrublands (see Figure C2). The old roaded catchment area has been revegetated with native plants (see Figure C1).

1.3.2 Climate

The area has a Mediterranean-type climate, characterised by warm, dry summers and cool, wet winters. Since 1999, the average monthly maximum temperature has ranged from 14.7 °C in July to 30.1 °C in January, and the average monthly minimum temperature has ranged from 5.9 °C in July to 14.2 °C in February (Bureau of Meteorology 2016).

Average annual rainfall (since 1999) is 454.8 mm, mostly occurring during the winter months (Bureau of Meteorology 2016).

1.4 How is this drinking water source currently protected?

The Katanning Catchment Area was first constituted as a catchment area for the Katanning water supply on 7 September 1917 under section 36 of the *Water Boards Act 1904*. It was then constituted again on 28 June 1957 under the *Country Areas Water Supply Act 1947* (see Figure A2). Constitution identifies the location of the catchment area and ensures that its drinking water value is considered in land use planning decisions. It also allows by-laws to be applied for the protection of water quality.

The Katanning Catchment Area's original constitution included land beyond the physical catchment of the Pinwernying Dam, to the east and south-west. Some of this land is vested with the Water Corporation, but the rest is privately owned. This area is larger than the actual catchment area of the Pinwernying Dam, as confirmed by the Water Corporation in its *Katanning-Pinwernying catchment management strategy* (2010). So, we propose to remove the privately owned land from the constituted boundary. The proposed Katanning Catchment Area boundary will include the dam, the land surrounding the dam owned by the Water Corporation, and the water treatment plant (see Figure A2).

Currently, no priority areas or protection zones are assigned within the Katanning Catchment Area. This plan recommends that the entire proposed catchment is assigned a priority 1 (P1) area (see Figure A5). As the catchment area will be less than 2 km in size, we propose that a reservoir protection zone (RPZ) cover the entire catchment to protect the dam from immediate contamination threats (see Figure A5).

Although treatment and disinfection are essential barriers against contamination, PDWSA management is the first step in protecting water quality and ensuring a safe drinking water supply. This approach is endorsed by the ADWG (NHMRC & NRMCC 2011) and is based on preventive risk and multiple barriers 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.

For more information on why it is so important to protect our catchments, and the Department of Water and Environmental Regulation's approach based on preventive risk, read Appendix F.

1.4.1 Enforcing by-laws, surveying the area and maintenance

This plan recommends that the Water Corporation continues by-law enforcement under the existing delegation arrangement (see section 3, recommendation no. 6). This also includes:

- erecting and maintaining signs (see Figure C7 for existing signs) in accordance with *S111 Source protection signage* (Water Corporation 2013)
- maintaining security and fencing surrounding Pinwernying Dam
- ongoing regular catchment surveillance and inspections.

2 Contamination risks in this drinking water source

2.1 Water quality information

The Water Corporation regularly monitors the quality of raw water from the Katanning Catchment Area for microbiological, health-related and aesthetic (non-health-related) characteristics. This data shows the quality of water in the PDWSA. An assessment of the drinking water quality once treated is also made against the ADWG. This assessment is made by an intergovernmental committee called the Advisory Committee for the Purity of Water, chaired by the Department of Health.

A water quality summary for the Katanning Catchment Area from December 2011 to November 2016 is presented in Appendix B. For more information on water quality, see the Water Corporation's most recent drinking water quality annual report at www.watercorporation.com.au.

Iron, aluminium and turbidity have exceeded the ADWG's aesthetic guideline levels, and pH is lower than the guideline levels. These issues are likely to be naturally occurring within the catchment. It should be noted that during this monitoring period, drainage diversions were built which have reduced these water quality issues.

Eighty-five per cent of samples showed microbiological contamination readings. Of those, 11 per cent were high. This contamination is likely to be from birds and kangaroos which frequent the dam and its direct surroundings, in addition to occasional unauthorised access by people.

There are times when significant numbers of waterbirds (over 300) access the dam (see Figure C4). There are abattoir effluent ponds located 500 m south of the catchment and while these ponds pose no direct risk to the Pinwernying Dam, it is possible that the birds might visit the ponds and then the dam, thereby transporting contaminants from the ponds into the dam.

It is important to appreciate that this raw-water data 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 and addresses these water quality issues before supplying to consumers.

3 Land uses and activities

The proposed Katanning Catchment Area is located entirely on land owned by the Water Corporation. Current land uses and activities and their risks to the drinking water source are described below, and shown in Figure A4. Table 2, at the end of this section, summarises this information in an easy-to-read format. Appendix D displays a more detailed risk assessment, and includes recommended protection strategies to address water quality risks.

3.1.1 Roads and tracks

There are several management tracks in the catchment. The Water Corporation maintains these on a regular basis to ensure adequate access. These are gated, but there was one incident of a gate being destroyed to obtain unauthorised access.

The erosion caused by vehicles contributes to turbidity in the water body. Hydrocarbon contamination can also come from vehicle leaks or spills.

3.1.2 Communication tower

There is a communication tower located on Water Corporation freehold land. This is a low risk landuse, however maintenance can pose hydrocarbon and turbidity risks.

3.1.3 Animal access

Significant numbers of native (including waterbirds) and pest animals regularly access the Pinwernying Dam. This access poses a high risk of pathogen contamination.

A cyclone fence is proposed to be installed. While this will not prevent bird access, it will reduce access by other animals.

3.1.4 Unauthorised recreation

There have been reports of illegal recreation in Pinwernying Dam. Evidence has been found of activities occurring such as swimming, fishing and marroning.

Body contact with the water can result in pathogen contamination, which puts the community at risk of serious health issues from consuming the contaminated water. Swimming, fishing and marroning in the reservoir is illegal and penalties may apply under the *Country Areas Water Supply Act 1947* and the *Water Services Act 2012*.

The Water Corporation is proposing to install a cyclone fence surrounding the Pinwernying Dam and its drainage diversions. This will help reduce illegal access.

3.1.5 Aboriginal sites of significance and native title claims

Aboriginal sites of significance are important places with special cultural connections to Aboriginal people. They are important because they link Aboriginal cultural tradition to place, land and people over time. These sites are integral to the lives of Aboriginal people, and are found in urban, rural and remote areas. They are most common near rivers, lakes, swamps, hills and the coast. The *Aboriginal Heritage Act*

1972 protects all Aboriginal places and objects that are culturally important to Aboriginal people. It is against the law to disturb a site or to remove artefacts.

There is one Aboriginal site of significance that is partly within the proposed Katanning Catchment Area. This is the Katanning Town Creek (Site ID 22816).

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 three native title claims within the proposed Katanning Catchment Area. These are Wagyl Kaip (WAD6286/1998), Single Noongar Claim (WAD6006/2003) and Southern Noongar (WAD6134/1998).

The State Government of Western Australia and the Noongar native title claimants have negotiated a South West Native Title Settlement. The settlement recognises the Noongar people as the traditional owners of land in the South West Settlement Area, which extends from a point south of Dongara on the west coast, approximately east to a point north of Moora and then south-easterly to a point midway between Albany and Esperance (see Figure A6).

The Katanning Catchment Area is in the South West Native Title Settlement Area and therefore the three native title claims listed above will be extinguished as part of the agreement.

The settlement includes six identical Indigenous Land Use Agreements (ILUAs). The agreements enable some types of land-based customary activities to be undertaken by Noongar people in PDWSAs within the South West Settlement Area. The Department of Water and Environmental Regulation amended two sets of by-laws (Metropolitan Water Supply, Sewerage and Drainage By-laws 1981 and the Country Areas Water Supply By-laws 1957) on 8 June 2016 to enable Noongar people to undertake some of these land-based activities.

Some of the land-based activities include:

- entry to registered Aboriginal sites in RPZs for customary purposes
- gathering invertebrates and eggs, lighting fires and gathering flora for customary purposes.

The ILUA is available via the Department of the Premier and Cabinet, see www.dpc.wa.gov.au. Refer to Water quality information sheet 39: *Aboriginal customary activities in public drinking water source areas in the South West Native Title Settlement Area* (Department of Water 2016).

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

4 Contamination risks

Table 2 Summary of key potential water quality risks, land use compatibility and best management practices

Land use/activity	Hazard	Management priority	Compatibility of land use/activity	Best management practice guidance¹
Roads and tracks (see Figure C8)	Hydrocarbons Turbidity	Medium	Existing roads are acceptable, but need to be managed to control access	WQPN no.44: <i>Roads near sensitive water resources</i>
Illegal recreation, including swimming, fishing and marroning	Pathogens from body contact	Medium	These activities are illegal and penalties may apply	Operational policy 13: <i>Recreation within public drinking water source areas on Crown land</i>
Access by animals including birds, kangaroos and rabbits	Pathogens from excrement and carried from nearby waste ponds	High	Not applicable	WQPN no.96: <i>Pest animal management in PDWSAs</i>

¹Water quality protection notes (WQPNs) are available www.dwer.wa.gov.au.

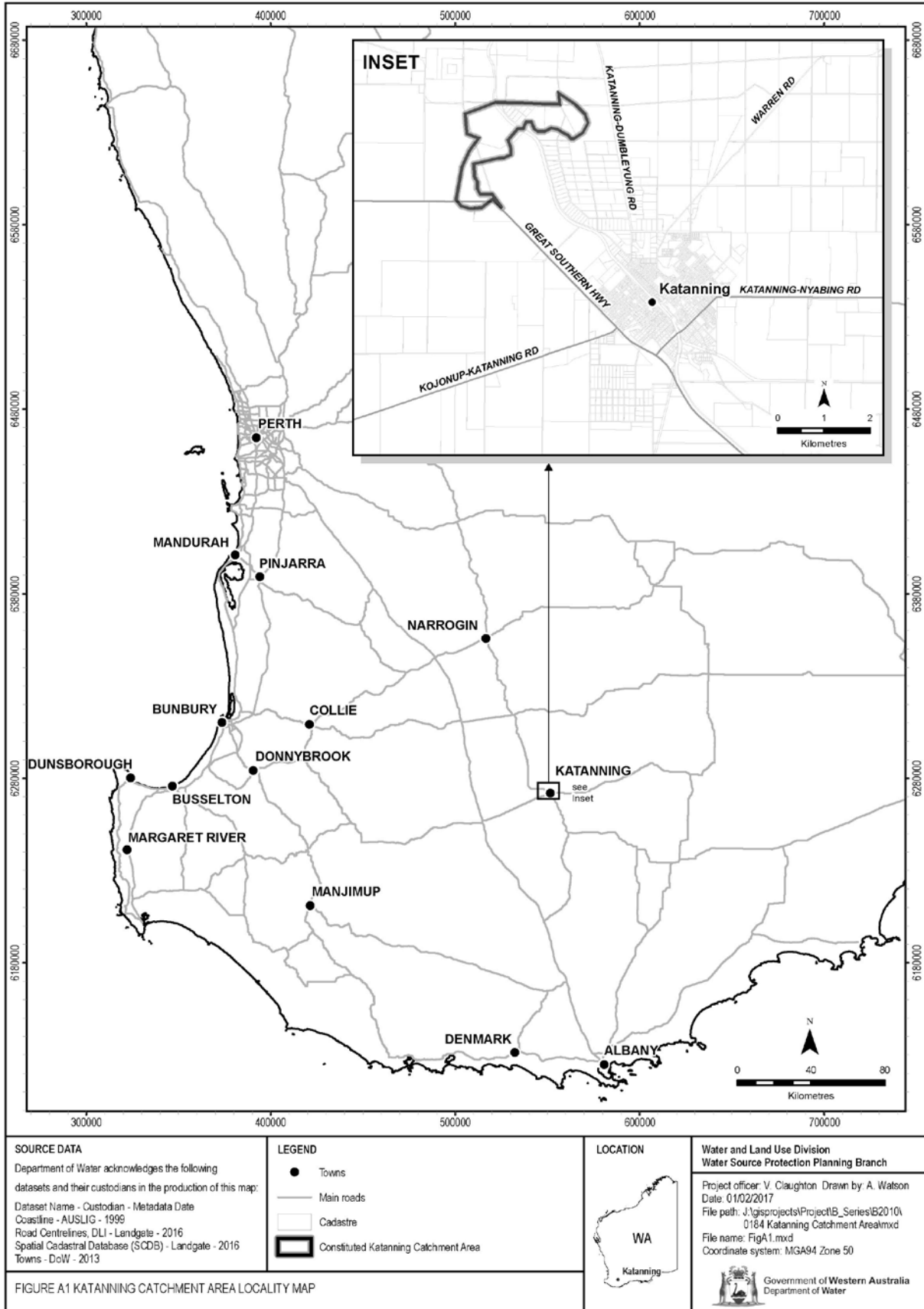
5 Recommendations

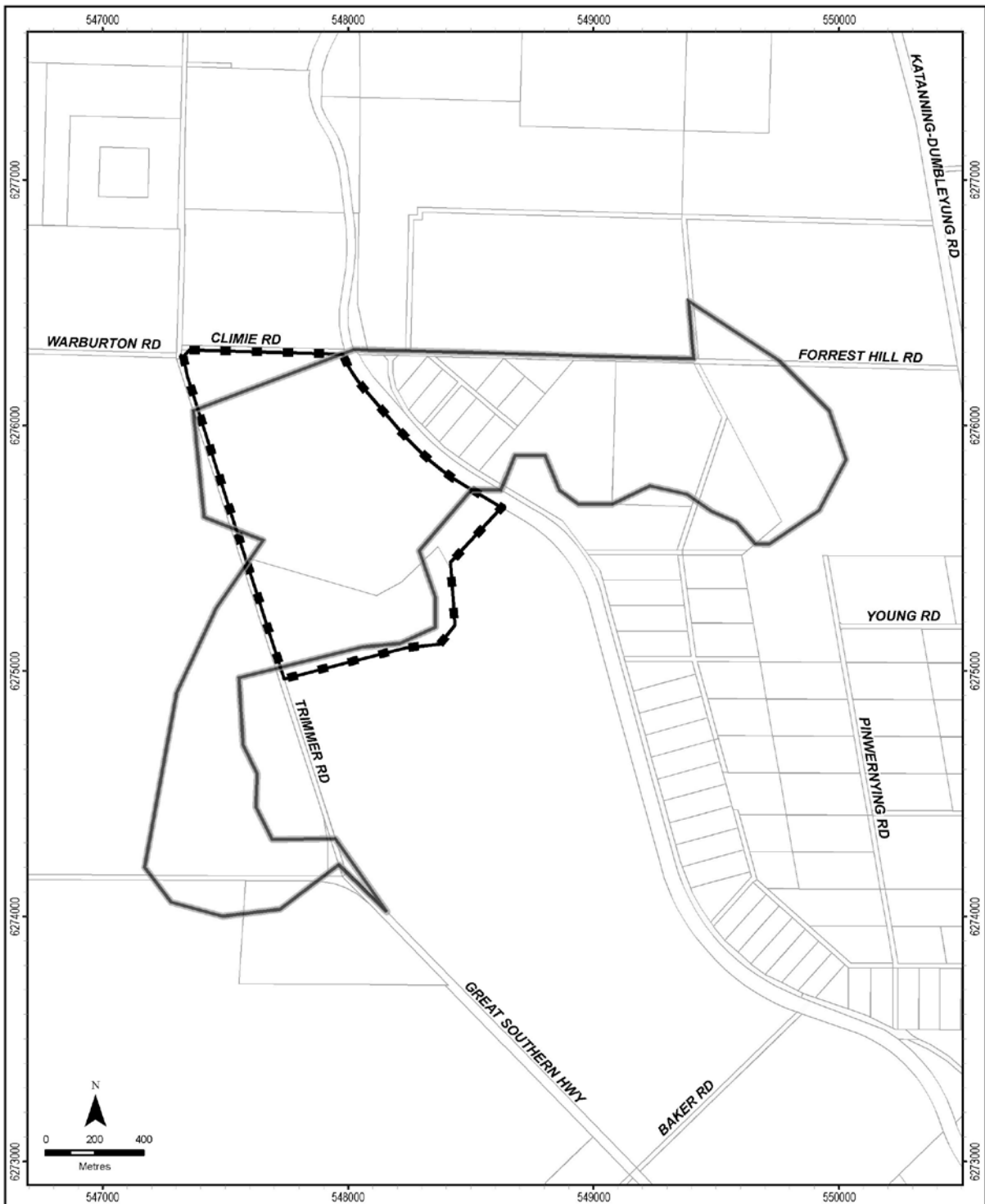
Based on the findings of this plan, the following recommendations will now be applied to the Katanning Catchment Area. The bracketed stakeholders are those expected to have a responsibility for, or an interest in, the implementation of that recommendation.

1. After this report is published, the Department of Water and Environmental Regulation will progress constitution of the amended Katanning Catchment Area under the *Country Areas Water Supply Act 1947*, in accordance with Figure A5. (Department of Water and Environmental Regulation)
2. Incorporate the findings of this plan and the location of the Katanning Catchment Area (including its priority area and protection zone) in the Shire of Katanning's local planning scheme in accordance with the Western Australian Planning Commission's State planning policy no. 2.7: *Public drinking water source policy*. (Shire of Katanning)
3. Refer development proposals within the Katanning Catchment Area that are inconsistent with the Department of Water and Environmental Regulation's WQPN no. 25: *Land use compatibility tables for public drinking water source areas* or recommendations in this plan to the Department of Water and Environmental Regulation regional office for advice. (Department of Planning, Lands and Heritage, Shire of Katanning, proponents of proposals)
4. Ensure incidents covered by Westplan–HAZMAT in the Katanning Catchment Area are addressed by ensuring that:
 - the Great Southern Emergency Management District local emergency management committee is aware of the location and purpose of the Katanning Catchment Area
 - the locality plan for the Katanning Catchment Area 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 Katanning Catchment Area
 - personnel dealing with Westplan–HAZMAT incidents in the area have ready access to a locality map of the Katanning Catchment Area and information to help them recognise the potential impacts of spills on drinking water quality. (Water Corporation)
5. Maintain signs along the boundary of the Katanning Catchment Area including an emergency contact telephone number, in accordance with the Water Corporation's *S111 Source protection signage* (2013). (Water Corporation)
6. Water Corporation should continue the current regime of water quality monitoring, maintenance of fencing, inspections and by-law enforcement. (Water Corporation)
7. This report will be reviewed in seven years or in response to changes in water quality contamination risks. (Department of Water and Environmental Regulation)

Appendices

Appendix A – Figures





SOURCE DATA

Department of Water acknowledges the following datasets and their custodians in the production of this map:
 Dataset Name - Custodian - Metadata Date
 Coastline - AUSLIG - 1999
 Road Centrelines, DLI - Landgate - 2016
 Spatial Cadastral Database (SCDB) - Landgate - 2016
 Towns - DoW - 2013

LEGEND

-  Constituted Katanning Catchment Area
-  Proposed Katanning Catchment Area
-  Cadastre

LOCATION



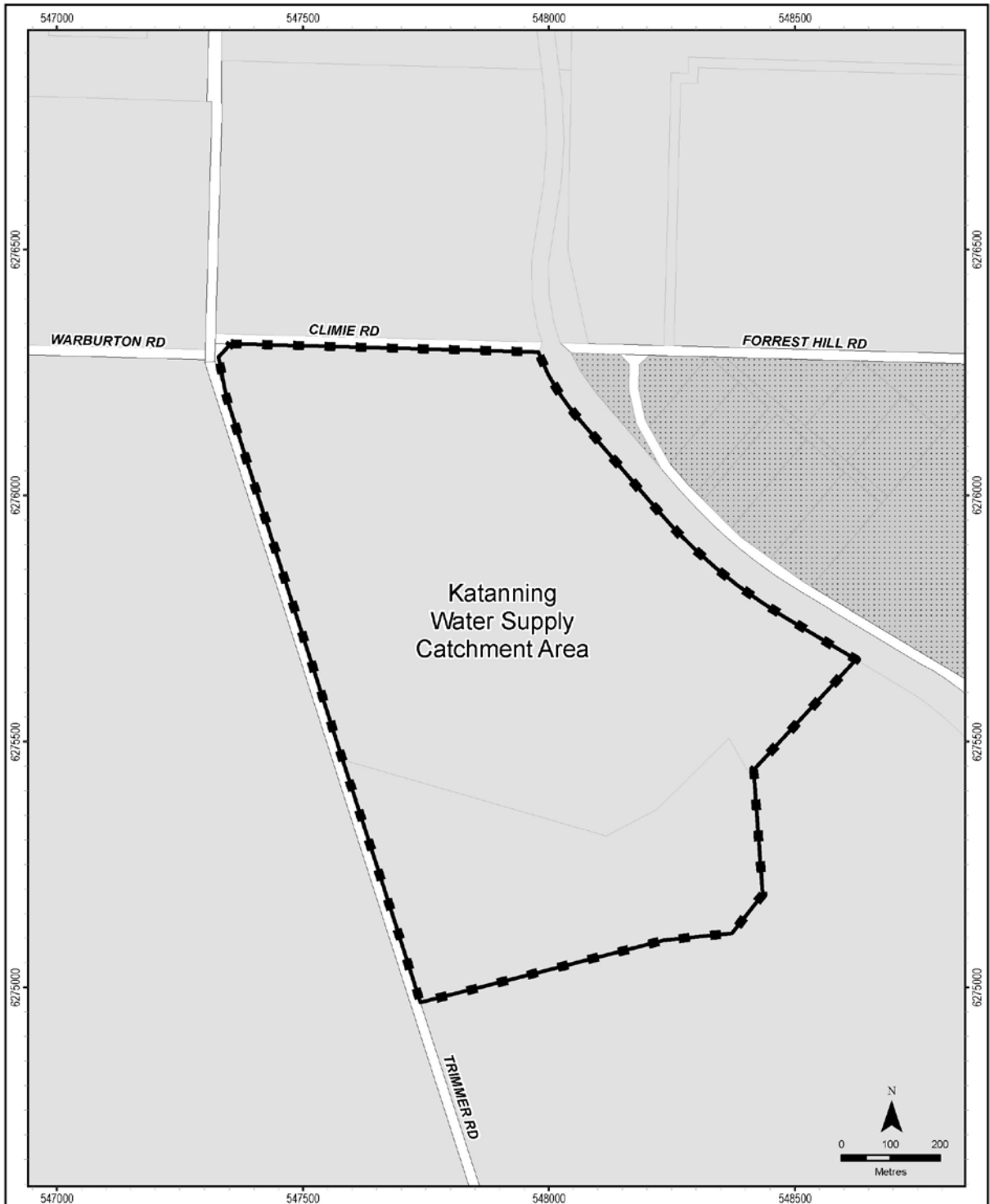
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 Water Source Protection Planning Branch**

Project officer: V. Cloughton Drawn by: A. Watson
 Date: 01/02/2017
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 File name: FigA2.mxd
 Coordinate system: MGA84 Zone 50



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FIGURE A2 EXISTING AND PROPOSED KATANNING CATCHMENT AREA









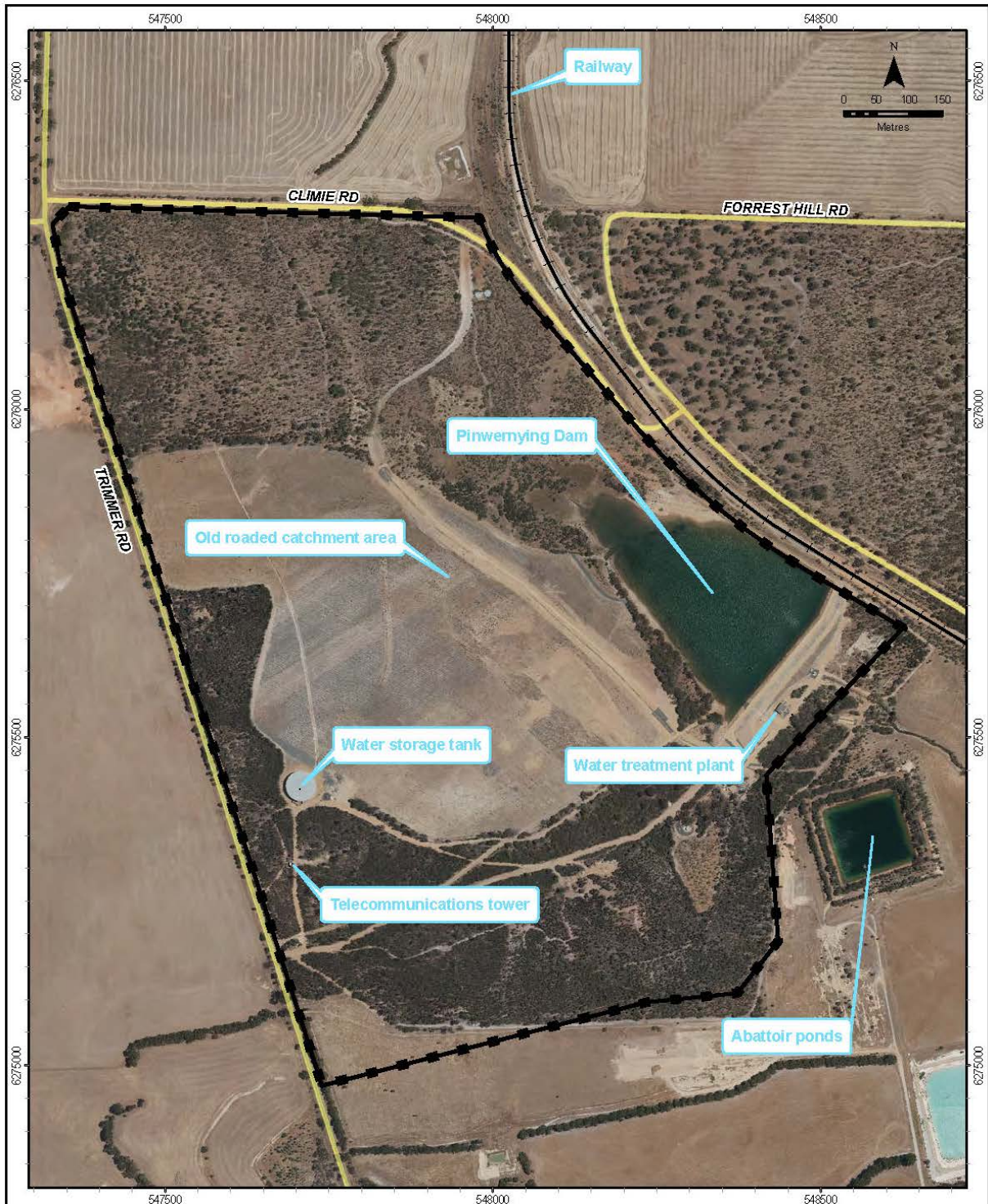
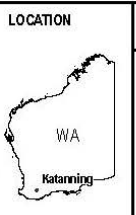
<p>SOURCE DATA</p> <p>Department of Water acknowledges the following datasets and their custodians in the production of this map:</p> <p>Dataset Name - Custodian - Metadata Date Coastline - AUSLIG - 1999 Road Centrelines, DLI - Landgate - 2016 Spatial Cadastral Database (SCDB) - Landgate - 2016 Towns - DoW - 2013</p>	<p>LEGEND</p> <p> Proposed Katanning Water Supply Catchment Area</p> <p>Land Tenure</p> <p> Crown Reserve</p> <p> Freehold</p> <p> Public Roads</p>	<p>LOCATION</p> 	<p>Water and Land Use Division Water Source Protection Planning Branch</p> <p>Project officer: V. Cloughton Drawn by: A. Watson Date: 01/02/2017 File path: J:\gis\projects\Project\B_Series\B2010\0184 Katanning Catchment Area.mxd File name: FigA3.mxd Coordinate system: MGA94 Zone 50</p>  <p>Government of Western Australia Department of Water</p>
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FIGURE A3 TENURE IN AND AROUND THE KATANNING WATER SUPPLY CATCHMENT AREA



SOURCE DATA
 Department of Water acknowledges the following datasets and their custodians in the production of this map:
 Dataset Name - Custodian - Metadata Date
 Coastline - AUSLIG - 1999
 Katanning Townsite 2014 10cm z50 - Landgate - 2014
 Railways - Landgate - 2010
 Road Centrelines, DU - Landgate - 2016
 Towns - DoW - 2013

LEGEND	
	Proposed Katanning Water Supply Catchment Area
	Railways
	Roads

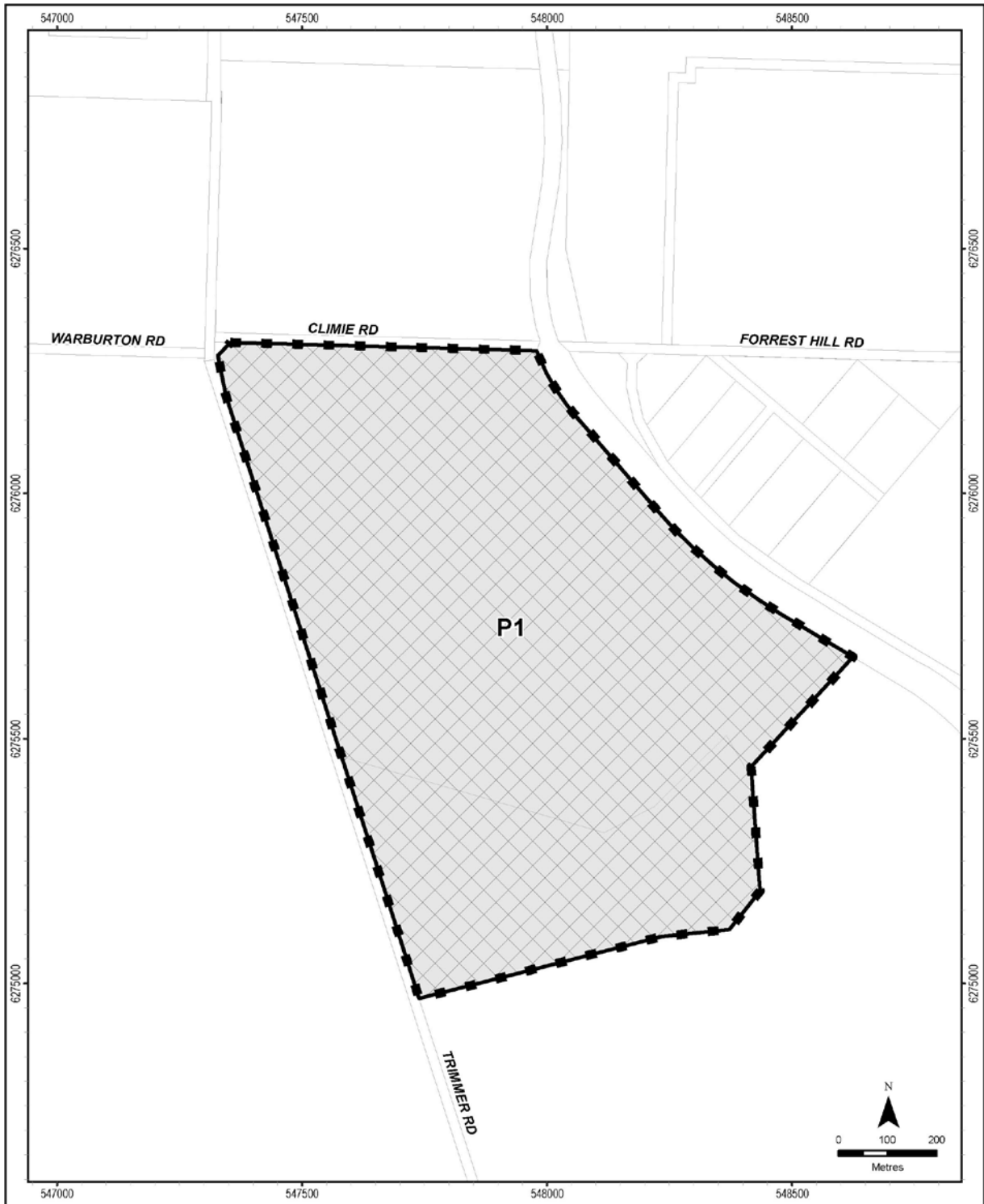


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Water Source Protection Planning Branch

Project officer: V. Cloughton Drawn by: A. Watson
 Date: 01/02/2017
 File path: J:\gisprojects\ProjectB_Series\B2010\0184 Katanning Catchment Area.rxd
 File name: FigA4.rxd
 Coordinate system: MGA94 Zone 50

FIGURE A4 AERIAL PHOTOGRAPHY AND LAND USES IN THE KATANNING WATER SUPPLY CATCHMENT AREA





SOURCE DATA

Department of Water acknowledges the following datasets and their custodians in the production of this map:
 Dataset Name - Custodian - Metadata Date
 Coastline - AUSLIG - 1999
 Road Centrelines, DLI - Landgate - 2016
 Spatial Cadastral Database (SCDB) - Landgate - 2016
 Towns - DoW - 2013

LEGEND

-  Proposed Katanning Catchment Area
-  Proposed Priority One Area (P1)
-  Proposed Reservoir Protection Zone
-  Cadastre

LOCATION



**Water and Land Use Division
 Water Source Protection Planning Branch**

Project officer: V. Cloughton Drawn by: A. Watson
 Date: 01/02/2017
 File path: J:\gis\projects\Project\B_Series\B2010\0184_Katanning_Catchment_Area.mxd
 File name: FigA5.mxd
 Coordinate system: MGA94 Zone 50



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FIGURE A5 PROPOSED BOUNDARY, PRIORITY AREA AND RESERVOIR PROTECTION ZONE IN THE KATANNING CATCHMENT AREA

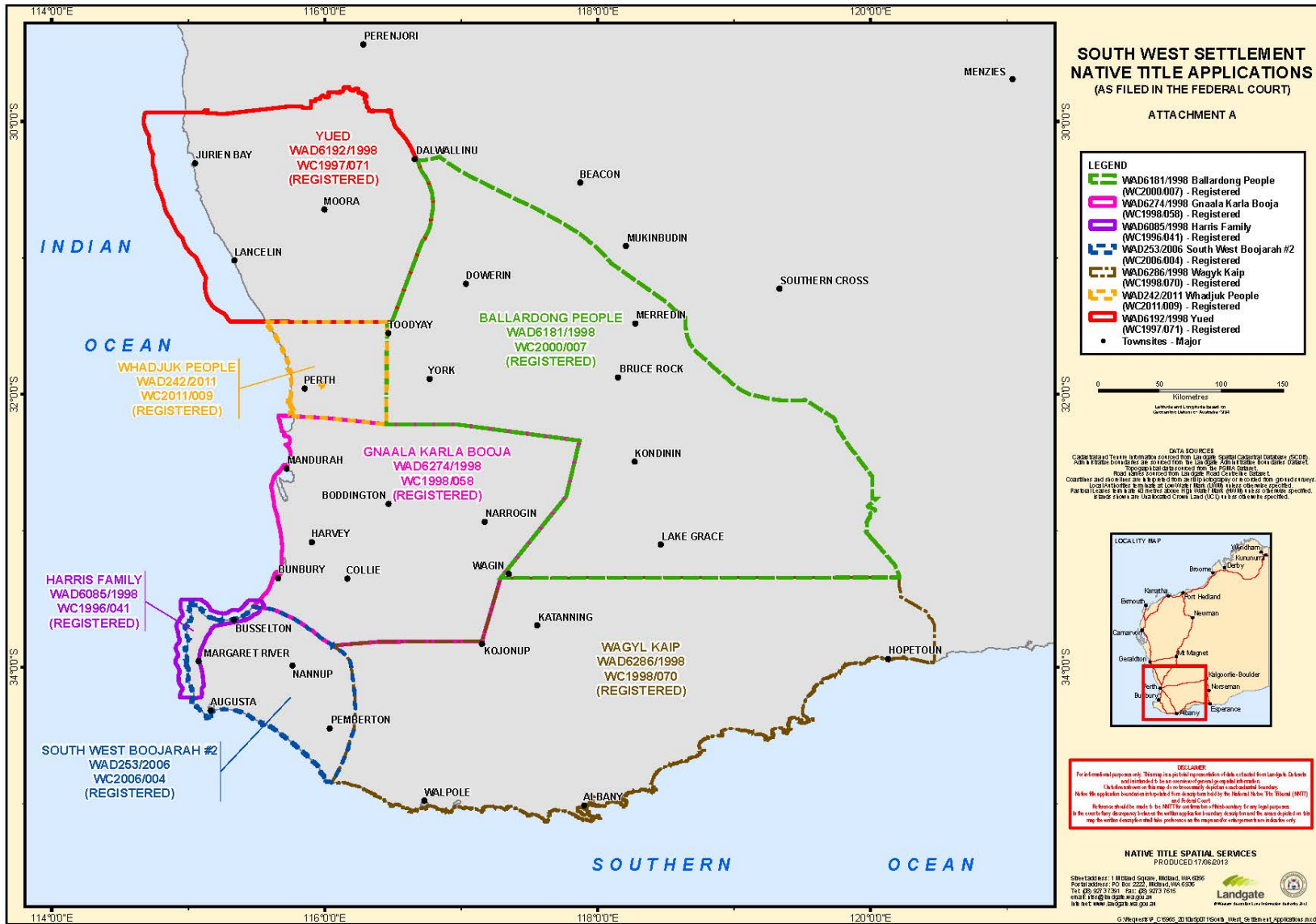


Figure A6 South West Native Title Agreement area (source: Department of Premier and Cabinet)

Appendix B – 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 Pinwernying Dam 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 Pinwernying Dam. 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 December 2011 to November 2016.

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 health guideline values of the ADWG.

For more information on the quality of drinking water supplied to Katanning refer to the most recent Water Corporation drinking water quality annual report at watercorporation.com.au.

Aesthetic characteristics

The aesthetic quality analyses for raw water from Pinwernying Dam are summarised in the following table.

Aesthetic detections for Pinwernying Dam (Katanning)

Parameter	Units	ADWG aesthetic guideline value ¹	Pinwernying Dam (Katanning)	
			Range	Mean
Aluminium (acid soluble)	mg/L	0.2	0.035– 3.3	0.075
Ammonia as nitrogen	mg/L	0.41	0.014–0.018	0.016
Chloride	mg/L	250	90–145	105
Colour (true)	TCU	15	1–12	6
Copper	mg/L	1	<0.002–0.002	<0.002
Hardness as CaCO ₃	mg/L	200	42–58	50
Iron unfiltered	mg/L	0.3	0.08– 0.66	0.26
Manganese unfiltered	mg/L	0.1	<0.002–0.03	0.007
Silicon as SiO ₂	mg/L	80	<0.2–2.1	0.45
Sodium	mg/L	180	44–77	52.5
Sulfate	mg/L	250	8–22	9.25
Total filterable solids by summation	mg/L	600	183–299	216
Turbidity	NTU	5	0.2– 9	1.1
pH measured in laboratory	no units	6.5–8.5	6.81– 10.3	7.46

¹ 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 Pinwernying Dam 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 Katanning (Pinwernying Dam)

Parameter	Units	ADWG health guideline value ²	Pinwernying Dam (Katanning)	
			Range	Mean
Barium	mg/L	2	0.011–0.035	0.0225
Boron	mg/L	4	0.04–0.06	0.04
Copper	mg/L	2	<0.002–0.002	<0.002
Fluoride (lab measured)	mg/L	1.5	0.65–0.95	0.8
Iodide	mg/L	0.5	0.05–0.05 ⁴	0.05
Manganese (unfiltered)	mg/L	0.5	<0.002–0.03	0.007
Nitrite plus nitrate as N	mg/L	11.29 ³	<0.05–0.2	<0.05
Radon-222	Bq/L	100	0.043–0.043 ⁴	0.043
Sulfate	mg/L	500	8–22	9.25

² 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 (NHMRC & NRMCC 2004).

³ A 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.

⁴ Only one sample was taking during the review period.

Microbiological contaminants

Microbiological testing of raw-water samples from Pinwernying Dam is currently conducted on a weekly basis. *Escherichia 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 may indicate contamination of faecal material.

During the reviewed period, positive *E. coli* counts were recorded in 84 per cent of samples. Of these, 11 per cent of samples had *E. coli* counts greater than 20 MPN/100mL. The maximum *E. coli* count was 160 MPN/100mL.

Appendix C – Photographs

Photographs by V. Claughton, Department of Water and Environmental Regulation



Figure C1 Old roaded catchment under revegetation



Figure C2 Drainage diversions within the Katanning Catchment Area



Figure C3 Water storage tank within the Katanning Catchment Area

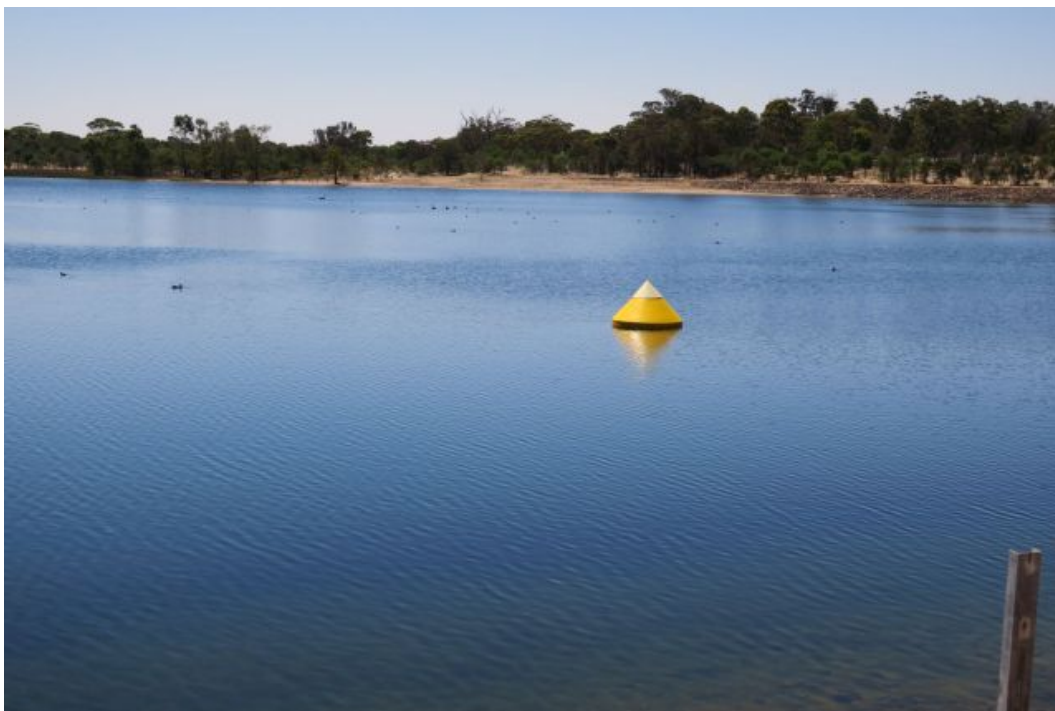


Figure C4 Pinwernying Dam and waterbirds



Figure C5 Wetland at the back of the Pinwernying Dam



Figure C6 Pinwernying dam wall and Katanning water treatment plant



Figure C7 Katanning Catchment Area road and signs



Figure C8 Katanning Catchment Area fencing and neighbouring road and railway

Appendix D – Land uses, potential water quality risks and recommended protection strategies

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	Management priority			
Roads and tracks	Hydrocarbon and chemicals from leaks and accidents	High	Existing sealed roads are acceptable. Public access is not common.	<ul style="list-style-type: none"> • water quality monitoring • gates and signs • emergency response to spills and accidents 	<ul style="list-style-type: none"> • WQPN no. 44: <i>Roads near sensitive water resources</i> • WQPN no. 10: <i>Contaminant spills emergency response</i> • Increase signs to inform people that they are within the catchment area and there is a need to protect water quality
	Turbidity from erosion and runoff	Medium			
Illegal recreation such as swimming,	Pathogens from body contact	Medium	These illegal activities are not a regular occurrence.	<ul style="list-style-type: none"> • water quality monitoring 	<ul style="list-style-type: none"> • Operational policy no. 13: <i>Recreation within public</i>

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	Management priority			
fishing and marroning	Turbidity from erosion	Low		<ul style="list-style-type: none"> • surveillance and enforcement • gates and signs 	<p><i>drinking water source areas on Crown land</i></p> <ul style="list-style-type: none"> • Increase signs to inform people that they are within the catchment area and there is a need to protect water quality • Increase fencing and surveillance
Telecommunications tower	Hydrocarbon spills and turbidity from infrastructure works and access	Low	Compatible with conditions.	<ul style="list-style-type: none"> • water quality monitoring • development conditions 	<ul style="list-style-type: none"> • WQPN no. 10: <i>Contaminant spills – emergency response</i> • WQPN no. 83: <i>Infrastructure corridors near sensitive water resources</i>
Access by animals including birds, kangaroos and rabbits	Pathogens from excrement and carried from nearby waste ponds	High	A larger cyclone fence is proposed to be installed to reduce animal access.	<ul style="list-style-type: none"> • water quality monitoring • fencing 	<ul style="list-style-type: none"> • WQPN no. 96: <i>Pest animal management in PDWSAs</i>

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	Management priority			
	Turbidity from animals access to the water	Low	Preventing bird access is difficult.		

Appendix E – Typical contamination risks in surface water sources

Land development and land- or water-based activities within a catchment area can directly affect the quality of drinking water and its treatment. Contaminants can reach drinking water sources through runoff over the ground and infiltration through soil. A wide range of microbiological, chemical and physical contamination risks can impact on water quality and therefore affect the provision of safe, good quality drinking water to consumers.

Some contaminants in drinking water can affect human health resulting in illness, hospitalisation or even death. Other impurities can affect the water's aesthetic qualities, including its appearance, taste, smell and 'feel' but are not necessarily hazardous to human health. For example, cloudy water with a distinctive odour or strong taste may not be harmful to health, but clear, pleasant-tasting water may contain harmful, undetectable microorganisms (NHMRC & NRMCC 2011). Contaminants can also interfere with water treatment processes, and damage water supply infrastructure (such as iron corroding pipes).

The *Australian drinking water guidelines* (ADWG; NHMRC & NRMCC 2011) outline criteria for acceptable drinking water quality to protect human health, manage aesthetics and maintain water supply infrastructure.

Some commonly seen contamination risks relevant to surface water drinking water sources are described below.

Microbiological risks

Pathogens are types of microorganisms that are capable of causing illness and include bacteria, protozoa and viruses. When people consume drinking water that is contaminated with pathogens, the consequences vary considerably, ranging from mild illness (such as stomach upset or diarrhoea) to hospitalisation and in some cases even death. For example, seven people died and about 2500 became ill in Walkerton, Canada, during 2000, because the town's water supply was contaminated by a pathogenic strain of *Escherichia coli* and *Campylobacter* (NHMRC & NRMCC 2011).

The types of pathogens that are likely to cause harm to people are commonly found in the faeces of humans and domestic animals (such as dogs and cattle). These pathogens can enter drinking water supplies from faecal contamination in the catchment area, either directly or indirectly.

Directly: When people or domestic animals come into contact with a body of water, pathogens may enter that water source. This occurs through the direct transfer of faecal material into the water such as while fishing, marroning or swimming.

Indirectly: Pathogens can wash over or infiltrate into the soil, and find their way into water supplies, such as from septic tanks or animal manure deposited in paddocks.

A number of pathogens are commonly known to contaminate water supplies worldwide. These include bacteria (for example *Salmonella*, *Escherichia coli* and cholera), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses. Monitoring for the presence of *E. coli* in water supplies provides an indication of the level of recent faecal contamination.

Pathogen contamination of a drinking water source is influenced by many factors including the existence of pathogen carriers (humans and domestic animals), the transfer to and movement of the pathogen in the water source and its ability to survive in the water.

The percentage of humans in the world that carry pathogens varies. For example, it is estimated that between 0.6 to 4.3 per cent of people are infected with *Cryptosporidium* worldwide, and 7.4 per cent with *Giardia* (Geldreich 1996).

The ability of pathogens to survive in surface water differs between species. *Salmonella* may be viable for two to three months, *Giardia* may still infect after a month in the natural environment (Geldrich 1996) and *Cryptosporidium* oocysts (cells containing reproductive spores) may survive weeks to months in fresh water (NHMRC & NRMCC 2011).

Unlike chemicals, which dissipate and dilute when they enter a water source, pathogens can multiply under the right conditions, increasing the likelihood of contamination. Therefore it is important to understand both the groundwater and surface water systems to be able to protect the drinking water source from pathogens.

Given the wide variety of pathogens, their behaviour in the environment and the potential consequences of consuming contaminated water, the most effective way to protect public health and reduce water treatment costs is to avoid the introduction of pathogens into a water source.

Physical risks

Turbidity is the result of soil or organic particles becoming suspended in water (cloudiness). Erosion from activities such as off-road driving and clearing of vegetation can cause turbidity in surface water sources. Increased turbidity can result in cloudy or muddy-looking water, which is not aesthetically appealing to consumers. Turbidity can also reduce the effectiveness of treatment processes (such as disinfection). This is because pathogens and chemicals can attach onto soil particles and become more difficult to remove during disinfection and treatment processes. High levels of turbidity in a water body can also affect the environment. Suspended particles smother riparian vegetation and reduce the ability of light to penetrate the water column. This affects plant growth which in turn can affect water quality.

Other physical properties of water can affect water supply infrastructure, or the aesthetics of the drinking water. For example, pH can contribute to the corrosion and encrustation of pipes; iron and dissolved organic matter can affect the colour and smell of water; and salinity levels can affect its taste. Although not necessarily

harmful to human health, water with properties like this will be less appealing to customers.

Chemical risks

Chemicals can occur in drinking water as a result of natural leaching from mineral deposits or from different land uses (NHMRC & NRMMC 2011). A number of these chemicals (organic and inorganic) are potentially toxic to humans.

Pesticides include agricultural chemicals used to control weeds (herbicides) and pests (insecticides, rodenticides, nematicides (for worms) and miticides (for mites)). Contamination of a drinking water source by pesticides (and other chemicals) may occur as a result of accidental spills, incorrect use or leakage from storage areas. In these cases, the relevant authorities should be notified promptly and the spill cleaned up to prevent contamination of the drinking water source.

Hydrocarbons such as fuels and oils are potentially toxic to humans. Harmful chemical by-products may be formed when hydrocarbons are combined with chlorine during the water treatment process. Hydrocarbons can occur in water supplies as a result of spills and leaks from vehicles and machinery.

Drinking water sources can also be contaminated by nutrients such as nitrogen and phosphorus. Nutrients can be introduced into a catchment via the application of fertiliser, from septic systems, and from animal faecal matter deposited in the catchment that washes over soil and down waterways and into the water supply. Nitrate and nitrite are two forms of nitrogen that can be toxic to humans at high levels, with infants younger than three months being most susceptible (NHMRC & NRMMC 2011).

Other chemicals and heavy metals can be associated with land uses such as industry and landfill. These may enter groundwater and could be harmful to human health if consumed.

Appendix F – How do we protect public drinking water source areas?

The *Australian drinking water guidelines* (ADWG; NHMRC & NRMCC 2011) outline how we should protect drinking water in Australia. The ADWG recommends a 'catchment to consumer' framework that uses an approach based on preventive risk and multiple barriers. 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 the taps in your home. It ensures a holistic assessment of water quality risks and solutions to ensure the delivery of a reliable and safe drinking water to supply your home.

An approach based on preventive risk means that we look at all the different risks to water quality. We determine what risks can reasonably be avoided and what risks need to be minimised or managed to protect public health. This approach means that the inherent risks to water quality are as low as possible. A risk-based approach is often suggested as a way to address risks to water quality in a public drinking water source area (PDWSA; the area from which water is captured to supply drinking water). However, a risk-based approach is not the same as an approach based on preventive risk. A risk-based approach is inadequate for addressing risks to public health, and is not recommended by the ADWG.

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 PDWSA. If we get this barrier right, it has a flow-on effect that can result in a lower cost, safer drinking water supply. Other barriers against contamination include storage of water to help reduce contaminant levels, disinfecting the water (for example chlorination to inactivate pathogens), maintenance of pipes and testing of water quality.

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 report is important. We should not forget that ultimately it's about safeguarding your health by protecting water quality now and for the future.

An additional benefit from PDWSA protection is that it complements the state's conservation initiatives.

In Western Australia, the Department of Water and Environmental Regulation protects PDWSAs by implementing the ADWG, writing reports, policies and guidelines, and providing input into land use planning.

This drinking water protection report achieves elements 2 and 3 of the 12 elements in the ADWG recommended for protecting drinking water. It shows the PDWSA's location, its characteristics, existing and potential water quality contamination risks, and makes recommendations to deal with those risks.

The *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* and the *Country Areas Water Supply Act 1947* provide us with legislative tools to protect water quality for PDWSAs. These Acts and the associated by-laws allow us to assess and manage the water quality contamination risks from different land uses and activities. The department works cooperatively with other agencies and the community to implement this legislation and develop drinking water source protection reports. For example, the Western Australian Planning Commission has developed a number of state planning policies to help guide development in PDWSAs.

An important step in maximising the protection of water quality in PDWSAs is to define their boundaries, priority areas and protection zones to help guide land use planning and to identify where legislation applies. Our Strategic policy: *Protecting public drinking water source areas in Western Australia* (Department of Water 2016a) describes how we do this. It is available www.dwer.wa.gov.au.

There are three different priority areas. The objective of priority 1 (P1) areas is risk avoidance – ensuring there is no degradation of the water quality (for example over Crown land). The objective of priority 2 (P2) areas is risk minimisation – maintaining or improving water quality (for example over rural-zoned land). The objective of priority 3 (P3) areas is risk management – maintaining the water quality for as long as possible (for example, urban- or commercial-zoned land). Protection zones surround drinking water abstraction bores and surface water reservoirs so that the most vulnerable areas are protected from contamination.

Our Water quality protection note (WQPN) no. 25: *Land use compatibility tables for public drinking water source areas* (Department of Water 2016b) outlines appropriate development and activities within each of the priority areas (P1, P2 and P3).

With more than 120 constituted PDWSAs across Western Australia, the department prioritises the update of drinking water source protection reports (such as this document). Our aim is to update each report every seven years. In some locations, more frequent updates may be required to address changing water quality risks and land uses. These updates allow us to make changes to the PDWSA boundary, priority areas and protection zones if required. They also allow solutions to new water quality risks to be considered.

There are three different types of drinking water source protection report – each providing for different needs. The following table shows the differences between the types of reports.

There is a fourth type of report – Land use and water management strategy – that performs the same functions as a drinking water source protection report. However, these strategies are prepared by the Western Australian Planning Commission (with input from the Department of Water and Environmental Regulation) and are strategic documents that integrate land use planning with water management. There are currently land use and water management strategies for Gnangara, Jandakot and Middle Helena.

If you would like more information about the ADWG and how we protect drinking water in Western Australia, visit www.dwer.wa.gov.au or read our Strategic policy: *Protecting public drinking water source areas in Western Australia* (Department of Water 2016a). You can also contact the Department of Water and Environmental Regulation's Water source protection planning branch on +61 8 6364 7600 or email drinkingwater@dwer.wa.gov.au.

Drinking water source protection reports produced by the Department of Water and Environmental Regulation

Drinking water source protection report	Scope and outcome	Consultation	Time to prepare	Implementation table	Gazettal
Drinking water source protection assessment (DWSPA)	Desktop assessment of readily available information	Preliminary	Up to 3 months	No	Arrange for the constitution and gazettal of the source under legislation. This helps protect water quality and guides land use planning. All types of consulted drinking water source protection reports can recommend to constitute a source's boundary under legislation.
Drinking water source protection plan (DWSPP)	Full investigation of risks to water quality building on information in the DWSPA	Public	6–12 months	Prepared from recommendations in the DWSPA and/or information from public consultation	
Drinking water source protection review (DWSPR)	Review changes in land and water factors and implementation of previous recommendations. Sometimes prepared to consider specific issues in a PDWSA	Key stakeholders	3–6 months	Prepared from recommendations in the DWSPA or DWSPP	

Appendix G – Understanding risks to drinking water quality

The existing integrated land use planning and public drinking water source area (PDWSA) protection program is based on the findings of three parliamentary committee reports in 1994, 2000 and 2010 (see *Further reading*). Since 1995, this program has resulted in the development of four Western Australian Planning Commission state planning policies (SPPs), recognising the importance of PDWSAs for the protection of water quality and public health:

- SPP no. 2.2: *Gnangara groundwater protection*
- SPP no. 2.3: *Jandakot groundwater protection*
- SPP no. 2.7: *Public drinking water source policy*
- SPP no. 2.9: *Water resources*.

This integrated program relies upon a risk assessment process based on preventive risk in each PDWSA through the development of drinking water source protection reports. It is important to understand how risks are assessed to appreciate the impact of development within PDWSAs.

Risk-based assessments normally focus on the acceptability of risks after mitigation (residual risks). For drinking water sources, an assessment based on preventive risk that considers both the maximum and residual risks is required. This means that in some cases, the maximum risks from land uses will still be considered unacceptable, even after mitigation has reduced the risk. This is a more conservative approach needed to protect the health of consumers.

Water quality risks are evaluated by considering the type and scale of a potential contamination event (consequence), together with the probability/frequency of that event occurring (likelihood). An understanding of this relationship will prevent the common misunderstanding that probability equals risk (see risk matrix below).

Risk matrix: Level of risk (from the Australian drinking water guidelines 2011)

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Moderate	High	Very high	Very high	Very high
Likely	Moderate	High	High	Very high	Very high
Possible	Low	Moderate	High	Very high	Very high
Unlikely	Low	Low	Moderate	High	Very high
Rare	Low	Low	Moderate	High	High

For example, just because a drinking water contamination incident has not occurred for many years (low likelihood) does not mean that the risk is low, because we also need to consider the consequence of that contamination when determining risk. Furthermore, no previous detection of contamination is not proof that the risk is acceptable.

Shortened forms

List of shortened forms

ADWG	<i>Australian drinking water guidelines</i>
ANZECC	Australian and New Zealand Environment Conservation Council
HAZMAT	hazardous materials
ILUA	Indigenous land use agreement
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
P1, P2, P3	priority 1, priority 2, priority 3
PDWSA	public drinking water source area
RPZ	reservoir protection zone
SPP	state planning policy
Westplan– HAZMAT	Western Australian plan for hazardous materials
WQPN	water quality protection note

Units of measurement

Bq/L	becquerel per litre
km	kilometre
km²	square kilometre
m	metres
mg/L	milligram per litre
mm	millimetre
MPN	most probable number
NTU	nephelometric turbidity units
TCU	true colour units

Volumes of water

One millilitre	0.001 litre	1 millilitre	(mL)
One litre	1 litre	1 litre	(L)
One thousand litres	1000 litres	1 kilolitre	(kL)
One million litres	1 000 000 litres	1 megalitre	(ML)
One thousand million litres	1 000 000 000 litres	1 gigalitre	(GL)

Glossary

Aesthetic guideline value	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 & NRMMC 2011).
Australian drinking water guidelines	The <i>National water quality management strategy: Australian drinking water guidelines 6, 2011</i> (NHMRC & NRMMC 2011) (ADWG) outlines acceptable criteria for the quality of drinking water in Australia (see <i>References</i>).
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Constitute	Define the boundaries of any catchment area or water reserve by Order in Council under the <i>Country Areas Water Supply Act 1947</i> or by Proclamation under <i>the Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> .
Contamination	A substance present at concentrations exceeding background levels that presents – or has the potential to present – a risk of harm to human health, the environment, water resources or any environmental value.
Drinking water source protection report	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.
Gazette	Publication within the Government Gazette of Western Australia of the Order in Council or Proclamation defining the boundaries of any catchment area or water reserve.
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 2011).
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.
Hydrology	The science dealing with water on the land, including such things as its properties, laws and geographical distribution.
mg/L	A measurement of something (such as salinity) in a solution, i.e. 0.001 grams per litre.

Microbe	A microorganism, usually one of vegetable nature, a germ. Also known as a bacterium, especially one causing illness.
Most probable number	A measure of microbiological contamination.
Nephelometric turbidity units	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 <i>Escherichia coli</i>), protozoa (such as <i>Cryptosporidium</i> and <i>Giardia</i>) and viruses.
pH	A logarithmic scale for expressing the acidity or alkalinity of a solution. A pH below 7 indicates an acidic solution and above 7 indicates an alkaline solution.
Pollution	Water pollution occurs when waste products change the physical, chemical or biological properties of the water, adversely affecting water quality, the ecosystem and beneficial uses of the water.
Public drinking water source area	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> .
Priority 1, 2 and 3	Three different priority areas are assigned within PDWSAs to guide land use decisions. The objective of priority 1 (P1) areas is <i>risk avoidance</i> , priority 2 (P2) areas is <i>risk minimisation</i> and priority 3 (P3) areas is <i>risk management</i> .
Reservoir	A dam, tank, pond or lake that captures water from a surface catchment to create a water supply source.
Reservoir protection zone	A buffer measured from the high water mark of a drinking water reservoir, and inclusive of the reservoir (usually 2 km). This is referred to as a prohibited zone under the Metropolitan Water Supply, Sewerage, and Drainage Act By-laws 1981.
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.
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	A measure of degree of colour in water.
Turbidity	The cloudiness or haziness of water caused by the presence of fine suspended matter.
Water quality	Collective term for the physical, aesthetic, chemical and biological properties of water.
Westplan–HAZMAT	State emergency management plan for hazardous materials emergencies.

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