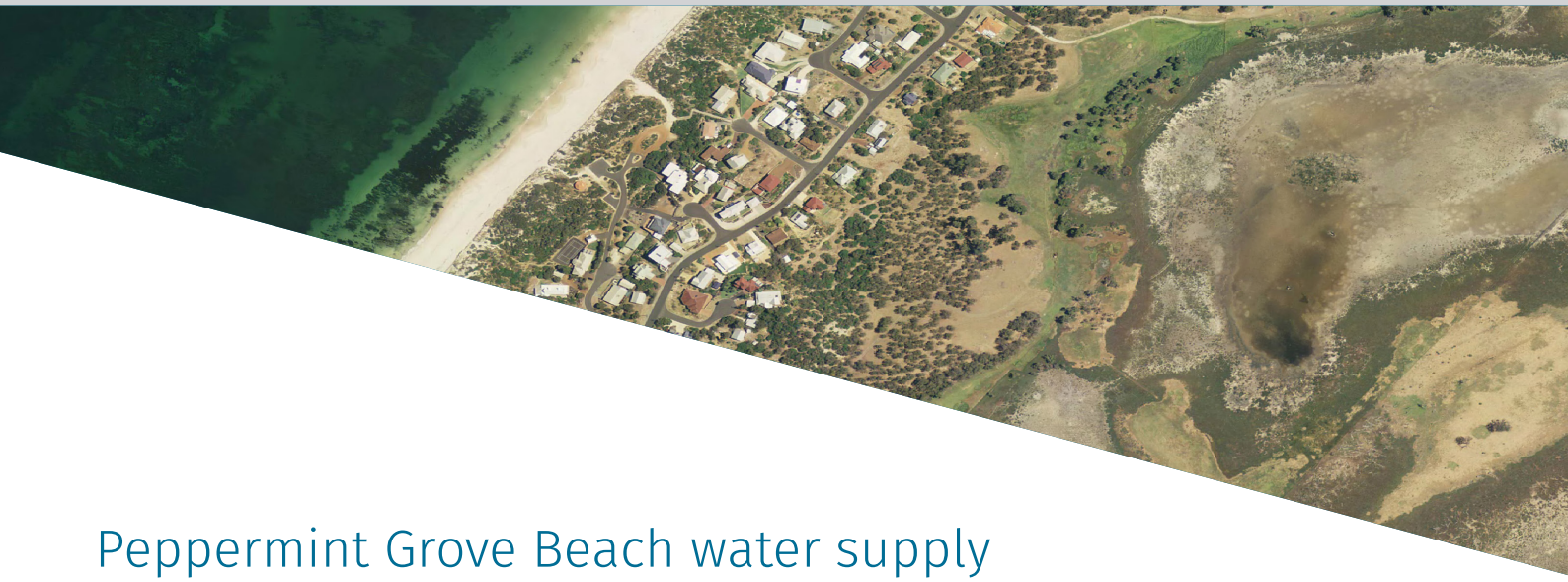
Government of **Western Australia**
Department of **Water and Environmental Regulation**

Peppermint Grove Beach Water Reserve

drinking water source protection plan



Peppermint Grove Beach water supply

Water resource protection series
Report WRP 175
July 2018

Peppermint Grove Beach Water Reserve drinking water source protection plan

Peppermint Grove Beach town water supply

Department of Water and Environmental Regulation

Water resource protection series

Report no. 175

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Cover photograph: Aerial photo of the proposed Peppermint Grove Beach Water Reserve

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Summary

Peppermint Grove Beach is a small coastal village located about 6 km north-west of Capel on the Swan Coastal Plain, within the Shire of Capel. The resident population at Peppermint Grove Beach was around 400 in 2014, however during holiday periods the population can increase substantially (Shire of Capel 2014).

Peppermint Grove Beach's drinking water is supplied by the Water Corporation from the Yarragadee aquifer. The water supply system consists of two Water Corporation production bores and a water treatment plant. These are contained within a single compound located in the centre of the residential area, approximately 250 m inland from the ocean. The water supply scheme provides drinking water to more than 300 households and other premises in Peppermint Grove Beach.

The Yarragadee aquifer is a deep, confined water source at Peppermint Grove Beach. There is very low risk of contamination of the Yarragadee aquifer from land uses surrounding the production bores because of the confined nature of the aquifer.

The boundaries and priority areas have been determined to provide an appropriate level of protection for Peppermint Grove Beach's drinking water source. The proposed Peppermint Grove Beach Water Reserve will cover only the Water Corporation compound containing the production bores (see Figure A4).

Some of the protection strategies recommended include:

- The proposed Peppermint Grove Beach Water Reserve needs to be proclaimed.
- The land in the proposed water reserve should be assigned a priority 1 (P1) area.
- The water reserve boundary and P1 area need to be recognised in the Shire of Capel's local planning scheme and other applicable schemes and strategies.
- Best management practices for existing or future bore construction in close proximity to the water reserve should be implemented.
- The production bores should be permanently sealed through the Water Corporation's bore integrity improvement program.

This plan is consistent with the *Australian drinking water guidelines* (ADWG) (NHMRC & NRMMC 2011) and State planning policy no. 2.7: *Public drinking water source policy.*

Table 1 shows important information about the proposed Peppermint Grove Beach Water Reserve.

Table 1 Key information about the proposed Peppermint Grove Beach Water Reserve

Peppermint Grove Beach Water Reserve	
Local government authority	Shire of Capel
Location supplied	Peppermint Grove Beach
Water service provider	Water Corporation
Aquifer type	Confined – Yarragadee aquifer
Licensed abstraction	150 000 kL/year (Licence number 97635)
Number of bores	2
Bore names and GPS coordinates	1/77 (E 361 602.8, N 6 289 540.6, zone 50) 1/80 (E 361 600.4, N 6 289 516.7, zone 50)
Date of bore completion	1/77: 1977 1/80: 1980
Bore depth and screening	1/77: 186 to 198 m 1/80: 186 to 198 m
Date of drinking water source protection report	2017: Peppermint Grove Beach Water Reserve drinking water source protection review (this document)
Consultation	2015–16: government and water service provider
Proclamation status	Proclamation will need to be progressed under the *Country Areas Water Supply Act 1947* when this report is finalised
Reference documents	*Australian drinking water guidelines* (NHMRC & NRMMC 2011) State planning policy no. 2.7: *Public drinking water source policy* (Western Australian Planning Commission 2003) *South West groundwater areas allocation plan* (DoW 2009) *South West groundwater areas allocation plan: Evaluation statement 2009–2012* (DoW 2013) *Busselton – Capel groundwater area subarea reference sheets: plan companion for the South West groundwater areas allocation plan* (DoW 2009)

1 Overview

1.1 The drinking water supply system

The Peppermint Grove Beach scheme is sourced from the Yarragadee aquifer by two production bores, 1/77 and 1/80, located about 25 m apart within a single compound (figures A1, C1 and C2). Both bores abstract water from between approximately 170 m and 200 m below ground level. The wellfield and scheme are operated by Water Corporation.

Water drawn from the Yarragadee aquifer is chlorinated to disinfect the water, aerated and filtered to reduce naturally occurring iron, manganese, colour and turbidity levels, before being stored in an elevated tank for distribution to the scheme.

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 & NRMMC 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.

For more information on why it is so important to protect our PDWSAs, see Appendix D.

1.2 Water management

1.2.1 Licence to take water

Water resource use and conservation in Western Australia is administered by the Department of Water and Environmental Regulation (DWER) in accordance with the *Rights in Water and Irrigation Act 1914*. Under this act, the right to use and control water is vested with the Crown. This means that a licence is required for drilling bores and abstracting groundwater (pumping water from a bore, spring or soak) within proclaimed groundwater areas throughout the state. Some exemptions apply such as abstracting water for domestic purposes only.

The Peppermint Grove Beach Water Reserve is located within the Busselton – Capel Groundwater Area (and the Busselton - Yarragadee subarea) which is proclaimed under the *Rights in Water and Irrigation Act 1914*. Water Corporation is licensed by the DWER, under the *Rights in Water and Irrigation Act 1914*, to abstract water from the Yarragadee aquifer for public water supply. The annual abstraction from this aquifer for public water supply is 150 000 kL under groundwater licence 97635.

1.2.2 Future water needs and water planning

The licenced allocation for Peppermint Grove Beach was increased from 110 000 kL per year to the current 150 000 kL allocation in 2004–05.

The number of households at Peppermint Grove Beach has steadily increased over time, and is predicted to continue increasing in the short-term with a number of vacant lots available in the area. However, water abstraction has decreased from a peak of almost 140 000 kL in 2008–09 to below 99 000 kL in 2012–13 due to improvements in the water supply infrastructure. Abstraction slightly increased to almost 101 000 kL in 2013–14 and is expected to continue increasing slowly. Water Corporation does not expect the allocation of 150 000 kL to be exceeded in the short-term.

1.2.3 Water planning

The *South West groundwater areas allocation plan* (DoW 2009) reserved an additional 350 000 kL per year from the Yarragadee aquifer (Busselton-Yarragadee subarea) for the Peppermint Grove Beach and Capel schemes. This allows for increases in allocation limits for public drinking water supply when required in the long-term. The Yarragadee aquifer (Busselton-Yarragadee subarea) is otherwise fully allocated with no additional water available.

1.3 Characteristics of the catchment

1.3.1 Physical environment

Peppermint Grove Beach is located along the Geographe Bay on the Swan Coastal Plain, about 6 km north-west of Capel. The wellfield is contained within a Water Corporation compound in the centre of the residential area, approximately 250 m inland. The wellfield is on the top of a steep dune about 20 m above sea level.

The northern extent of the Peppermint Grove Beach town site is bounded by the mouth of the Capel River, while the inland extent of the townsite is bounded by an area of wetlands running parallel to the coastline.

1.3.2 Climate

Peppermint Grove Beach has a Mediterranean-type climate with cool, wet winters and warm, dry summers. The average annual rainfall in the Capel area is around 800 mm. Winter temperatures typically range from 5 ^{o}C to 26 ^{o}C, while summer temperatures typically range from 14 ^{o}C to 40 ^{o}C.

1.3.3 Hydrogeology

The Peppermint Grove Beach scheme is sourced from the Yarragadee aquifer which is regionally confined by a layer of rock. At Peppermint Grove Beach this aquifer is shallower beginning about 100 m to 200 m below ground level.

The Yarragadee aquifer is recharged in the Blackwood Plateau area where the aquifer outcrops, with some recharge occurring from overlying aquifers where the confining rock layer is locally absent. The aquifer flows generally north-west and discharges off Bunbury and into the Geographe Bay.

As Peppermint Grove Beach's drinking water is drawn from a confined groundwater source there is little potential for groundwater contamination from surrounding land uses. This is because the source is adequately protected from surface contamination by the considerable depth to the groundwater and the presence of a confining layer of rock that sits above the groundwater. This confining layer acts as a barrier to contamination.

1.4 How this drinking water source is currently protected

The Peppermint Grove Beach Water Reserve is not yet proclaimed under the *Country Areas Water Supply Act 1947*. However, the proposed water reserve is located entirely over private land owned by Water Corporation.

The production bores and water treatment plant are contained in a fenced, locked compound to deter unauthorised access and vandalism (Figure C1). Water Corporation employs best management practices for operating and managing the production bores, water treatment plant and compound (Water Corporation 2011). The compound is regularly inspected by Water Corporation staff.

1.5 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. The sites are significant because they link Aboriginal culture and tradition to place, land and people over time. These areas form an integral part of Aboriginal identity and the heritage of Western Australia. The *Aboriginal Heritage Act 1972* protects all Aboriginal sites in the state.

There is one Aboriginal site of significance within the proposed Peppermint Grove Beach Water Reserve: Peppermint Grove Beach Burial (S03024) (Figure A3).

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 Peppermint Grove Beach Water Reserve. These are:

- Harris Family (WAF6085/1998)
- Single Noongar Claim (Area 2) (WAD6012/2003)
- Gnaala Karla Booja (WAD6274/1998).

DWER 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.

The Government of Western Australia and the Noongar native title claimants 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, 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 A5).

The ILUA is available via the Department of Premier and Cabinet, see www.dpc.wa.gov.au.

2 Common contamination risks

Land development and land or water-based activities within a water reserve 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. 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 & NRMMC 2011). Contaminants can also interfere with water treatment processes, and damage water supply infrastructure (such as corroding iron pipes).

The ADWG (NHMRC & NRMMC 2011) outlines criteria for acceptable drinking water quality to protect human health, manage aesthetics and maintain water supply infrastructure.

For more information about water quality in this PDWSA, see section 3.

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

2.1 Microbiological risks

Pathogens are types of microorganisms that are capable of causing illness. These include bacteria, protozoa and viruses. In drinking water supplies, pathogens are commonly found in the faeces of humans and domestic animals – such as dogs and cattle.

Pathogens can enter drinking water supplies from faecal contamination in the water reserve. This can occur indirectly in groundwater sources when faecal material infiltrates through the soil and into the groundwater. For example, contamination can occur from septic tanks or grazing animals.

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 survival and movement of pathogens in groundwater is influenced by the characteristics of the pathogen (such as its size and the length of time it normally takes to decay) and the groundwater properties (including flow rate, porosity, amount of carbon in the soil, temperature and pH). Inactivation rate (the time it normally takes a pathogen to decay) is one of the most important factors governing how far pathogens may migrate. Typical half-lives of pathogens range from a few hours to a few weeks. For example, some reported migration distances of bacteria in groundwater are:

- 600 m in a sandy aquifer
- 1000 m - 600 m in channelled limestone
- 250 m - 408 m in glacial silt-sand aquifers (Robertson & Edbery 1997).

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 surface water and groundwater systems to be able to protect the drinking water source from pathogens.

When people consume drinking water contaminated with pathogens the consequences vary considerably, ranging from mild illness (such as stomach upset or diarrhoea) to hospitalisation and sometimes even death. During 2000, seven people died in Walkerton, Canada, because the town's water supply was contaminated by a pathogenic strain of *E. coli* and *Campylobacter* (NHMRC & NRMMC 2011).

Given the wide variety of pathogens, the differences in how they act 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.

2.2 Physical risks

Turbidity is the result of soil or organic particles becoming suspended in water (cloudiness). 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 can adsorb onto soil particles and may be shielded from the effects of disinfection. Chemicals can also attach to suspended soil particles.

Some physical properties of water such as pH (a measure of acidity or alkalinity) can contribute to the corrosion and encrustation of pipes. Other properties such as iron and dissolved organic matter can affect the colour and smell of water. Although not necessarily harmful to human health, coloured or 'hard' water will not be as appealing to consumers. Salinity can affect the taste of drinking water.

2.3 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 such as:

- weeds (herbicides)
- pests (insecticides, rodenticides)
- worms (nematicides)
- mites (miticides).

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, and harmful chemical by-products may be formed when they are combined with chlorine during the water-treatment process. Hydrocarbons can occur in water supplies as a result of spills and leaks from vehicles.

Drinking water sources can also be contaminated by nutrients (such as nitrogen) from fertiliser, septic systems, and faecal matter from domestic or feral animals that washes through or over soil and into a water source. Nitrate and nitrite (forms of nitrogen) 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 drinking water sources and can be harmful to human health.

3 Contamination risks in this drinking water source

3.1 Water quality

Water Corporation regularly monitors the quality of raw water from the Peppermint Grove Beach wellfield 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.

A water quality summary for the Peppermint Grove Beach wellfield from January 2011 to December 2015 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.

Water from the Yarragadee aquifer at Peppermint Grove Beach has exceeded the ADWG aesthetic guideline values due to the naturally occurring levels of colour, turbidity, iron, manganese and pH. The health guideline values were not exceeded for any parameters during the review period. *Escherichia coli* was detected in three per cent samples during the period, which investigations have attributed to small animals or insects entering the bores (see Section 3.2.1 below).

Water from this wellfield is disinfected via chlorination, then aerated and filtered to ensure the quality of the reticulated water meets the ADWG aesthetic and health guideline values.

3.2 Land uses and activities

The proposed Peppermint Grove Beach Water Reserve is located on freehold land owned by the Water Corporation. The bores are within a single compound also containing water treatment facilities and storage tanks. The compound is located on the top of a dune, with drainage from surrounding properties flowing away from the compound.

As Peppermint Grove Beach's drinking water is drawn from a confined groundwater source there is little potential for contamination from surrounding land uses. This is because the source is adequately protected from surface contamination by the considerable depth to groundwater and the presence of a confining layer of rock that sits above the groundwater. This confining layer acts as a barrier to contamination.

3.2.1 Bore seals

The production bores are adequately constructed to prevent contaminated surface waters entering directly into the aquifer through the production bores (Figure C2). However, inadequate sealing has previously allowed small animals or insects to enter the bores, which may pose a risk to water quality. Detections of microbial

contaminants in the raw water have attributed to the entry of these animals into the bores.

The bores have been temporarily sealed and should be permanently sealed to prevent the entry by small animals and insects.

3.2.2 Other groundwater bores in the area

Water Corporation operates drinking water bores in the proposed Peppermint Grove Beach Water Reserve. If bores for other purposes (for example irrigation or private household use) are drilled near a public drinking water supply bore, they can cause contamination of the drinking water source. For example, a poorly constructed private bore may introduce contaminants from surface leakage down the outside of the bore casing into an otherwise uncontaminated aquifer.

It is therefore 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 the DWER'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 are no licensed users of the Yarragadee aquifer nearby.

3.2.3 Unconventional gas

The proposed Peppermint Grove Beach Water Reserve is located within the Perth Basin, which is a prospective shale and tight gas area. Exploration and mining activities are regulated by the Department of Mines and Petroleum.

Any proposals for the extraction of shale or tight gas within the proposed Peppermint Grove Beach Water Reserve or within 5 km of any drinking water production bore should be referred to DWER for comment. This is consistent with the *Administrative agreement between the Department of Mines and Petroleum and Department of Water for onshore petroleum and geothermal activities in WA* (2015).

Oil or gas exploration and production is to be managed in accordance with this administrative agreement, as well as government's response to the Legislative Council Standing Committee on Environment and Public Affairs' Report no. 42: *Implications for Western Australia of hydraulic fracturing for unconventional gas* (2015), and *Guide to the regulatory framework for shale and tight gas in WA: A whole-of-government approach* (Government of Western Australia 2015).

4 Protecting your drinking water source

The objective of the actions in this plan is to protect water quality in the proposed Peppermint Grove Beach Water Reserve to ensure safe drinking water for the local public water supply.

4.1 Proclaiming public drinking water source areas

To protect the quality of the drinking water source, we are proposing to proclaim the Peppermint Grove Beach Water Reserve under the *Country Areas Water Supply Act 1947*.

Drinking water sources that are supplied from a confined aquifer, such as this one, only require a boundary that reflects the compound in which the drinking water bores are located. This ensures that the location of this important drinking water supply will be proclaimed and mapped so it is considered in future land use decisions or development of other bores. A larger boundary is not deemed necessary because the source is adequately protected from surface contamination risks by a confining layer of rock (figure A4).

Once the water reserve is proclaimed the local government authority should incorporate the public drinking water source area (PDWSA) into their planning schemes consistent with State planning policy no. 2.7: *Public drinking water source policy*. PDWSAs are commonly shown in planning schemes as special control areas. This provides guidance for state and local government planning decision makers and developers.

Proclamation of a PDWSA will not change the zoning of this land. All existing, approved land uses and activities in a proclaimed area can continue. However, we recommend that best management practices are employed in PDWSAs to protect the quality of the drinking water source. New developments or expansion of existing land uses or activities need to consider the recommendations in this plan. As a general guide, DWER does not recommend land use intensification in a PDWSA because the increased risks to water quality and public health.

For more guidance on appropriate land uses and activities please refer to our Water quality protection note (WQPN) no. 25: *Land use compatibility tables for public drinking water source areas*.

4.2 Defining priority areas

The protection of PDWSAs relies on statutory and non-statutory measures for water resource management and land-use planning. DWER's policy for the protection of PDWSAs includes a system that defines three specific priority areas:

- Priority 1 (P1) areas have the fundamental water quality objective of risk avoidance (for example state forest and other Crown land).

- Priority 2 (P2) areas have the fundamental water quality objective of risk minimisation (for example land that is zoned rural).
- Priority 3 (P3) areas have the fundamental water quality objective of risk management (for example areas zoned urban, industrial or commercial).

The determination of priority areas is based on the strategic importance of the land or water source including risks to water quality and quantity, the local planning-scheme zoning, the form of land tenure and existing approved land uses or activities. For further detail, please refer to our WQPN no. 25: *Land use compatibility in public drinking water source areas*.

The proposed priority area for the Peppermint Grove Beach Water Reserve has been determined in accordance with current department policy. This area is described below and displayed in Figure A4. Our WQPN no.25: *Land use compatibility in public drinking water source areas* outlines activities that are 'acceptable', 'compatible with conditions' or 'incompatible' within the different priority areas. For an explanation of the background and support for protection of PDWSAs, please refer to WQPN no. 36: *Protecting public drinking water source areas*.

We propose to assign all the land in the Peppermint Grove Beach Water Reserve as P1 because:

- water from this source is the only supply available to Peppermint Grove Beach
- all the land within the water reserve is owned by the Water Corporation.

4.3 Defining protection zones

In addition to priority areas, protection zones are defined in PDWSAs to protect water from contamination in the immediate vicinity of water extraction facilities (i.e. bores or dams). Specific conditions may apply within these zones such as restrictions on the storage of chemicals or prohibition of public access.

Wellhead protection zones (WHPZs) are generally circular (unless information is available to determine a different shape or size), with a 500 m radius around each production bore in a P1 area and a 300 m radius around each production bore in P2 and P3 areas. WHPZs do not extend outside the boundary of the water reserve and they adopt the priority area of the land over which they occur.

WHPZs are not considered necessary for the Peppermint Grove Beach Water Reserve due to the confined nature of the water source, the depth of the bores and the fenced compound around the bores on land owned by the Water Corporation.

4.4 Planning for future land uses

It is recognised under the Western Australian Planning Commission's (WAPC) *State planning strategy* (1997) that appropriate protection mechanisms in statutory land-use planning processes are necessary to secure the long-term protection of drinking water sources. As outlined in the WAPC's State planning policy no. 2.7: *Public drinking water source policy* (2003) it is appropriate that the Peppermint Grove Beach

Water Reserve and its priority areas be recognised in the Shire of Capel's local planning scheme.

4.5 Using best management practices

There are opportunities to reduce water contamination risks by carefully considering design and management practices. To help protect water sources, DWER will continue to encourage the adoption of best management practices.

Guidelines on best management practices for many land uses are available in the form of industry codes of practice, environmental guidelines and WQPNs. They recommend practices to help managers reduce their impacts upon water quality. These guidelines have been developed in consultation with stakeholders such as industry groups, agricultural producers, state government agencies and technical advisers. Examples include *Minimum construction requirements for water bores in Australia* (National Uniform Drillers Licensing Committee 2012).

Education and awareness-raising (such as through providing information on signs and publications) are key mechanisms for protecting water quality.

5 Recommendations

The following recommendations apply to the proposed Peppermint Grove Beach 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 Peppermint Grove Beach Water Reserve under the *Country Areas Water Supply Act 1947* in accordance with Figure A4. (DWER)
2. Incorporate the findings of this plan and location of the Peppermint Grove Beach Water Reserve (including its priority area) in the Shire of Capel's local planning scheme in accordance with the WAPC's State planning policy no. 2.7: *Public drinking water source policy*. (Shire of Capel)
3. Ensure incidents covered by Westplan–HAZMAT in the Peppermint Grove Beach Water Reserve are addressed by ensuring that:
    - the Shire of Capel local emergency management committee is aware of the location and purpose of the Peppermint Grove Beach Water Reserve
    - the locality plan for the Peppermint Grove Beach Water Reserve is provided to the Department of Fire and Emergency Services headquarters for the HAZMAT emergency advisory team
    - Water Corporation acts in an advisory role during incidents in the Peppermint Grove Beach Water Reserve
    - personnel dealing with Westplan–HAZMAT incidents in the area have ready access to a locality map of the Peppermint Grove Beach Water Reserve and information to help them recognise the potential impacts of spills on drinking water quality. (Water Corporation)
4. Ensure the production bores are permanently sealed to prevent access by small animals and insects. (Water Corporation)
5. Maintain signs along the boundary of the Peppermint Grove Beach Water Reserve including an emergency contact telephone number, in accordance with the Water Corporation's *S111 Source protection signage* (2013). (Water Corporation)
6. Oil or gas exploration and production should be managed in accordance with government's response to the Legislative Council Standing Committee on Environment and Public Affairs, Report no. 42: *Implications for Western Australia of hydraulic fracturing for unconventional gas*, the *Administrative agreement between the Department of Mines and Petroleum and Department of Water for onshore petroleum and geothermal activities in WA* and *Guide to the regulatory framework for shale and tight gas in WA: A whole-of-government approach*. (DWER, Department of Mines, Industry Regulation and Safety)
7. Update this plan within seven years. (DWER)

6 Consultation

6.1 Stakeholder consultation process

The draft recommendations and proposed water reserve boundary were consulted with the Shire of Capel, Water Corporation, the previous Department of Planning, the previous Department of Mines and Petroleum and the Department of Health during the preparation of this drinking water source protection plan.

6.2 Issues raised in consultation

The potential risks to water quality from unconventional gas exploration and mining was the only issue raised during consultation. This has been explained in section 3.2.2 and reflected in recommendation 6.

Appendices

Appendix A — Figures

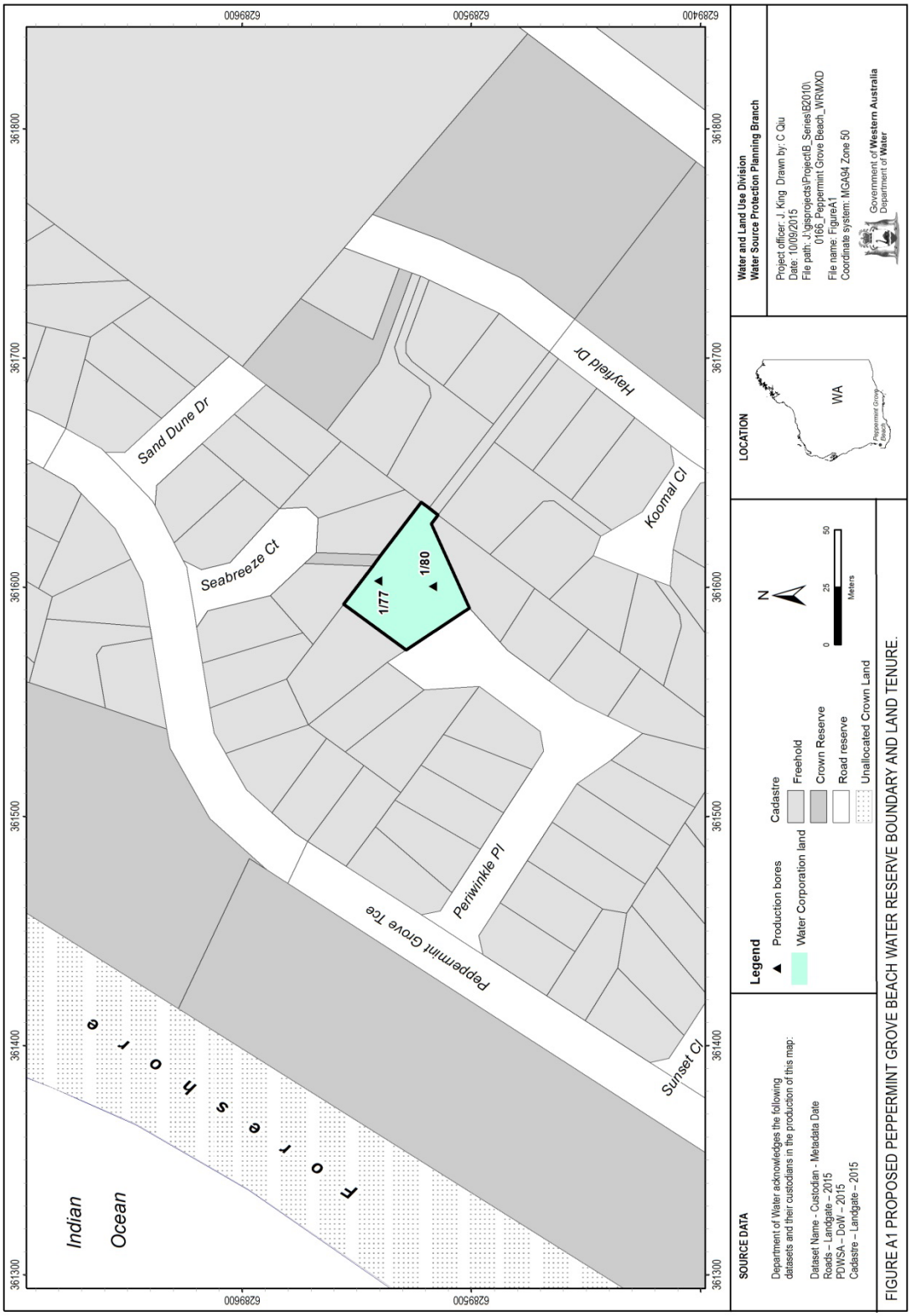

Figure A1 Proposed Peppermint Grove Beach Water Reserve boundary and land tenure

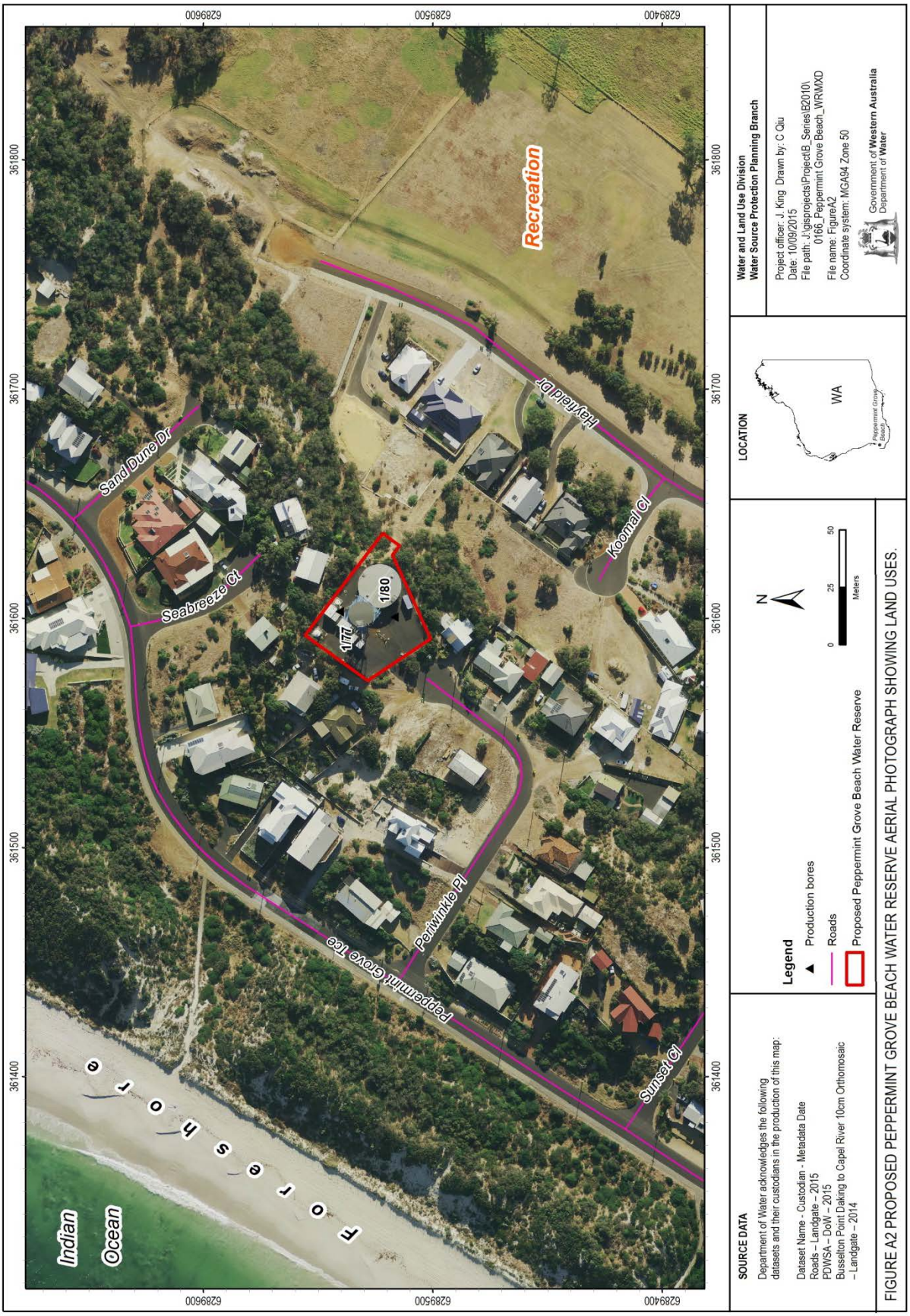

Figure A2 Proposed Peppermint Grove Beach Water Reserve aerial photograph showing land uses

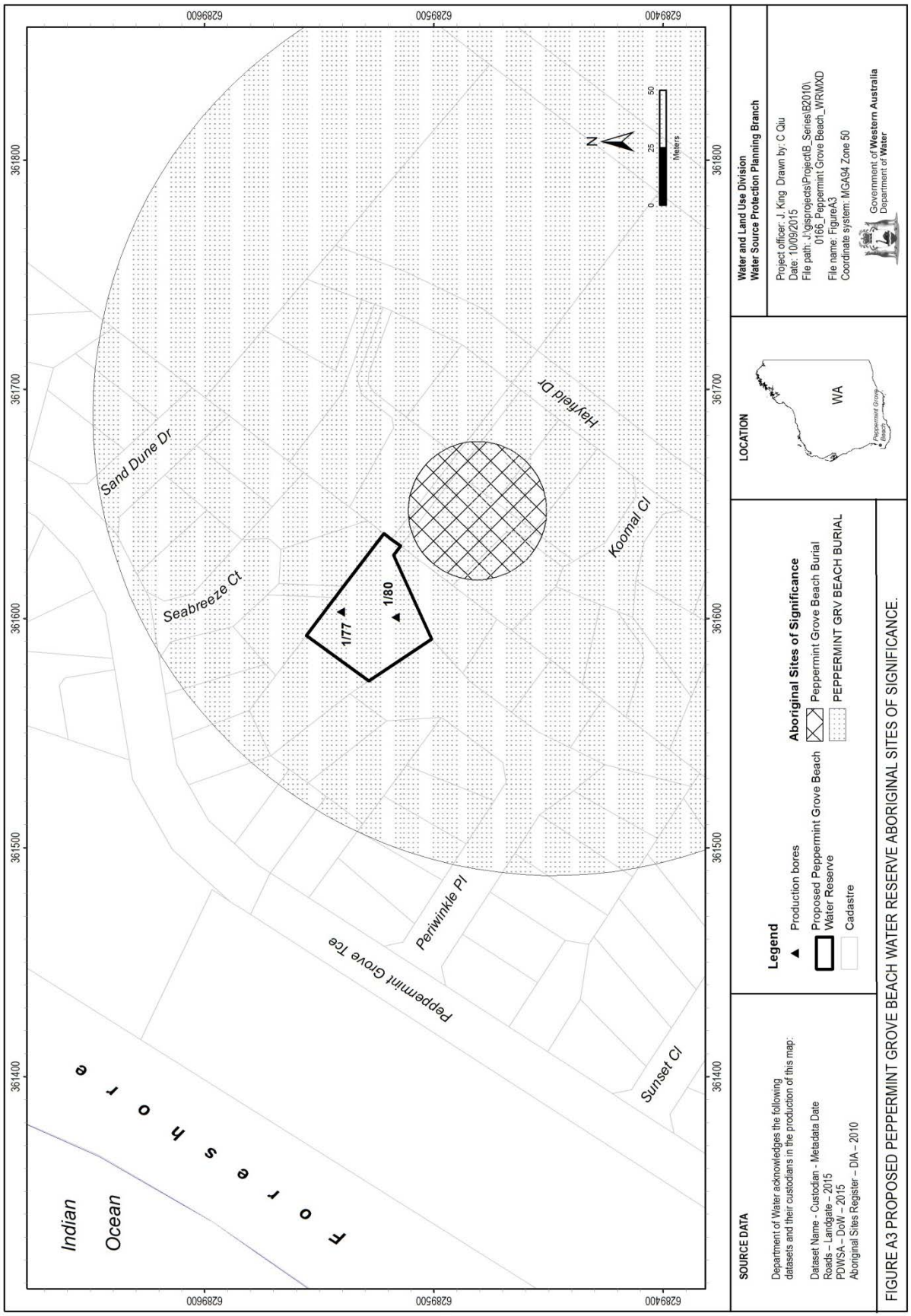

Figure A3 Proposed Peppermint Grove Beach Water Reserve Aboriginal Sites of Significance

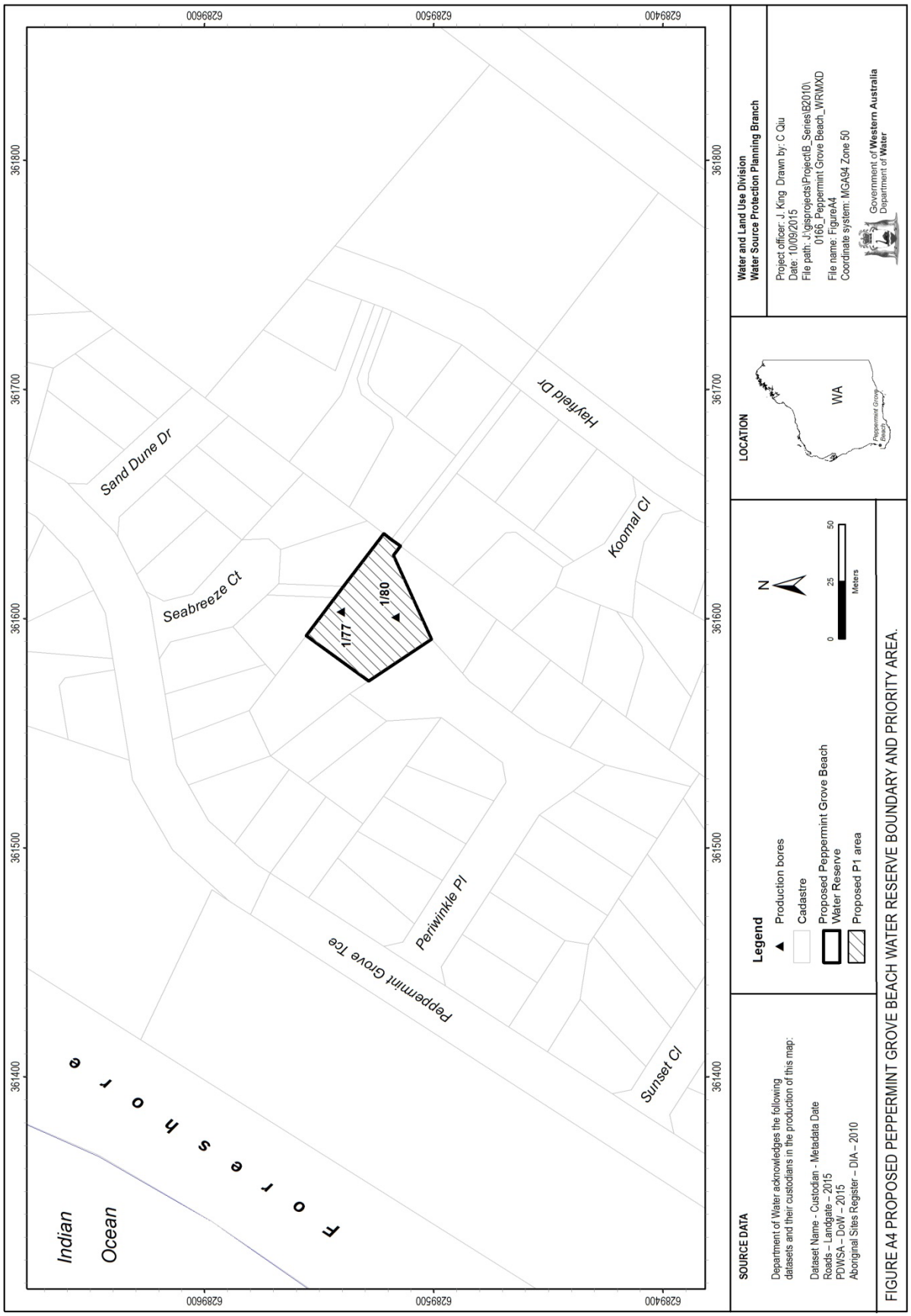

Figure A4 Proposed Peppermint Grove Beach Water Reserve boundary and priority area

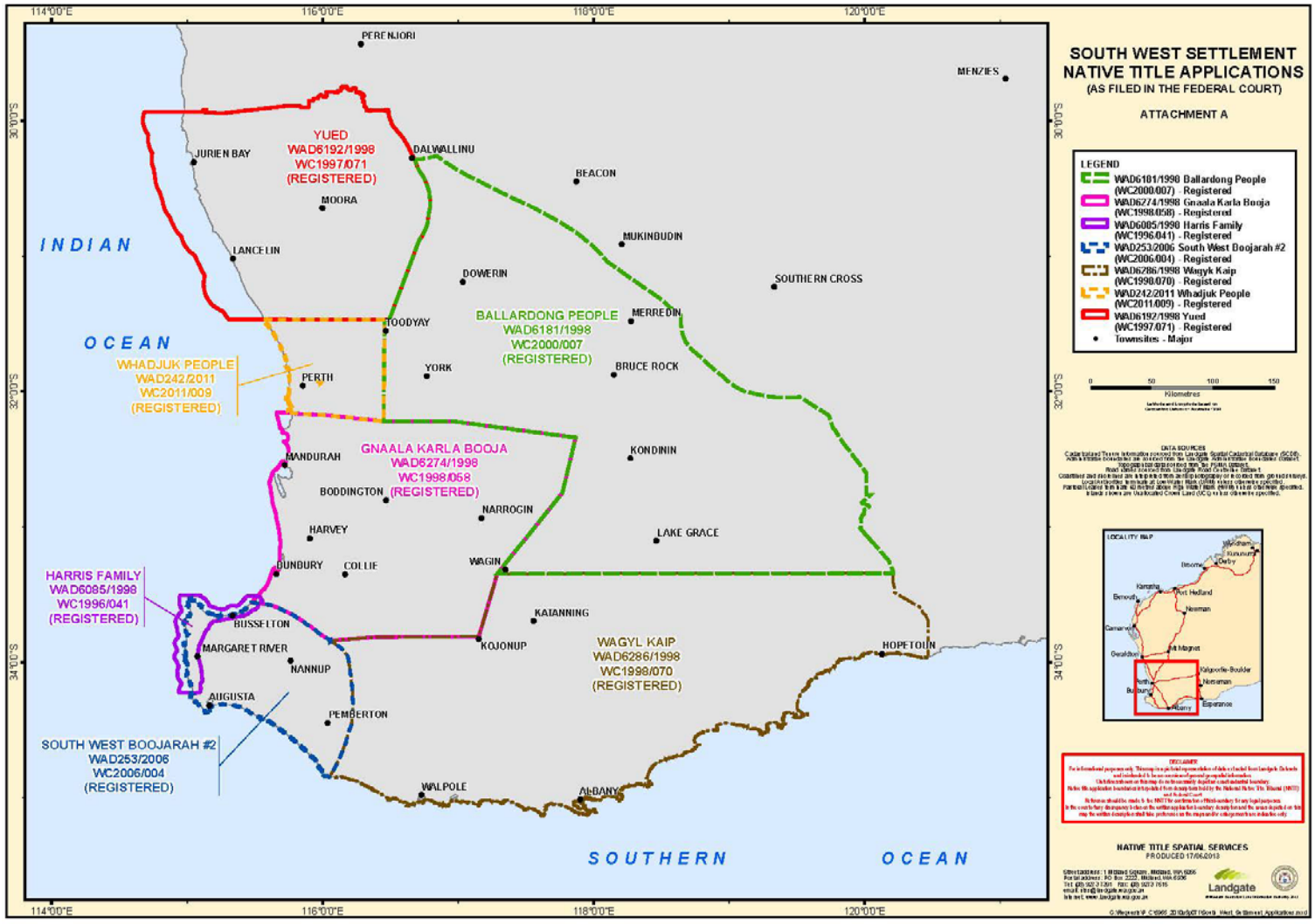

Figure A5 South West Native Title Agreement area (source: Department of Premier and Cabinet)

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 Peppermint Grove Beach wellfield in accordance with the requirements of the *Australian drinking water guidelines* (ADWG) (NHMRC & NRMMC 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 Peppermint Grove Beach. 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 January 2011 to December 2015.

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 Peppermint Grove Beach refer to the most recent Water Corporation drinking water quality annual report at www.watercorporation.com.au.

Aesthetic characteristics

The aesthetic quality analyses for raw water from Peppermint Grove Beach are summarised in the following table.

Aesthetic detections for Peppermint Grove Beach

Parameter	**Units**	**ADWG aesthetic guideline value***	**Peppermint Grove Beach bores**	
			Range	**Median**
Ammonia as nitrogen	mg/L	0.41	<0.005–0.1	0.09
Chloride	mg/L	250	55–65	55
Colour (true)	TCU	15	<1–***44***	5
Hardness as $CaCO_3$	mg/L	200	47–53	50
Iron unfiltered	mg/L	0.3	***2.2***–***8.2***	***5.6***
Manganese unfiltered	mg/L	0.1	***0.12***–***0.16***	**0.14**
pH measured in laboratory	no units	6.5–8.5	***6.39***–6.99	6.535
Silicon as SiO_2	mg/L	80	14–16	15
Sodium	mg/L	180	44–50	47
Sulfate	mg/L	250	16–17	16
Total filterable solids by summation	mg/L	500	271–298	284.5
Turbidity	NTU	5	2.1–***60***	***36***

** 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 Peppermint Grove Beach is analysed for chemicals that are harmful to human health, including:

- inorganics
- heavy metals
- industrial hydrocarbons
- pesticides.

Health-related parameters that have been detected in the source are summarised in the following table.

Health-related detections for Peppermint Grove Beach

Parameter	Units	ADWG health guideline value*	Peppermint Grove Beach bores	
			Range	Median
Fluoride*** measured in laboratory	mg/L	1.5	0.2–0.3	0.25
Iodide**	mg/L	0.5	<0.02^	<0.02^
Manganese unfiltered	mg/L	0.5	0.12–0.16	
Nitrite as nitrogen	mg/L	0.91	<0.002–0.028	<0.002
Nitrite plus nitrogen as N	mg/L	11.29 †	<0.002–0.008	<0.05
Sulfate	mg/L	500	16–17	16
Total cyanide**	mg/L	0.08	<0.05^	<0.05^

** 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 & ARMCANZ 2011).*

*** Data derived from the raw water sampling point.*

**** Data derived from a combination of bores and raw water sampling point.*

^ Data derived from a single sample.

Microbiological contaminants

Microbiological testing of raw water samples from Peppermint Grove Beach is currently conducted on a monthly basis. *Escherichia coli* counts are used as an indicator of the degree of recent faecal contamination of the raw water 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 reviewed period, positive *E. coli* counts were recorded in 3 per cent of samples; a total of two detections.

Appendix C — Photographs

Figure C1 Peppermint Grove Beach compound, photograph by J. King

Figure C2 Peppermint Grove Beach production bores, photograph by J. King

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

The *Australian drinking water guidelines* (ADWG; NHMRC & NRMMC 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
- 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, DWER 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 (WAPC) 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* (DoW 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* (DoW 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 also 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 WAPC (with input from DWER) 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* (DoW 2016a). You can also contact DWER'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 DWER

Drinking water source protection report	Scope and outcome	Consultation	Time to prepare	Implementation table	Proclamation
Drinking water source protection assessment (DWSPA)	Desktop assessment of readily available information.	Preliminary	Up to 3 months	No	Proclamation to protect water quality and guide land use planning can occur as a result of any type of drinking water source protection report.
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.	

List of shortened forms

ADWG	*Australian drinking water guidelines*
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
DoW	Department of Water
DWER	Department of Water and Environmental Regulation
HAZMAT	hazardous materials
ILUA	Indigenous Land Use Agreement
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NTU	nephelometric turbidity units
PDWSA	public drinking water source area
TCU	true colour units
WAPC	Western Australian Planning Commission
Westplan–HAZMAT	Western Australian plan for hazardous materials
WHPZ	wellhead protection zone
WQPN	water quality protection note

Units of measurement

m	metres
mg/L	milligram per litre
mm	millimetre
km	kilometre

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

Abstraction	The pumping of groundwater from an aquifer, or the removal of water from a waterway or water body.
Adsorb	Adsorb means to accumulate on the surface of something.
Aesthetic guideline value	The concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, such as appearance, taste and odour (NHMRC & NRMMC 2011).
Allocation	Is the volume of water that a licensee is permitted to abstract, usually specified in kilolitres per annum (kL/a).
Aquifer	An aquifer is a geological formation or group or formations able to receive, store and transmit significant quantities of water.
Australian drinking water guidelines	The *National water quality management strategy: Australian drinking water guidelines 6*, 2011 (NHMRC & NRMMC 2011) (ADWG) outlines acceptable criteria for the quality of drinking water in Australia (see this plan's References).
Bore	A bore is a narrow, lined hole drilled into the ground to monitor or draw groundwater (also called a well).
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Confined aquifer	An aquifer that is confined between non-porous rock formations (such as shale and siltstone) and therefore contains water under pressure.
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.
Gigalitre	A gigalitre is equivalent to 1 000 000 000 litres or one million kilolitres.

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.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
Leaching/ leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater. The material washed out is known as leachate. Leachate can pollute groundwater and waterways.
mg/L	A milligram per litre (0.001 grams per litre) is a measurement of something in a solution, such as salinity.
Nephelometric turbidity units	Nephelometric turbidity units are a measure of turbidity in water.
Nutrients	Minerals, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorous (phosphate) dissolved in water which provide nutrition (food) for plant growth.
Pathogen	A disease-producing organism that can cause sickness and sometimes death through the consumption of water, including bacteria (such as *Escherichia coli*), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
pH	A logarithmic scale for expressing the acidity or alkalinity of a solution. A pH below seven indicates an acidic solution and above seven indicates an alkaline solution.
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 *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.
Recharge	Recharge is the action of water infiltrating through the soil/ground to replenish an aquifer.

Recharge area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Scheme supply	Water diverted from a source or sources by a water authority or private company and supplied via a distribution network to customers for urban and industrial use or for irrigation.
Stormwater	Rainwater that has runoff the ground surface, roads, paved areas etc., and is usually carried away by drains.
Total filterable solids by summation	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_4 equivalent (sulfate) or S (sulfur) in grams, Fe (iron), Mn (manganese), and SiO_2 (silicon oxide). The higher the value, the more solids that are present and generally the saltier the taste.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes, including drinking and discharge to the environment.
True colour units	True colour units are a measure of degree of colour in water.
Turbidity	The cloudiness or haziness of water caused by the presence of fine suspended matter.
Unconfined aquifer	An aquifer in which the upper surface of water is lower than the top of the aquifer itself. The upper surface of the groundwater within the aquifer is called the watertable. This is also known as a superficial aquifer.
Water quality	Water quality is the collective term for the physical, aesthetic, chemical and biological properties of water.
Water reserve	A water reserve is an area proclaimed under the *Country Areas Water Supply Act 1947* or the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* for the purposes of protecting a drinking water supply.
Wellfield	A wellfield is a group of bores located in the same area used to monitor or withdraw groundwater.
Wellhead	The top of a well (or bore) used to draw groundwater is referred to as a wellhead.

Wellhead protection zone A wellhead protection zone is usually declared around wellheads in public drinking water source areas to protect the groundwater from immediate contamination threats in the nearby area.

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