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

Salmon Gums Catchment Area

Drinking water source protection plan

Salmon Gums town water supply

Looking after all our water needs

Water resource protection series
Report WRP 143
September 2013

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Cover photograph: Salmon Gums Quarry, provided by Vivien Claughton

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Salmon Gums is located inland from the south coast of Western Australia, approximately 106 km north of Esperance and 560 km south-east of Perth (Figure A1). The Coolgardie-Esperance Highway runs through the town. The Salmon Gums area has an estimated population of 160 residents (Australian Bureau of Statistics 2011) but the town itself has a significantly smaller population.

Salmon Gums' drinking water is supplied by a dam (and its catchment area) and a quarry reservoir located less than 3 km north-west of the town. The Water Corporation supplies drinking water to 38 services within the Salmon Gums town.

The Salmon Gums Catchment Area was proclaimed under the *Country Areas Water Supply Act 1947* in 1960 and its boundary is proposed to be reduced in this plan.

The Department of Water has prepared this drinking water source protection plan to help protect water quality in the Salmon Gums drinking water source to ensure it is safe for drinking. This plan:

- shows the location, size and significance of this drinking water source
- identifies the risks to water quality from surrounding land uses and activities
- proposes a new, smaller catchment boundary that needs protecting
- defines a priority area and a protection zone (to guide land use planning and protect water quality)
- recommends strategies to address risks to water quality.

This document has been prepared in consultation with key stakeholders, including the Water Corporation, the Department of Health, the Shire of Esperance and the Salmon Gums Development Group. The majority of the proposed Salmon Gums Catchment Area consists of freehold land owned by the Water Corporation. However there is one section owned by the Department of Lands. There are also two small sections of Crown reserve, one vested with the Water Corporation and the other vested with the Department of Education.

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* (Western Australian Planning Commission 2003).

The most important recommendations in this plan are to:

- Include the amended boundary, priority area and protection zone in the Shire of Esperance local planning scheme.
- Regularly maintain the roaded catchment area to maximise water quality and flow.
- Refer any subdivision and development applications in the Salmon Gums Catchment Area that are inconsistent with our Water quality protection note no. 25: *Land use compatibility in public drinking water source areas* to our regional office.

Key information about the Salmon Gums Catchment Area

Local government authority	Shire of Esperance
Locations supplied	Salmon Gums
Dam completion date	Quarry reservoir created in 1992 Water Corporation Dam no. 1 constructed in 1930 Water Corporation Dam no. 2 constructed in 1984.
Capacity	Quarry reservoir capacity is 130 ML Water Corporation Dam no. 1 capacity is 17 ML Water Corporation Dam no. 2 capacity is 24 ML.
Proclamation status	Proclaimed on 24 June 1960 under the *Country Areas Water Supply Act 1947*. Proclamation of the amended boundary will need to be progressed under the *Country Areas Water Supply Act 1947* when this plan is finalised.

The following table outlines the stages involved in the preparation of this drinking water source protection plan:

Stages in development of a plan		**Comment**
1	Prepare draft drinking water source protection plan document. (September 2012 - February 2013)	Prepared after initial catchment survey and preliminary information gathering.
2	Conduct targeted stakeholder consultation. (March - April 2013)	Advice sought from key stakeholders using the draft plan as a tool for information and discussion.
4	Publish approved drinking water source protection plan. (September 2013)	Final protection plan published after considering submissions. Includes recommendations on how to protect water quality. Proclamation of the amended public drinking water source area can now be progressed.

1 Overview

1.1 The drinking water supply system

Salmon Gums is located inland from the south coast of Western Australia, approximately 106 km north of Esperance and 560 km south-east of Perth, as shown in Figure A1. The Coolgardie-Esperance Highway runs through the town. Salmon Gums is part of the Shire of Esperance. Salmon Gums is an agricultural province, producing sheep, wheat and cattle. Land uses in the area are shown in figures A3 and A4.

There are approximately 160 people living in the town of Salmon Gums and the surrounding areas encompassed by the suburb of Salmon Gums (Australian Bureau of Statistics 2011).

Salmon Gums' drinking water is supplied from two catchments: the Quarry reservoir and the Water Corporation Dam no. 2, which both receive run-off from natural and roaded catchment areas (see Figure A4). In addition, the supply system includes the covered dam no. 1, which receives no run-off but is used to store water from the quarry and the dam. The quarry and the dams are located less than 3 km north-west of the town (see Figure A4).

The roaded catchment areas for Salmon Gums require regular maintenance by the Water Corporation to maximise water quality and flow.

Water is pumped from Dam no. 1 to the water treatment system. The raw water is treated using chlorine, granular activated carbon and ultraviolet light. The treated water is then supplied into the town drinking water reticulation system.

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.

1.1.1 Water Corporation Dam no. 1

Dam no. 1 is a concrete-lined, roofed dam which is used for storage only. The dam was originally constructed in 1930 and has a volume of 17 000 kL. It previously had a 2.5 ha bitumen catchment which degraded then was removed and diverted, so the dam no longer has an active catchment area. Since it was first constructed the dam has undergone significant work including the addition of a covered roof. The dam is surrounded by security fencing, located in the same secure compound as the water

treatment plant. It is the sole, direct supply of water to the water treatment plant at Salmon Gums.

1.1.2 Water Corporation Dam no. 2

Dam no. 2 is an unroofed, earth dam. It was constructed in 1984 and has a volume of 24 000 kL. It has a 32 ha roaded catchment area with a yield of 13 000 kL, it also has a 320 ha natural bush catchment area. The dam is surrounded by a 1.8 m high security fence.

When necessary, water from Dam no. 2 is pumped into Dam no. 1. This typically occurs once or twice per year.

1.1.3 The Salmon Gums quarry reservoir

The Salmon Gums quarry reservoir was created in a disused quarry in 1992. It was filled by pumping water from a temporary fresh-water lake, located 2.9 km away on the golf course, which had formed from significant rains in 1992 – the wettest year on record for the district.

In 1995, a grant of $50 000 was provided under the Farm Water Scheme to improve the Salmon Gums quarry reservoir. A media statement released by the Minister for Water Resources on 29 August 1996 stated that the *"project would provide a compacted and stabilised clay catchment adjacent to the quarry to improve run-off sufficiently to replace the water used and the amount lost by evaporation."*

The capacity of the quarry reservoir is around 130 000 kL and the estimated yield of the quarry is 10 000 kL per year. The quarry reservoir catchment area is a cleared, roaded catchment with a vegetated buffer.

The Water Corporation draws water from the quarry and, once compliant water quality sample results are confirmed, pumps the water into Dam no. 1 and then through the treatment system.

A safe yield volume has been calculated for the quarry. This is the maximum volume that can be transferred from the quarry to the Water Corporation dam. This limit accounts for the water required for agricultural uses in the area.

A Memorandum of Understanding (MOU) exists between the Shire of Esperance, the Salmon Gums Development Group and the Water Corporation. The MOU recognises the parties' commitment to participate in a sharing arrangement for the use of water from the Salmon Gums quarry reservoir.

Extraction from the quarry stops when there is a minimum water volume of 55 000 kL in the quarry. Any reduction in volume below 55 000 kL needs to be approved by a sub-committee consisting of members from each of the MOU parties.

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 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 altering the beds and banks of waterways and abstracting water (pumping water from a river or creek) within proclaimed surface water areas throughout the state. Some exemptions apply such as abstracting water for domestic purposes only.

The Salmon Gums Catchment Area is not located within a proclaimed *Rights in Water and Irrigation Act 1914* surface water area or groundwater area, therefore no licence is required to take water. The Water Corporation is able to take as much water as required for public water supply from their surface water sources, however, due to the low rainfall in the area, this is self-limiting. The quarry reservoir water supply is not only limited by rainfall but also by the Memorandum of Understanding between the Shire of Esperance, the Salmon Gums Development Group and the Water Corporation which prevents extraction from the quarry when there is less than 55 000 kL of water in the quarry.

1.2.2 Water planning

A water deficiency declaration was made for Salmon Gums in June 2011. Water carting occurred from Esperance to Salmon Gums starting in 2011 and continued for almost two years. Above average rainfall in the area during the 2013 months of March and May has generated runoff into farm dams and emergency livestock water is no longer required to be carted to Salmon Gums. The water deficiency declaration was removed on the 4 June 2013.

The Water Corporation and the Department of Water are both planning for the future water supply needs in Salmon Gums under a drying climate model. New water supply options will be considered as part of this process.

Emergency farmland water response plan, Shire of Esperance

The *Emergency farmland water response plan*, *Shire of Esperance*, was published by the Department of Water in June 2011. This plan was developed to be used as a guide for agricultural water users. It outlines the emergency water response process and local neighbourhood supplies and explains how to access strategic community water supplies and scheme water pipeline standpipes or tanks. It also explains how to apply for water during a water deficiency declaration. It includes details specific to the Salmon Gums Catchment Area as well as maps and images of the quarry reservoir.

Esperance region water resources review and development plan

The *Esperance region water resources review and development plan*, was published by the Department of Water's predecessor, the Water and Rivers Commission, in 1997. The objectives of this report were to:

- collate current information on existing and potential divertible surface water and groundwater resources in the Esperance region
- undertake surface water yield analyses to assess and confirm existing information
- consolidate all available groundwater information pertaining to the region
- collate current information on domestic, industrial, agricultural and environmental water demands in the region
- predict future water demands within the study area for a 30-year planning horizon
- provide planning advice for the development of water resources in the region.

1.2.3 Future water needs

The Salmon Gums water source is variable and dependent upon rainfall. During 2011 and up to December 2012 water was carted to Salmon Gums because demand exceeded the availability. However significant rainfall during the 2013 months of March and May meant that ongoing carting was no longer required. In the future the availability of this water source will continue to vary depending upon annual rainfall.

The Australian Bureau of Statistics data has shown that the population of Salmon Gums appears to be in decline. In 2006 the estimated population of Salmon Gums was 789. This reduced to an estimated 160 people in 2011. If this trend continues, the future water needs of Salmon Gums should not increase.

1.3 Characteristics of the catchment

1.3.1 Physical environment

Much of the landscape in the Salmon Gums area has been cleared for agricultural purposes including cropping and grazing of livestock.

There are some sections of native woodlands that remain. The remaining native vegetation of the Salmon Gums area is predominately mallee associations of *Eucalyptus eremophila* and *E. oleosa*, combined with woodlands of *E. oleosa* and *E. flocktoniae*, with some occurrences of *E. salmonophloia* (Department of Agriculture 2005). Photographs of the native vegetation in the area can be seen in figures D1, D2, D3 and D4.

1.3.2 Climate

Salmon Gums has a temperate climate, with cool winters and warm summers. Since 1932, the average monthly maximum temperature has ranged from 16^{o}C in July to

30.6°C in January and the average monthly minimum temperature has ranged from 4.6°C in July and August to 14°C in February (Bureau of Meteorology 2012). The average annual rainfall (since 1932) is 350.7 mm, with a slightly increased rainfall occurring during the winter months (Bureau of Meteorology 2012).

1.3.3 Hydrology

The topography of the area is level to very gently undulating. It is a slightly elevated, inland plain with few surface drainage features and occasional swamps and salt lakes. The area has low relief with poor external drainage.

The soils are alkaline, grey, shallow, sandy, duplex soils with calcareous loamy earths and minor non-cracking clays (Department of Agriculture 2005).

In the area, the basement rock is shallow and groundwater only occurs in isolated pockets (Department of Agriculture 2005).

1.4 How is this drinking water source currently protected?

The Salmon Gums Catchment Area was proclaimed in 1960 under the *Country Areas Water Supply Act 1947*. Proclamation identified the location of the catchment area and ensured that the drinking water value of the proclaimed area was considered in land use planning decisions. It also allowed by-laws to be applied for the protection of water quality.

The Water Corporation conducts regular inspections at Salmon Gums Catchment Area to identify risks to water quality and enforce the by-laws where required. To find out more about by-laws, please see section 4.6: *Enforcing by-laws and surveying the area*.

The Shire of Esperance *local planning scheme no. 23*, recognises the Salmon Gums Catchment Area as a special control area—therefore the types of development supported are guided by our Water quality protection note (WQPN) no. 25: *Land use compatibility in public drinking water source areas*. This note is linked to the Western Australian Planning Commission's Statement of planning policy no. 2.7: *Public drinking water source policy*, which addresses development in PDWSAs.

2 Common contamination risks

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 run-off 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 iron corroding 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: Contamination risks in this drinking water source*.

Some commonly seen contamination risks relevant to surface water PDWSAs 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 catchment area. When people (e.g. while fishing, marroning, swimming) 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, or infiltrating through the soil, such as from septic tanks or animal manure in paddocks.

A number of pathogens are commonly known to contaminate water supplies worldwide. These include bacteria (e.g. *Salmonella*, *Escherichia coli* and cholera), protozoa (e.g. *Cryptosporidium*, *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 (e.g. 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 also 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 & NRMMC 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.

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). Erosion from activities such as off-road driving and clearing vegetation can cause turbidity. 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. High levels of turbidity in a water body can also affect the environment. It smothers riparian vegetation and reduces the transfer of light within the water column, affecting plant growth.

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 insecticides, herbicides, nematicides (used to control worms), rodenticides and miticides (used to control 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 (e.g. 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 leakage 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 could be harmful to human health.

3 Contamination risks in this drinking water source

3.1 Water quality

The Water Corporation regularly monitors the quality of raw water from the Salmon Gums 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 Salmon Gums Catchment Area from January 2008 to January 2013 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> What we do > Water quality > Water quality publications > Click on the most recent *Water quality annual report*.

3.2 Land uses and activities

The Salmon Gums Catchment Area is predominately located over freehold land owned by the Water Corporation and Crown reserve vested with the Water Corporation. There is one small section that is Crown reserve vested with the Department of Education.

There are also two parcels of land owned by the Department of Lands but one of these parcels is excluded from the proposed Salmon Gums Catchment Area (see Figure A2).

The Esperance Branch Railway and the Coolgardie-Esperance Highway run through the catchment area. The railway reserve for the Esperance Branch Railway is excluded from the proposed Salmon Gums Catchment Area, however the Coolgardie-Esperance Highway will remain within the new boundary.

Current land uses and activities and their risks to the drinking water source are described below. Table 1, at the end of this section, summarises this information in an easy-to-read format. Appendix C displays a more detailed risk assessment, and includes recommended protection strategies to address water quality risks. Please refer to figures A3 and A4 for tenure and land uses within and surrounding the Salmon Gums Catchment Area.

3.2.1 Water Corporation freehold and Crown land

The majority of the Salmon Gums Catchment Area is freehold land owned by the Water Corporation. This land is managed by the Water Corporation.

Roads and tracks

There are a number of roads within the Salmon Gums Catchment Area including the Coolgardie-Esperance Highway. The highway passes along the eastern side of the proposed Salmon Gums Catchment Area, just east of the dams. There are also several management tracks throughout the catchment area. However, these tracks also enable people to undertake unauthorised off-road driving. The erosion caused by vehicles off-road driving contributes to turbidity in the water body. Roads also pose a risk of hydrocarbon contamination from vehicle leaks or spills.

Water tankers filling station

When water deficiencies exist in Salmon Gums, farmers in the area fill tankers with water from an off-take pipe within the Salmon Gums Catchment Area. The off-take pipe pumps water from the Quarry reservoir and supplies it to farmers through an outlet designed to fill large tankers. This allows farmers to use the quarry when their farm dams are insufficient. This activity poses a risk of hydrocarbon and chemical contamination arising from the tankers spilling or leaking. This plan recommends further investigations into defining the quarry capture area to confirm if this is a water quality risk.

Wildfire

Human access increases the likelihood of wildfire. Wildfire potentially removes streamline and reservoir vegetation buffers which leads to an increased risk of turbidity, and decreases water quality.

Streamline and reservoir buffers are considered before application of chemical fire suppressors to avoid contamination of waterways.

Turbidity can be caused by the use of unsealed roads in the construction of, and access to, water points for wildfires. Wildfires are a significant risk to water quality.

Introduced and native fauna

There is the potential for pathogen and nutrient contamination of the quarry and the dam from animal carcasses and faeces. Native animals pose a lower risk than domestic and pest animals, because they carry different strains of pathogens. Domestic and pest animals can carry pathogens that infect humans. The quarry and the dams are fenced which reduces animal access.

3.2.2 Recreation

Historically, the quarry was a farm water supply (not a public drinking water supply), and was used for recreational purposes.

However, in the current 2004 MOU between the Shire of Esperance, the Salmon Gums Development Group and the Water Corporation it has been agreed that *"to ensure that the water quality in the quarry is preserved as a potable water supply, the parties acknowledge that the use of the quarry for recreational purposes will not be permitted".*

This outcome was reflected in the findings of the recent Standing Committee on Public Administration's Report 11: *Recreation Activities within Public Drinking Water Source Areas* (September 2010) that found that recreation should not occur in or near a source of water used for public (drinking) water supply due to the public health contamination risks (please refer to section 2 *Common contamination risks*).

The small size of the proposed Salmon Gums Catchment Area means that the proposed reservoir protection zone (RPZ) will cover the whole catchment area and that recreation is not supported in this catchment. This includes off-road vehicle use, bushwalking, camping and swimming. Access to public roads is not prevented.

There are alternative vegetated areas close to Salmon Gums that could be investigated for recreational use. The eastern section of the Salmon Gums Catchment Area that is proposed to be removed from the catchment area is a vegetated area. The majority of this vegetated area is Crown land vested with the Water Corporation and another section is owned by the Department of Lands. Once the amended catchment area is proclaimed there is the potential for this excluded land to be investigated as an alternative site for recreation opportunities. The development of this area for recreation would be dependent on landuse decisions made by the Water Corporation and Department of Lands.

Off-road vehicle use

Off-road driving within the catchment poses a water quality risk through increases in turbidity, the presence of people (pathogens) and potential accidents resulting in fuel or chemical spills. Vehicle access to the roaded catchment areas increases the potential for turbidity and hydrocarbon contamination. Public access to the RPZ is prohibited whether by car, bike, or on foot, to protect water quality. Illegal trail bike use is known to sometimes occur in the catchment and it will need to be prevented in the future.

Swimming

Swimming is a prohibited activity in PDWSAs and penalties may apply. Body contact with the water can result in pathogen contamination. Human or animal contact with water involves a direct threat to water quality with the potential for pathogen contamination and significantly reduces the effectiveness of detention time in the reservoir as a barrier. Chlorination alone does not provide sufficient protection against all human pathogens. In addition, human activity in and around the reservoir increases turbidity and fire risk.

There have been reports of people swimming in the dam and quarry, but swimming has decreased to minimal levels since the water bodies were fenced. Security fencing and signage around Dam no. 2 and the quarry aim to prevent swimming.

3.2.3 Contaminated sites

There is an area identified as possibly contaminated (further investigation required) within the Salmon Gums Catchment Area. This area has been reported as a

suspected contaminated site under the *Contaminated Sites Act 2003*, which is administered by the Department of Environment and Conservation.

The area within the Salmon Gums Catchment Area that is listed as possibly contaminated includes the former landfill site on Crown reserve 13328, 288 Salmon Gums West Road. The rubbish tip previously accepted primarily domestic waste from the town of Salmon Gums, however some light industrial and farming waste may have also been accepted. The Shire of Esperance has closed the site down and although the waste disposal trenches are covered with dirt, there is still a risk of leaching and contaminated run-off entering the water storage system.

Further investigation into this possibly contaminated area is recommended. If the Department of Environment and Conservation classify this site as requiring remediation, this should be addressed as soon as possible to reduce the risk of groundwater contamination.

3.2.4 Surrounding land uses

Agricultural

The land uses surrounding the Salmon Gums Catchment Area are mainly related to stock grazing and cropping. These pose a risk of contamination from fertilisers and pesticides from spraying. In the past, dieldrin (a pesticide) has been detected in Dam no. 1, however no pesticides have been detected between 2004 and 2012.

Railway line

The Esperance Branch Railway runs along the eastern border of the PDWSA outside the proposed Salmon Gums Catchment Area. The railway line poses a risk of contamination from windblown materials that are transported by rail. This should not occur if materials are transported correctly. There is also the risk from pesticides during the maintenance of the railway line. Although the railway is outside the catchment there is a contamination risk from windblown pesticides during weed management.

3.2.5 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 Salmon Gums Catchment Area. Only a small proportion of the site (less than 6 per cent) is within the catchment area. The site has been lodged and is titled Esperance Pipeline 2, but, as it has not been permanently registered, it does not have a site number.

Native title is the recognition in Australian law that some Aboriginal people continue to hold native title rights to lands and water arising from their traditional laws and customs.

There is one native title claim within the Salmon Gums Catchment Area. This is the Esperance Nyungars claim (WAD6097/98).

The Department of Water 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.

3.3 Possible future contamination risks

The former Department of Land Administration has shown some interest in further development (through subdivisions) in Salmon Gums. This may include development of a future home for children in need and a new power station. Decisions on the location of these developments should consider the recommendations in this plan (please also see section 1.4 *How is this drinking water source currently protected?*).

There are three mining tenements within the Salmon Gums Catchment Area. Two of these mining tenements are pending and they are all classified as unsurveyed. Any future exploration or mining proposals should be referred to the Department of Water regional office for advice.

Table 1 Summary of 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 guidance[1]
Roads and tracks	Hydrocarbons and turbidity	Medium	Existing sealed roads and highway are acceptable. Unsealed roads should be managed to control access.	WQPN no. 44: *Roads near sensitive water resources*
Swimming in the reservoir	Pathogens from body contact	High	Swimming is illegal – penalties may apply.	Operational policy 13: *Recreation within public drinking water source areas on Crown land*
Former landfill site	Chemicals and hydrocarbons from wastes	Medium	The landfill site has closed down.	Subject to post-closure monitoring under the *Contaminated Sites Act 2003*
Surrounding agricultural land uses	Chemicals and nutrients from pesticides and fertilisers	Low	Agriculture is generally compatible This land use is outside the PDWSA, however windblown contamination can still be a risk.	WQPN no.1 : *Agriculture – dryland crops near sensitive water resources* Statewide policy no.2: *Pesticide use in public drinking water source areas* WQPN no. 104 : *Aerial spraying of crops with pesticides*

[1]Water quality protection notes are available <http://drinkingwater.water.wa.gov.au> and scroll down to the link for *water quality protection notes*.

4 Protecting your drinking water source

The objective of this plan is to address identified water quality risks, and where practical achieve an improvement so as to ensure the continued supply of safe drinking water to consumers in Salmon Gums.

4.1 Proclaiming public drinking water source areas

Salmon Gums Catchment Area was proclaimed under the *Country Areas Water Supply Act 1947* in 1960.

The Department of Water has investigated the current Salmon Gums Catchment Area boundary using available hydrographic data, aerial photography and elevation datasets. Based on an assessment of this information the Department of Water proposes a new Salmon Gums Catchment Area boundary. A visual site inspection has established that the area east of the Coolgardie-Esperance Highway does not contribute water inflow to either Dam no.2 or the quarry. Therefore this plan proposes to remove this section from the current Salmon Gums Catchment Area. Please refer to Figure A2 for a map of the proposed change.

Due to the limited hydrological information of the area it is recommended that, when possible, a ground survey or further investigations be undertaken to confirm the accuracy of the proposed PDWSA. The elevation data used for the hydrological assessment was limited and additional information would be useful to accurately establish the hydrological boundary of the Salmon Gums Dam no.2 and the quarry catchment areas.

The proclamation process for the amended boundary begins with consultation as part of the development of this drinking water source protection plan. This plan recommends proclamation of the amended Salmon Gums Catchment Area (please refer to Figure A5) under the *Country Areas Water Supply Act 1947*.

Once the catchment area is amended the local government authority should incorporate the 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. The Shire of Esperance's *local planning scheme no. 23*, already shows the Salmon Gums Catchment Area as a special control area. This should be amended to reflect the new proposed boundary once this plan is published.

Proclamation of a PDWSA will not change the zoning of the land. Best management practices for activities should be employed in this PDWSA to protect its water quality. New developments or expansion of existing land uses or activities need to consider the recommendations in this plan. As a general guide, the Department of Water does not recommend land use intensification in a PDWSA because of the increased risks to water quality and public health.

For more guidance on appropriate land uses and activities please refer to our WQPN no. 25: *Land use compatibility in 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. The Department of Water'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 (e.g. state forest and other Crown land).
- Priority 2 (P2) areas have the fundamental water quality objective of risk minimisation (e.g. land that is zoned rural).
- Priority 3 (P3) areas have the fundamental water quality objective of risk management (e.g. areas zoned urban or light industrial/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 areas for the Salmon Gums Catchment Area have been determined in accordance with current Department of Water policy. These areas are described below and displayed in Figure A5. 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 the Water Corporation land, Department of Lands land and all Crown land in the Salmon Gums Catchment Area as P1 because:

- water from this source is the sole supply available to Salmon Gums
- there is limited water within the Salmon Gums Catchment Area
- the catchment is predominately comprised of freehold land owned by the Water Corporation. There is also freehold land owned by the Department of Lands and Crown land vested with the Water Corporation and the Department of Education (i.e. no private land owners in this catchment).

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.

RPZs are assigned over the most vulnerable part of the catchment. They include the water storage body but do not extend outside the catchment or downstream of the dam wall. They adopt the priority area of the land over which they occur.

RPZs that occur in the *Metropolitan Water Supply, Sewerage, and Drainage Act 1909* are referred to as 'prohibited zones' and are legislatively set at a distance of 2 km from the high water level of a reservoir.

For consistency, and where reasonable, we also apply RPZs to country sources. In the proposed new water resource management legislation, the Department of Water has recommended that a 2 km RPZ – or other distance approved by the Minister for Water following development of a drinking water source protection report – should apply across the whole state.

A RPZ has been defined for the Salmon Gums Catchment Area to protect the portion of the PDWSA that is most vulnerable to contamination. Due to the small size of this catchment the Salmon Gums RPZ is proposed to cover the whole of the proposed Salmon Gums Catchment Area (see Figure A5).

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 Salmon Gums Catchment Area, its priority area and protection zones be recognised in the Shire of Esperance local planning scheme. Any development proposals in the Salmon Gums Catchment Area that are inconsistent with advice in our WQPN no. 25: *Land use compatibility in public drinking water source areas* or recommendations in this plan, need to be referred to our nearest regional office for advice.

For further information on the integration of land-use planning and water source protection, please refer to our WQPN no. 36: *Protecting public drinking water source areas*. This note describes the findings of Parliamentary Committee reviews instrumental in the integration of water quality protection and land use planning in WA. These Parliamentary Committees advocated protection over a reliance on costly water treatment or the cleanup of contaminated sources required in other parts of the world.

The department's protection strategy for PDWSAs provides for previously approved developments to continue even if those facilities would not be supported under current water quality protection criteria. In these instances, the department can provide advice to landowners or operators on measures they can use to improve their facilities and reduce water quality contamination risks (see section *4.5: Using best management practices*).

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, the Department of Water 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 WQPN no. 44: *Roads near sensitive water resources*, WQPN no. 1: *Agriculture – dryland crops near sensitive water resources* and WQPN no. 80: *Stockyards*, which are listed in this plan's *Further reading* section.

Education and awareness-raising (such as information on signs and in publications) are key mechanisms for protecting water quality, especially for people visiting the area.

4.6 Enforcing by-laws and surveying the area

The quality of water in PDWSAs within country areas of the state is protected under the *Country Areas Water Supply Act 1947*. Proclamation of PDWSAs allows by-laws to be applied to protect water quality.

The Department of Water considers by-law enforcement, through surveillance of land-use activities in PDWSAs, to be an important mechanism to protect water quality. Signs are erected on the boundaries of this catchment area to educate and advise the public about activities that are prohibited or regulated. The Water Corporation undertakes surveillance and by-law enforcement in this catchment area on a regular basis.

4.7 Responding to emergencies

The escape of contaminants during unforeseen incidents and the use of chemicals during emergency responses can result in water contamination. The Shire of Esperance local emergency management committee (LEMC), through the Goldfields-Esperance emergency management district, should be familiar with the location and purpose of the Salmon Gums Catchment Area.

A locality plan will be provided to the fire and rescue services headquarters for the hazardous materials (HAZMAT) emergency advisory team. The Water Corporation should have an advisory role to the HAZMAT team for incidents in the Salmon Gums Catchment Area.

Personnel who deal with Westplan–HAZMAT (Western Australian plan for hazardous materials) incidents within the area should have access to a map of the Salmon Gums Catchment Area. These personnel should have an adequate understanding of the potential impacts of spills on this drinking water source.

4.8 Implementing and updating this plan

Table 1 (found at the end of section 3) identifies a few of the potential water quality risks associated with existing land uses in the Salmon Gums Catchment Area. A full list of potential water quality risks associated with existing land uses and further information and the recommended protection strategies to deal with those risks are outlined in Appendix C.

With more than 130 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 five 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 table below shows the differences between the three types of reports.

Table 2 Drinking water source protection reports

Drinking water source protection report	**Scope and outcome**	**Consultation**	**Implementation table**	**Proclamation**
Drinking water source protection assessment (DWSPA)	Desktop assessment of readily available information	Targeted	No.	Yes, 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, with advertising or targeted if there are no private landowners	Prepared from recommendations in the DWSPA and information from public consultation.	
Drinking water source protection review (DWSPR)	Review change in land and water factors and implementation of previous recommendations.	Key stakeholders	Prepared from recommendations in the DWSPA or DWSPP.	

5 Recommendations

The following recommendations apply to the entire Salmon Gums Catchment Area. The bracketed stakeholders are those expected to have a responsibility for, or an interest in, the implementation of that recommendation.

1. Amend the boundary of the Salmon Gums Catchment Area under the *Country Areas Water Supply Act 1947*. (Department of Water)
2. Incorporate the findings of this plan and location of the Salmon Gums Catchment Area (including its priority area and protection zone) in the Shire of Esperance local planning scheme in accordance with the WAPC's State planning policy no. 2.7: *Public drinking water source policy*. (Shire of Esperance)
3. Refer development proposals within the Salmon Gums Catchment Area that are inconsistent with the Department of Water's WQPN no. 25: *Land use compatibility in public drinking water source areas* or recommendations in this plan to the Department of Water regional office for advice. (Department of Planning, Shire of Esperance, proponents of proposals)
4. Ensure incidents covered by Westplan–HAZMAT in the Salmon Gums Catchment Area are addressed by ensuring that:
    - the Shire of Esperance LEMC is aware of the location and purpose of the Salmon Gums Catchment Area (Department of Water)
    - the locality plan for the Salmon Gums Catchment Area is provided to the Department of Fire and Emergency Services headquarters for the HAZMAT emergency advisory team (Department of Water)
    - the Department of Water acts in an advisory role during incidents in the Salmon Gums Catchment Area (Department of Water)
    - personnel dealing with Westplan–HAZMAT incidents in the area have ready access to a locality map of the Salmon Gums Catchment Area and information to help them recognise the potential impacts of spills on drinking water quality. (Water Corporation, Department of Water)
5. Erect additional signs along the boundary of the Salmon Gums Catchment Area including an emergency contact telephone number. (Water Corporation, Department of Water)
6. Investigate the surface water catchment area of Dam no.2 and the quarry by undertaking further site investigations and hydrological work. This work should include investigating if run-off from the water tanker filling station flows into the quarry and if run-off from the highway flows into the catchment area. Any recommended changes to the boundary should be included in the next update of this plan. (Water Corporation, Department of Water)

7. Recommend regular maintenance of the roaded catchment areas in accordance with the Department of Agriculture Bulletin 4660: *Roaded catchments to improve reliability of farm dams*. This will help ensure the roaded catchment threshold is maintained to maximise water quality and flow. (Water Corporation)
8. Update this plan after five years. This may require a new plan if substantial changes have occurred. If not, a drinking water source protection review may be developed. (Department of Water)

Appendices

Appendix A — Figures

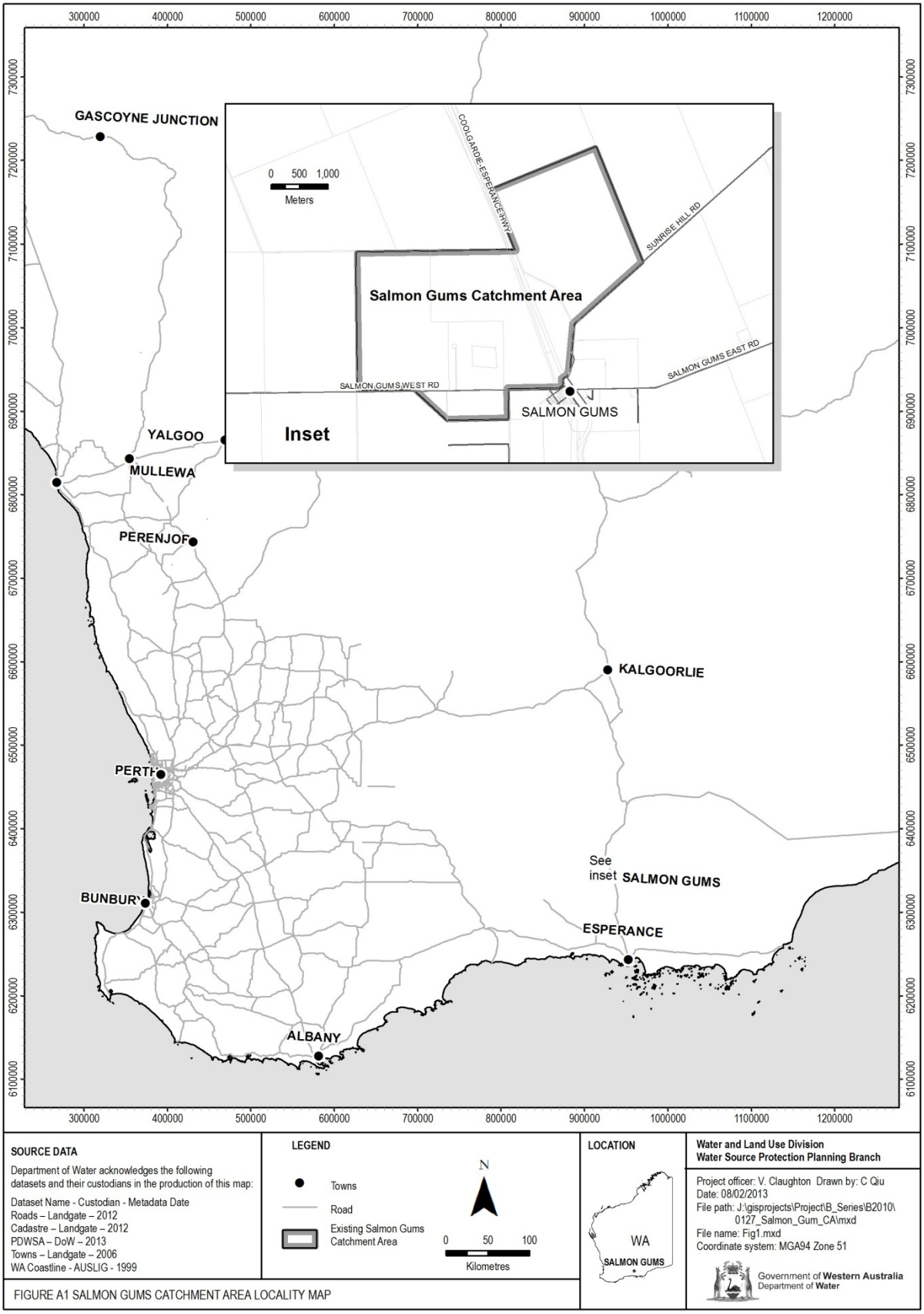
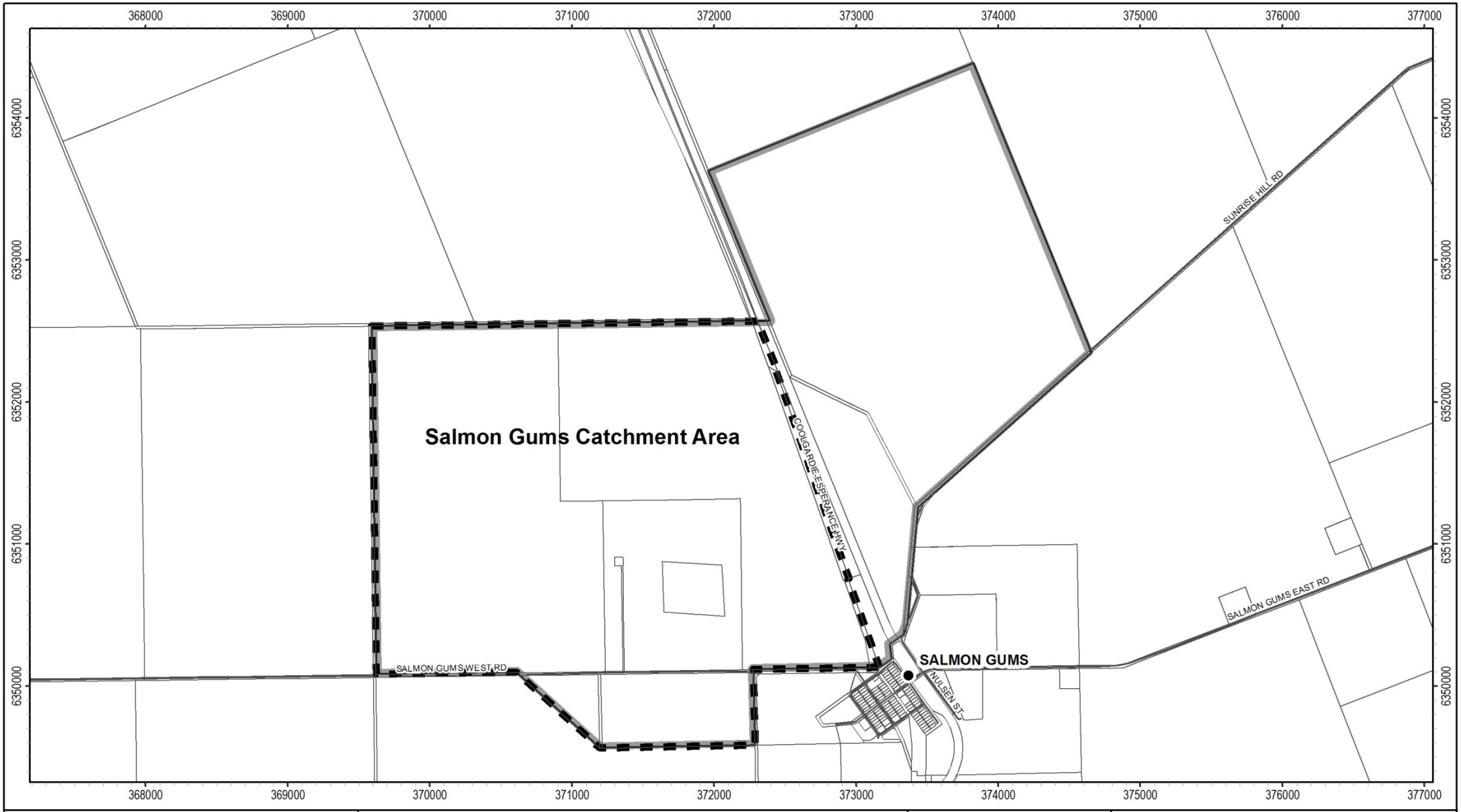


FIGURE A1 SALMON GUMS CATCHMENT AREA LOCALITY MAP



SOURCE DATA

Department of Water acknowledges the following datasets and their custodians in the production of this map:

Dataset Name – Custodian – Metadata Date
Roads – Landgate – 2010
Cadastre – Landgate – 2012
PDWSA – DoW – 2013

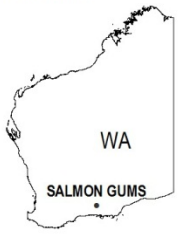
LEGEND

- Towns
- Roads
- Proposed Salmon Gums Catchment Area
- Existing Salmon Gums Catchment Area
- Cadastre

N

0 0.5 1
Kilometers

LOCATION

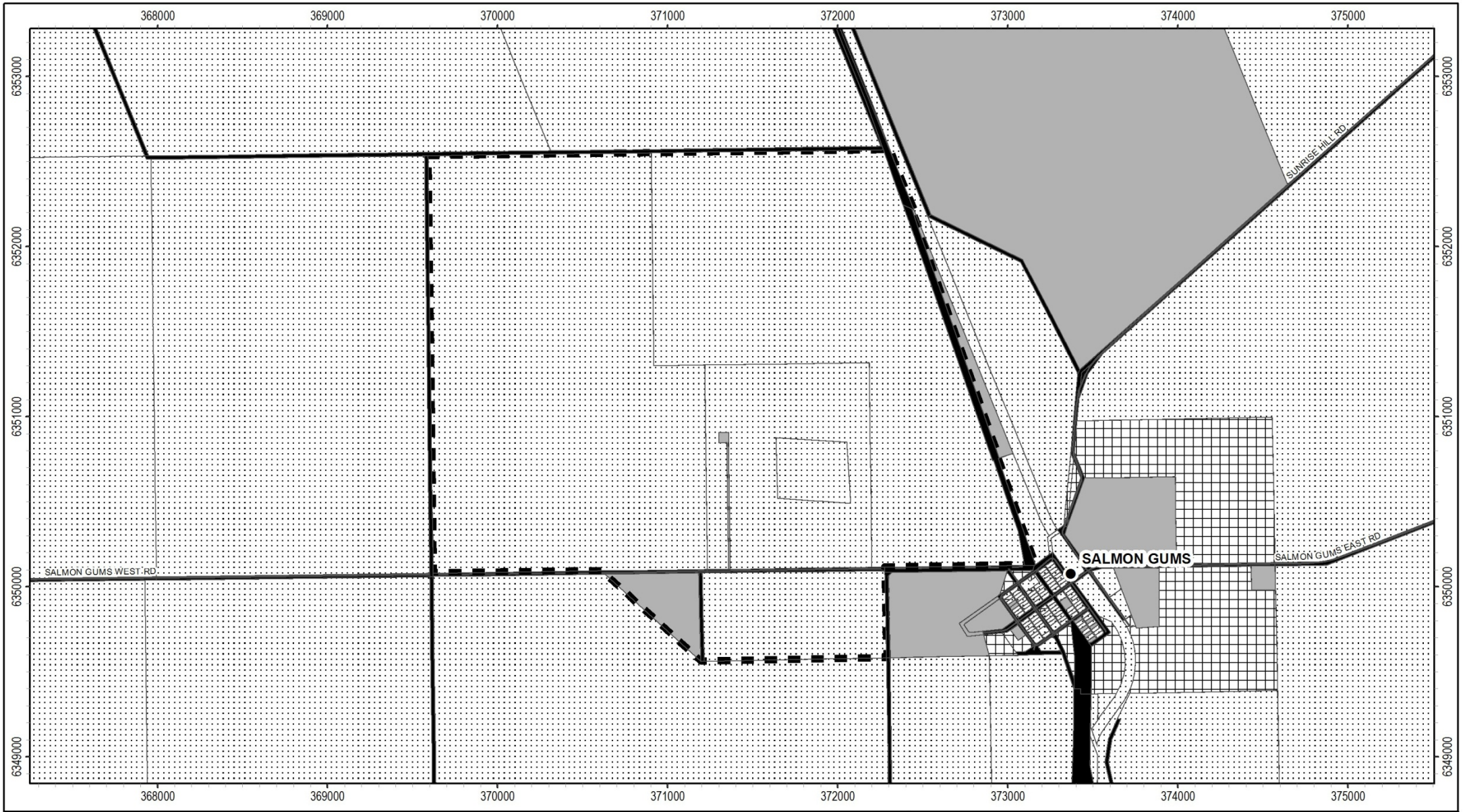


Water and Land Use Division
Water Source Protection Planning Branch

Project officer: V. Claughton Drawn by: C Qiu
Date: 08/02/2013
File path: J:\gisprojects\Project\B_Series\B2010\0127_Salmon_Gum_CA\mxd
File name: Fig2.mxd
Coordinate system: MGA94 Zone 51

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

FIGURE A2 EXISTING AND PROPOSED SALMON GUMS CATCHMENT AREA BOUNDARIES



SOURCE DATA

Department of Water acknowledges the following datasets and their custodians in the production of this map:

Dataset Name – Custodian – Metadata Date
Roads – Landgate – 2010
Cadastre – Landgate – 2012
PDWSA – DoW – 2013

LEGEND

- Towns
- Roads
- Proposed Salmon Gums Catchment Area

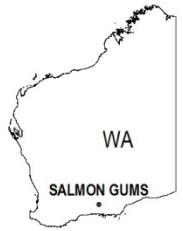
Cadastre, Land Tenure

- Crown Reserve
- Freehold
- Public Roads
- Unallocated Crown Land

N

0 250 500
Meters

LOCATION

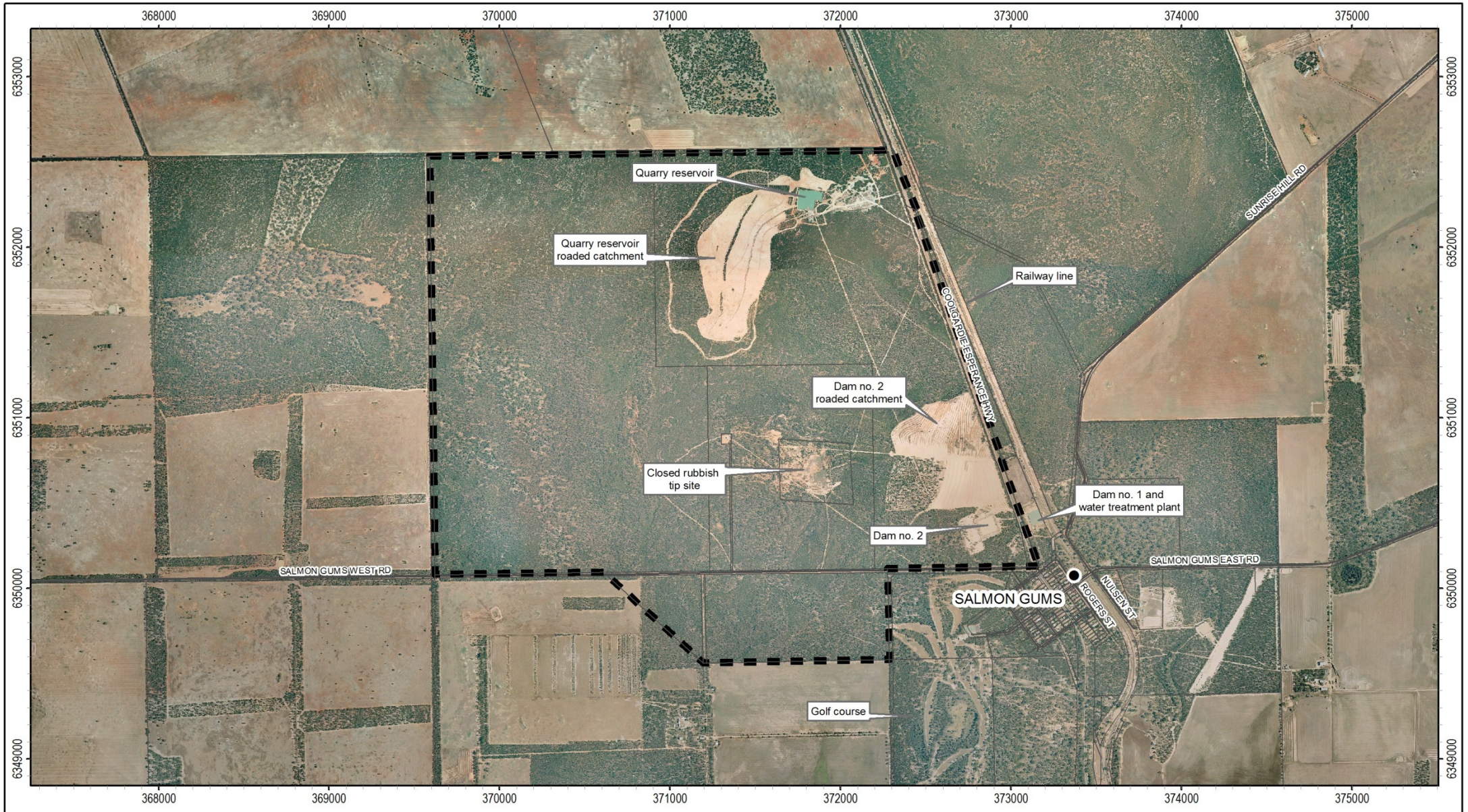


Water and Land Use Division
Water Source Protection Planning Branch

Project officer: V. Claughton Drawn by: C Qiu
Date: 08/02/2013
File path: J:\gisprojects\Project\B_Series\B2010\0127_Salmon_Gum_CA\mxd
File name: Fig3.mxd
Coordinate system: MGA94 Zone 51

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

FIGURE A3 LAND USE, ACTIVITIES AND TENURE IN AND AROUND THE SALMON GUMS 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
Roads – Landgate – 2010
Cadastre – Landgate – 2012

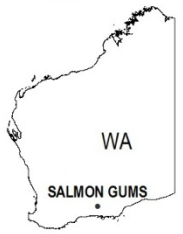
LEGEND

- Towns
- Roads
- Proposed Salmon Gums Catchment Area

N

0 250 500
Meters

LOCATION

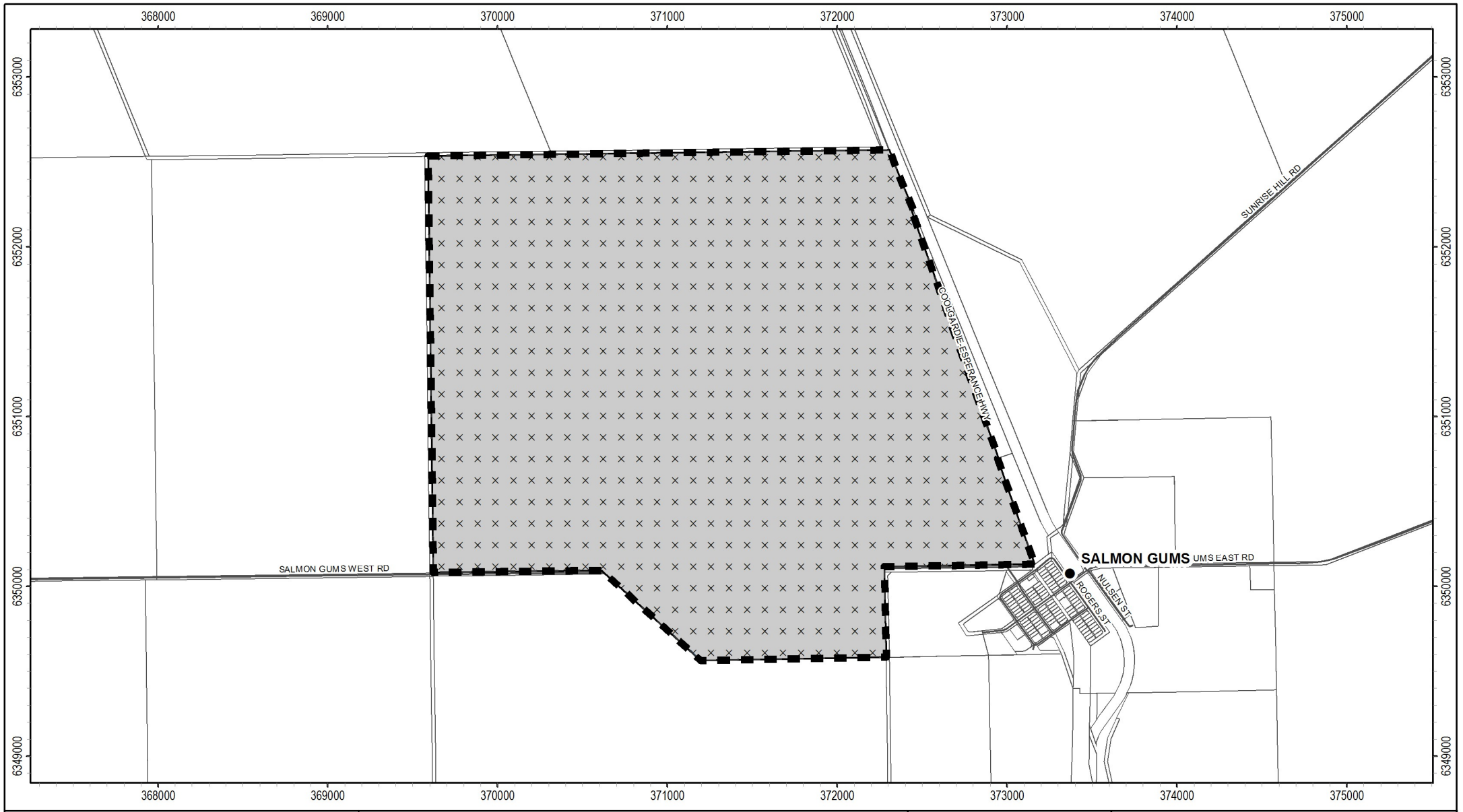


Water and Land Use Division
Water Source Protection Planning Branch

Project officer: V. Claughton Drawn by: C Qiu
Date: 08/02/2013
File path: J:\gisprojects\Project\B_Series\B2010\0127_Salmon_Gum_CA\mxd
File name: Fig4.mxd
Coordinate system: MGA94 Zone 51

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

FIGURE A4 AERIAL PHOTOGRAPHY AND LAND USES IN SALMON GUMS 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
Roads – Landgate – 2010
Cadastre – Landgate – 2012

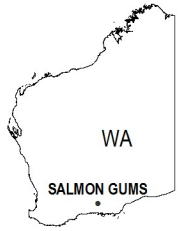
LEGEND

- Towns
- Roads
- Cadastre
- Proposed Salmon Gums Catchment Area
- Proposed Reservoir Protection Zone
- Priority One Area

N

0 250 500
Meters

LOCATION



Water and Land Use Division
Water Source Protection Planning Branch

Project officer: V. Claughton Drawn by: C Qiu
Date: 08/02/2013
File path: J:\gisprojects\Project\B_Series\B2010\0127_Salmon_Gum_CA\mxd
File name: Fig4.mxd
Coordinate system: MGA94 Zone 51

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FIGURE A5 PROPOSED BOUNDARY AND PRIORITY AREAS FOR THE SALMON GUMS CATCHMENT AREA

Appendix B— Water quality data

The Water Corporation has monitored the raw (source) water quality from Salmon Gums in accordance with the requirements of the *Australian Drinking Water Guidelines*, 2004 (ADWG) and interpretations agreed to with the Department of Health. This data shows the quality of water in the catchment. The raw water is regularly monitored 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 Salmon Gums Dam no. 2 and quarry reservoir. 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 2008 to January 2013.

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 the Goldfields and Agricultural Region refer to the most recent Water Corporation drinking water quality annual report at <watercorporation.com.au> What we do > Water quality > Water quality publications > Most recent *Drinking water quality annual report*.

Aesthetic

The aesthetic water quality analyses for raw water from Salmon Gums are summarised in the following table.

Aesthetic detections for Salmon Gums

Parameter	**Units**	**ADWG aesthetic guideline value***	**Dam no. 1 (raw)**	
			Range	**Median**
Chloride	mg/L	250	34–60	41
Colour - true	TCU	15	1–6	4
Hardness	mg/L	200	60–140	120
Iron	mg/L	0.3	<0.003–0.2	0.02
Sodium	mg/L	180	48–94	59
Total filterable solids by summation	mg/L	600	262–550	381
Turbidity	NTU	5	<0.1–**5.8**	0.75
pH	No unit	8.5	8.1–**8.62**	8.38

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

Health related

Health-related chemicals

Raw water from Salmon Gums 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 Salmon Gums

Parameter	**Units**	**ADWG health guideline value***	**Dam no. 1 (raw)**	
			Range	**Median**
Boron	mg/L	4	0.46–0.46	0.46
Fluoride	mg/L	1.5	0.2–0.4	0.3
Iodide	mg/L	0.1	<0.02–0.06	<0.02
Nitrate as nitrogen	mg/L	11.29[†]	0.05–0.25	0.19
Sulfate	mg/L	500	5.5–12	7.8

* A health guideline value is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant

risk to the health of the consumer over a lifetime of consumption (NHRMC & ARMCANZ, 2004).

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

Microbiological contaminants

Microbiological testing of raw-water samples from Salmon Gums is currently conducted on a fortnightly 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 count of less than 20 MPN (most probable number) per 100 mL sample is typically associated with low levels of faecal contamination and is used as a microbiological contamination benchmark of the raw water (WHO, 2004). As such, counts less than 20 MPN are seen as being an indication of raw water that has not been recently contaminated with faecal material.

During the review period, positive *Escherichia coli* counts were recorded in 54 per cent of samples. Approximately 30 per cent of these samples had *E. coli* counts greater than 20 MPN/100mL. There is additional treatment of the water prior to supply.

Appendix C— Land use, 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 chemical contamination from fuel and chemical spills	Medium	The Coolgardie-Esperance Highway runs along the eastern edge of the proposed catchment area. There are a number of unsealed roads in the catchment area, access is provided from the Coolgardie-Esperance Highway.	• water quality monitoring • Water Corporation surveillance • signage.	• Incident management procedures in place with Main Roads and local shires and maintain HAZMAT emergency response. • Close unused roads and install gates to other roads that currently provide public access. • Ensure adherence to WQPN no. 44: *Roads near sensitive water resources*. • Ensure adherence to WQPN no. 10: *Contaminant spills – emergency response.*
	Turbidity from erosion	Low			
Road verge weed management	Contamination from pesticides	Medium	Pesticides may be used along the Coolgardie-Esperance Highway to control weeds.	• water quality monitoring.	• Ensure all spraying in the catchment is consistent with Public sector circular number 88: *Use of herbicides in water catchment areas.*

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	**Management priority**			
Filling of tankers	Hydrocarbon and chemical contamination from fuel and chemical spills	Medium	During dry seasons when required, farmers fill their tankers from a water supply outlet within the catchment area. This is a dry season response to the lack of agricultural water in the area.	• water quality monitoring • signs.	• Incident management procedures in place with Main Roads and local shires. • Maintain HAZMAT emergency response. • Ensure adherence to WQPN no. 10: *Contaminant spills – emergency response.*
	Turbidity from erosion	Medium			
Off-road vehicles	Hydrocarbon contamination from fuel spills or accidents	Medium	Off-road vehicle use is rare but when it does occur it is a low-level activity.	• water quality monitoring • Water Corporation surveillance • signs.	• Signs in place. • Close unused roads. • Install gates to other roads that currently provide public access.
	Turbidity from erosion	Medium			
Water-based recreation including swimming and fishing in the quarry or dam	Turbidity from erosion	Low	Swimming or fishing in the water bodies is rare.	• water quality monitoring • Water Corporation surveillance • signs.	• Increase signs. • Install gates to other roads that currently provide public access. • Investigate the use of the deproclaimed section of the catchment for recreation.
	Pathogens from human and animal access	Medium			

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	**Management priority**			
Former landfill site (possible contaminated site)	Chemicals and hydrocarbons from leaching	Medium	The landfill site is no longer used. It is not yet known if it is a contaminated site.	• water quality monitoring.	• Investigation of the old landfill site to find out if it is contaminated. • Investigate the decommissioning process used to close the site and implement best practice site closure management procedures.
	Pathogens from human and animal waste	Medium			
Fauna (native and introduced)	Pathogens from animal faeces and carcasses	Medium	The fauna in the catchment area is predominately native kangaroos and birds. Domestic and pest animals carry pathogens that can infect humans.	• water quality monitoring before utilising the water source • fenced water bodies.	• Implement a pest management program. • Increased monitoring of the dam and quarry for dead or introduced fauna.
	Nutrients from animal faeces	Low			
	Turbidity from animal access	Low			

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	**Management priority**			
Wildfire	Nutrients from decomposition materials	Low	Wildfires in the area are rare, however they could be associated with thunderstorms, increasing the potential for rapid transport of decomposed and eroded material into the dam and quarry. The presence of people in the catchment increases the likelihood of wildfire.	• Water Corporation surveillance • Water Corporation post-event management • water quality monitoring before utilising the water source.	• Continue current fire management regime. • Water Corporation monitors water quality post wildfire. • Streamline and reservoir buffers are considered before applying chemical fire. • Liaise closely with the council's Local Emergency Management Advisory Committee through the Goldfields-Esperance Emergency Management District. The committee should be familiar with the location and purpose of the Salmon Gums PDWSA. • Provide a locality plan to the Fire and Rescue Services headquarters for the Hazardous Materials Emergency Advisory Team (HAZMAT).
	Turbidity caused by erosion and decomposition material	Low			

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	**Management priority**			
Fire management (firebreaks and controlled burns)	Nutrients from decomposition materials	Low	The roaded catchments are void of vegetation and do not contain a build up of organic material. Therefore they do not require regular controlled burning. The vegetated sections of the Salmon Gums Catchment Area do not contain a large build up of organic material.	• Water Corporation management • water quality monitoring before utilising the water source.	• Streamline and reservoir buffers are considered before applying chemical fire. • Adhere to the Bushfires Act 1954. • Ensure Water Corporation fire management of the catchment area considers water source contamination risks.
	Turbidity caused by erosion and decomposition material	Low			
Degradation of the roaded catchments	Turbidity	Medium	The roaded catchments areas are not compacted. This increases the turbidity of water that flows into the dam and quarry.	• silt trap for water flowing into Dam no.2 • water quality monitoring.	• Maintain and improve the roaded catchments in line with the Department of Agriculture Bulletin 4660: *Roaded catchments to improve reliability of farm dams.*

Land use/activity	Potential water quality risks		Consideration for management	Current preventive measures	Recommended protection strategies
	Hazard	**Management priority**			
Surrounding agricultural land uses	Chemicals from pesticides	Medium	The agricultural areas are outside the Salmon Gums Catchment Area, however contamination is possible due to windblown contamination or aerial spraying.	• water quality monitoring before using the water.	• Recommend best management practices for the surrounding agricultural land. • Ensure adherence to WQPN no.1: *Agriculture – dryland crops near sensitive water resources.* • Ensure adherence to Statewide policy no.2: *Pesticide use in public drinking water source areas.* • Ensure adherence to WQPN no.65: *Toxic and hazardous substances - storage and use.* • Ensure adherence to WQPN no. 104: *Aerial spraying of crops with pesticides.*
	Nutrients from fertilisers	Low			
	Hydrocarbon and chemical spills from vehicles	Low			
Railway bordering the eastern side of the catchment area	Chemicals from transported materials and maintenance of the railway line	Medium	This is outside the catchment but there is a risk of windblown contamination of pesticides and rail transported materials.	• water quality monitoring before utilising the water.	• Recommend best management practices for the railway line. • Ensure adherence to Statewide policy no.2: *Pesticide use in public drinking water source areas.*

Appendix D— Photographs

Figure D1 Salmon Gums Dam no. 2, photograph by V. Claughton

Figure D2 Salmon Gums Quarry, fencing and sign, photograph by V. Claughton

Figure D3 Salmon Gums roaded catchment area, photograph by V. Claughton

Figure D4 Salmon Gums Quarry, photograph by V. Claughton

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
CA	catchment area
HAZMAT	hazardous materials
kL	kilolitre
km	kilometre
LEMC	local emergency management committee
m	metres
mg/L	milligram per litre
mL	millilitre
ML	megalitre
MPN	most probable number
NHMRC	National Health and Medical Research Council
NRMMC	Natural Resource Management Ministerial Council
NTU	nephelometric turbidity units
PSC 88	Public sector circular number 88
PDWSA	public drinking water source area
RPZ	reservoir protection zone
TCU	true colour units
TDS	total dissolved solids
WAPC	Western Australian Planning Commission
Westplan–HAZMAT	Western Australian plan for hazardous materials
WQPN	water quality protection note

Glossary

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, e.g. appearance, taste and odour (NHMRC & NRMMC 2011).
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 Bibliography).
Catchment	The physical area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Drinking water source protection report	This is a report on water quality hazards and risk levels within a public drinking water source area that includes recommendations to avoid, minimise, or manage those risks for the protection of the water supply in the provision of safe drinking water supply.
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, its properties, laws, geographical distribution, etc.
Leaching/ leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater. The material washed out is known as leachate. Leachate can pollute groundwater and waterways.
mg/L	A milligram per litre (0.001 grams per litre) is a measurement of a total dissolved solid in a solution.
Most probable number	Most probable number is a measure of microbiological contamination.
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* and the *Country Areas Water Supply Act 1947*.
Public sector circular number 88	A state government circular produced by the Department of Health providing guidance on appropriate herbicide use within water catchment areas.
Reservoir	A reservoir, dam, tank, pond or lake that forms any part of a public water-supply works.
Reservoir protection zone	A buffer measured from the high water mark of a drinking water reservoir, 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.
Total dissolved solids	Total dissolved solids consist of inorganic salts and small amounts of organic matter that are dissolved in water. Clay particles, colloidal iron and manganese oxides, and silica fine enough to pass through a 0.45 micrometer filter membrane can also contribute to total dissolved solids. Total dissolved solids comprise sodium, potassium, calcium, magnesium, chloride, sulfate, bicarbonate, carbonate, silica, organic matter, fluoride, iron, manganese, nitrate (and nitrite) and phosphate (NHMRC & NRMMC 2011).

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). It is used as a more accurate measure than total dissolved solids (TDS). The higher the value, the more solids that are present and generally the saltier the taste.
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.
Water quality	Water quality is the collective term for the physical, aesthetic, chemical and biological properties of water.
Western Australian hazardous materials emergency management scheme	This is now known as Westplan–HAZMAT.

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