Department of Water
Government of Western Australia

Marbellup Brook Catchment Area Drinking Water Source Protection Plan

Lower Great Southern Town Water Supply

REPORT NO. 67
APRIL 2007

Water Resource Protection Series

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The Department of Water has received funding assistance from the National Action Plan for Salinity and Water Quality, through **South Coast Regional Initiative Planning Team (SCRIPT)** to help prepare this protection plan.

Subject of cover photograph
Marbellup Brook, taken by Letisha Newman

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Preface

The Department of Water has prepared this Drinking Water Source Protection Plan to report on the activities and risks to water quality within the Marbellup Brook Catchment Area and to recommend management strategies to address these.

A safe drinking water supply is critical to the well being of the community and catchment protection is necessary to help avoid, minimise or manage risks to water quality. The Department is committed to protecting drinking water sources to ensure the continued supply of 'safe, good quality drinking water' to consumers.

The Australian Drinking Water Guidelines recommend a multiple barrier risk based approach to protect public drinking water sources. Protection of drinking water catchments is the 'first barrier', with subsequent barriers implemented at the water storage, treatment and distribution stages of a water supply system. Catchment protection includes understanding the catchment, the hazards and hazardous events that can compromise drinking water quality, and developing and implementing preventive strategies and operational controls to ensure the safest possible water supply from our surface water dams and groundwater aquifers.

This plan details the location and boundary of the drinking water catchment, which provides potable water to the Lower Great Southern Town Water Supply Scheme. It describes the water supply system, discusses existing and future usage of the water source, identifies risks and recommends management approaches to maximise protection of the catchment.

This plan should be used to guide State and local government land use planning decisions. It should be recognised in the City of Albany Town Planning Scheme, consistent with the Western Australian Planning Commission's Statement of Planning Policy No. 2.7 - *Public Drinking Water Source Policy*. Other stakeholders should use this document as a guide for protecting the quality of water in the recommended Marbellup Brook Catchment Area.

The stages involved in preparing a Drinking Water Source Protection Plan are:

	Stages in development of a Plan	Comment
1	Prepare Drinking Water Source Protection Assessment	Prepared following catchment survey and preliminary information gathering.
2	Conduct stakeholder consultation	Advice sought from key stakeholders using the assessment as a tool for information and discussion.
3	Prepare Draft Drinking Water Source Protection Plan	Draft Plan developed taking into account input from stakeholders and any additional advice received.
4	Release Draft Drinking Water Source Protection Plan	Draft Plan released for a six week public consultation period.
5	**Publish approved Drinking Water Source Protection Plan**	**Final Plan published after considering advice received in submissions. Includes recommendations on how to protect the catchment.**

Summary

Albany is located approximately 400km south of Perth on the south coast of Western Australia. The public drinking water supply for Albany is part of the Water Corporation's Lower Great Southern Town Water Supply scheme. This scheme currently supplies drinking water from two different sources to the town of Albany and surrounding areas including Mount Barker, Kendenup, and Narrikup. These sources are nearing full allocation and the Water Corporation has identified the Marbellup Brook, within the Torbay catchment, as a potential future drinking water supply. Marbellup Brook is located approximately 15km north-west of Albany.

The Marbelup Brook Water Reserve was proclaimed in 1986 under the *Country Areas Water Supply (CAWS) Act 1947* to ensure protection of the water source from potential contamination. The boundary has recently been revised to reflect the physical drainage area of the catchment. It is recommended that this updated boundary be re-gazetted as the Marbellup Brook Catchment Area under the *CAWS Act 1947* to ensure adequate protection of the water supply.

Watershed Torbay is a partnership project, which has received funding for whole of catchment waterways restoration. Funding has assisted in better understanding of the Torbay catchment, and the development and implementation of a restoration plan. The work already completed through the Watershed Torbay project and the implementation of the Torbay Catchment Restoration Plan is of great benefit to this protection plan in terms of assisting with combating algal growth and nutrient loss to the Brook. However, more work is needed to address pathogens and chemical risks, which are not covered in the catchment restoration plan but will be addressed through the implementation of this Plan.

Land use in the Marbellup Brook Catchment Area includes general farming activities such as grazing, a piggery, a dairy, horticulture and hobby farms as well as a wood chip mill and timber precinct, plantations, a railway line, native vegetation, nature reserves, old landfill sites, gravel pits and the townsite of Redmond. Future development is expected to see businesses move into the timber precinct.

Potential water quality risks associated with existing land uses have been identified and protection strategies to manage these risks are recommended. Existing approved land uses are able to continue and the Department of Water and the Water Corporation encourage the adoption of best management practices.

It is proposed to classify all crown land and some City of Albany land to the west of the Redmond townsite for Priority 1 source protection. All rural zoned areas and the railway line are proposed for Priority 2 source protection and Redmond townsite, the area east of the townsite and the timber precinct as Priority 3 source protection.

This Drinking Water Source Protection Plan has been developed in consultation with the Water Corporation, City of Albany, Torbay Catchment Group, landowners and other relevant State government departments and stakeholders. The Department of Water has received funding assistance from the National Action Plan for Salinity and Water Quality, through South Coast Regional Initiative Planning Team (SCRIPT) to help prepare this Plan.

1 Introduction

1.1 Existing water supply system

Albany is located approximately 400 km south of Perth on the south coast of Western Australia. The public drinking water supply for Albany is part of the Water Corporation's Lower Great Southern Town Water Supply (LGSTWS) scheme. This supplies drinking water to the town of Albany and surrounding areas including Mount Barker, Kendenup and Narrikup.

There are currently two different sources supplying the LGSTWS scheme. These are groundwater from four borefields that make up the South Coast Borefield and surface water from Angove Creek. Water is pumped from the South Coast Borefield, six km south-west of Albany and treated at the South Coast Treatment Plant before being pumped to storage tanks and supplied to the LGSTWS scheme. Water from Angove Creek is treated at the Two People's Bay Treatment Plant and then pumped into Albany to join the supply to the LGSTWS scheme. The total licensed allocation is 5.95 gigalitres (GL) per year and for 2004/05 total abstraction from all sources was 5.056 GL. These sources are nearing the licence limit and the Water Corporation has therefore identified the Marbellup Brook as a potential future drinking water supply as demand increases.

Marbellup Brook is located approximately 15 km north-west of Albany. The catchment area is 125 km^2 upstream of the current gauging station at Elleker (see Figures 1 and 2).

1.2 Existing water source protection

The Marbelup Brook Water Reserve was proclaimed in 1986 under the *Country Areas Water Supply (CAWS) Act 1947* to ensure protection of the water source from potential contamination.

By-laws created under this Act enable the Department of Water to control potentially polluting activities, to regulate land use, inspect premises and to take the necessary steps to prevent or clean up pollution.

The boundary, as proclaimed in 1986, has recently been redefined to reflect the physical drainage area of the catchment (see Figure 2). It is recommended that this updated catchment boundary be re-gazetted under the *CAWS Act 1947* as the Marbellup Brook Catchment Area to ensure adequate protection of the water supply. More information on this is described in Section 6.2.

1.3 Allocation

Water resource use and conservation in Western Australia is administered by the Department of Water in accordance with the *Rights in Water and Irrigation (RIWI) Act*

1914. This Act requires users to have a licence to draw water from surface water and groundwater areas throughout the State that are proclaimed under the Act, except for domestic and stock use. 1500 kilolitres (kL) per year is used as a general guide in the south west of WA for household use, stock watering and the irrigation of 0.2 ha of garden. When drawn from surface water supplies adjoining a private property, this is known as riparian rights. Riparian rights are defined as the rights of landholders whose land has direct contact with a watercourse or wetland to take water for domestic and stock use. Riparian rights are not altered by this Drinking Water Source Protection Plan.

The Marbellup Brook catchment is not currently proclaimed under the *RIWI Act 1914*, and therefore no licences are issued for abstraction. Until such time as it is proclaimed under the *RIWI Act 1914* the Water Corporation has requested support from the Department of Water to exercise the right to divert water for public drinking water supply purposes under the *CAWS Act 1947* (Section 11 of Part II). It is expected that the Marbellup Brook will be proclaimed under the *RIWI Act 1914* as competition for use of water from the brook increases. This will require all abstraction of surface water to be licensed (excluding riparian rights).

An assessment of the Ecological Water Requirements (EWR) of Marbellup Brook is currently being undertaken through the Department of Water and funded by the South Coast Regional Initiative Planning Team (SCRIPT). This study will determine the amount of water needed to sustain the ecological values of ecosystems of water dependent plants and animals. A Social Water Requirements study is also being undertaken which will determine the social, recreational and amenity values of Marbellup Brook. For more information contact the Department of Water's Albany office.

These two studies combined with information on the sustainable yield of the Marbellup Brook will contribute to the development of a Water Allocation Plan. This will identify demand and specify sustainable limits on public and private use which will include the Water Corporation's allocation and abstraction for drinking water purposes. The allocation plan is expected to be complete by mid-2008.

1.4 Watershed Torbay restoration plan

The Torbay catchment is located between Albany and Denmark, and Marbellup Brook makes up one of Torbay's eight sub-catchments. Community concern about the deteriorating health of the Torbay catchment and in particular algal blooms in catchment water bodies led to the formation of the Torbay Catchment Group in 1999.

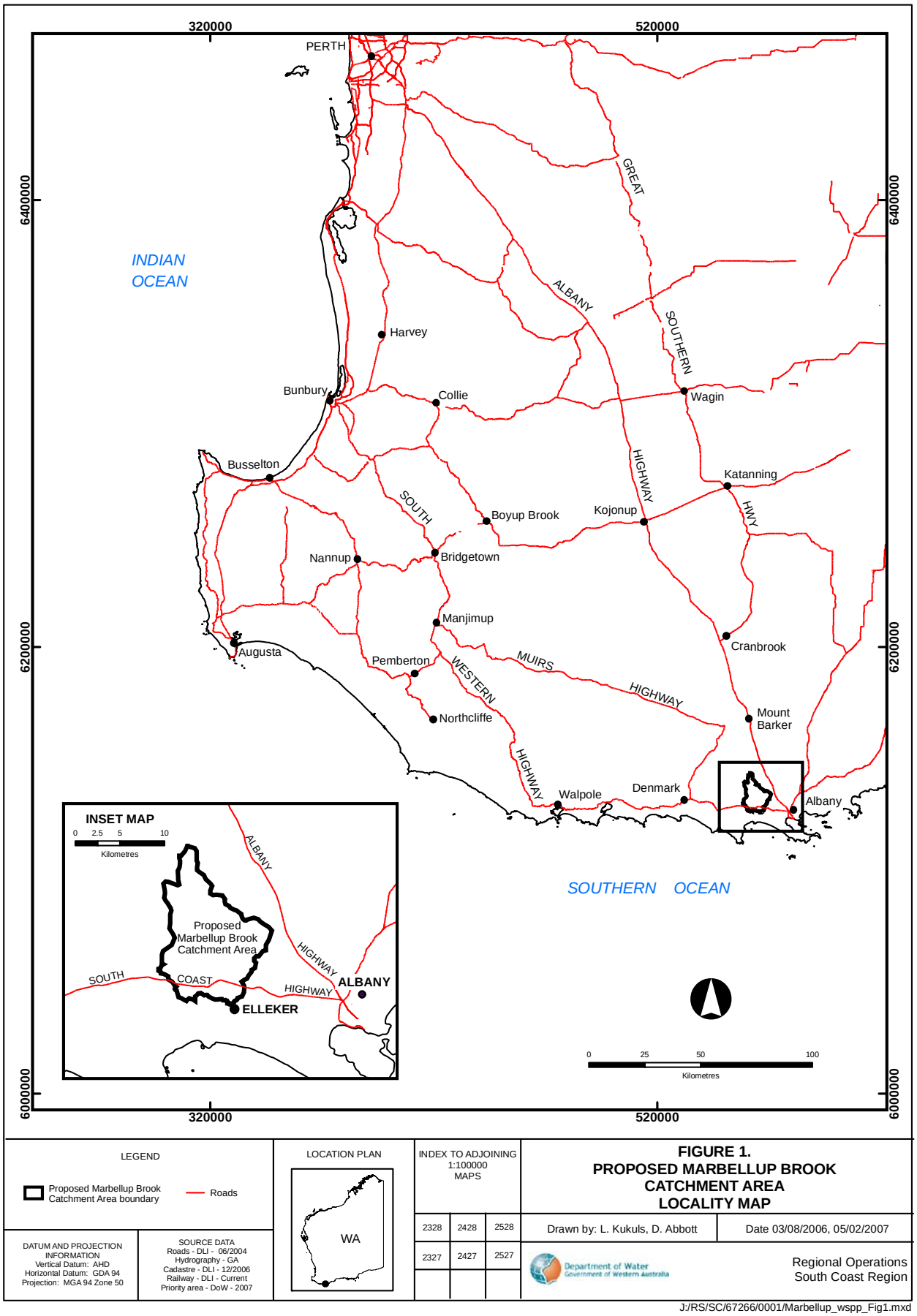
In 2000 the Torbay catchment was selected by the National Rivers Consortium to be a demonstration catchment for whole of catchment waterways restoration. The Water and Rivers Commission (now Department of Water) received funding to assist in better understanding the state of the catchment, and to develop a catchment restoration plan, including implementation and investment planning.

The project was named 'Watershed Torbay' and received $1.4 million to be distributed by the Water and Rivers Commission between 2001 and 2004. It is a partnership project with participation from a range of State and local government agencies, research institutions, community groups, and non-government organisations.

Environmental issues within the catchment include algal blooms, artificial drainage management, stream bank erosion and contamination from fertilisers, pesticides and pathogens. The project aims to help the community to:

- identify a future vision for the catchment;
- get better information about the state of the catchment, the sources of nutrients, and how to manage the wetlands which are receiving water from the catchment;
- develop a plan to improve drainage management;
- develop a plan to restore all of the waterways in the catchment;
- implement activities across the catchment to improve the waterways; and
- monitor and evaluate progress.

The work already completed through the Watershed Torbay project and the implementation of the Torbay Catchment Restoration Plan has been of great benefit to this Drinking Water Source Protection Plan in terms of combating algal growth and nutrient loss to the Brook. However, more work is needed to address pathogens and chemical risks, which are not covered in the Torbay Catchment Restoration Plan, which are addressed through this Plan. There are overlaps in proposed actions in both of these Plans, which are outlined in Appendix 1.



LEGEND

Proposed Marbellup Brook Catchment Area boundary

Roads

LOCATION PLAN

INDEX TO ADJOINING 1:100000 MAPS

2328	2428	2528
2327	2427	2527

FIGURE 1.
PROPOSED MARBELLUP BROOK CATCHMENT AREA LOCALITY MAP

Drawn by: L. Kukuls, D. Abbott

Date 03/08/2006, 05/02/2007

DATUM AND PROJECTION INFORMATION
Vertical Datum: AHD
Horizontal Datum: GDA 94
Projection: MGA 94 Zone 50

SOURCE DATA
Roads - DLI - 06/2004
Hydrography - GA
Cadastre - DLI - 12/2006
Railway - DLI - Current
Priority area - DoW - 2007

Department of Water
Government of Western Australia

Regional Operations
South Coast Region

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Figure 1 Marbellup Brook Catchment Area locality map

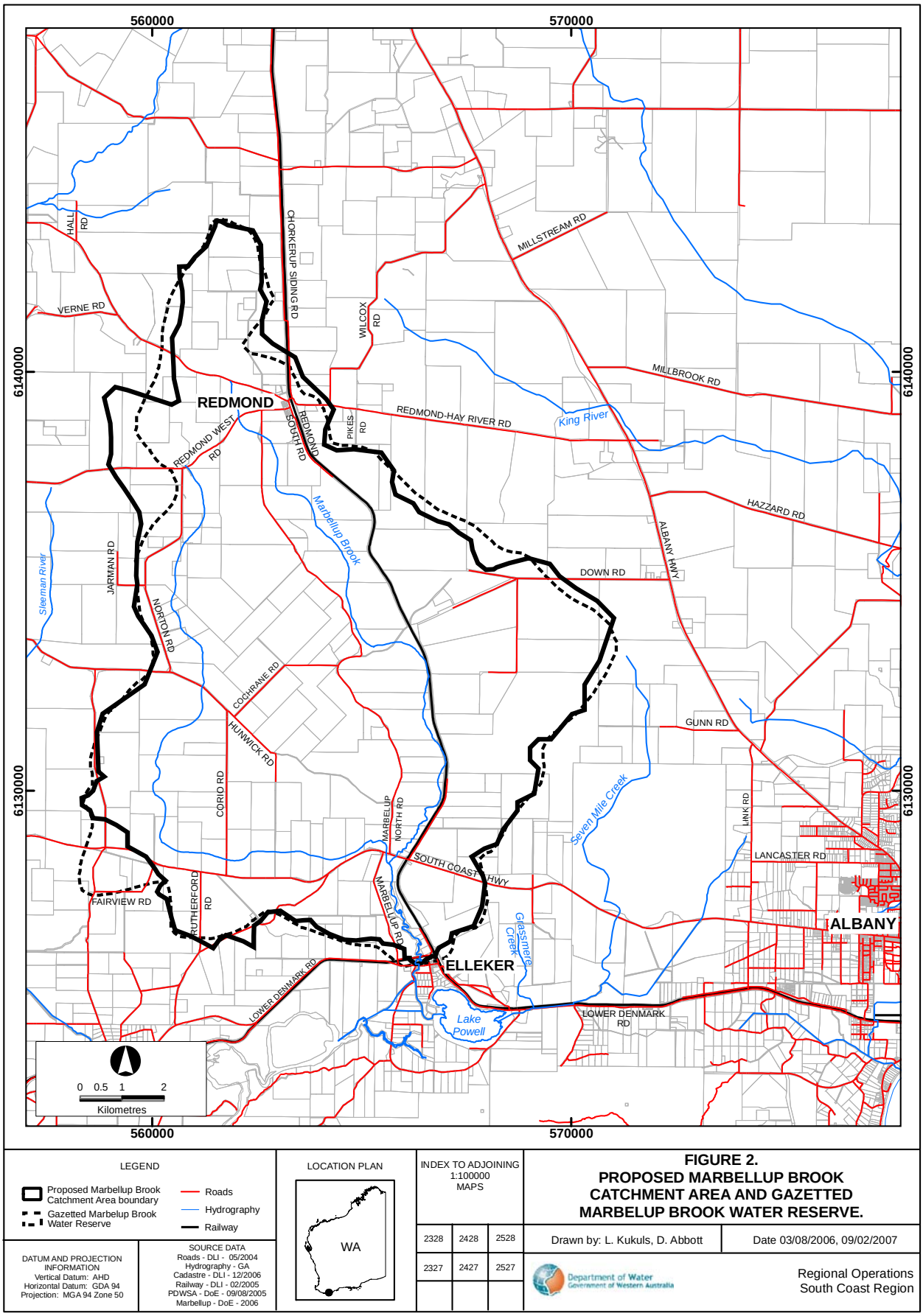


Figure 2 Proposed Marbellup Brook Catchment Area and gazetted Marbelup Brook Water Reserve

2 Future planning

2.1 Future water supply requirements

The demand on the LGSTWS scheme is estimated to increase substantially by 2030 (Rymarski, 2001). In the short term the Water Corporation proposes to meet demand growth using additional groundwater abstraction from the existing South Coast Borefield (Peter Coghlan, Water Corporation, pers comm). In the longer term, demand will need to be met by an additional source with Marbellup Brook being considered the best option (Water Corporation, 2005).

Marbellup Brook has a long-term (35 year) average annual flow of 15 GL and a short term (5 year) average annual flow of 13 GL (calculated from the Department of Water's Water Information Services database (WIN) from 1975 to 2005). Widespread climate change is thought to be the cause of the reduction in stream flows throughout the south-west of Western Australia. The Water Corporation has estimated that 5 GL per annum could potentially be diverted from Marbellup Brook with a run of the river scheme (Water Corporation, 2005). This estimate was determined during initial planning and hydrological studies indicating this potential divertible flow would have salinity less than 500 mg/L, thus making it suitable for public water supply. A run of the river scheme would require the construction of a pipehead dam on Marbellup Brook from which water would be pumped for treatment and supply. As described in Section 1.3 the divertible yield will be dependent on the outcome of the EWR, SWR and Water Allocation Plan for the brook and may differ from the Water Corporation's initial estimate of 5 GL per annum.

Whilst the Marbellup Brook is being investigated by the Water Corporation as a future public drinking water source it is important that the Department of Water provides adequate protection through the development of this Plan.

2.2 Potential extraction points

The Water Corporation has identified two possible locations for abstracting water from the Marbellup Brook (see Figure 3). One is in the area of the current weir and gauging station just north of the Elleker bridge on the Lower Denmark Road. The second is in Reserve 801 just south of South Coast Highway below the confluence of the east and west arms of the Brook. Reserve 801 is the preferred site from a water quality protection perspective as it is upstream of the Elleker hobby farms, horticulture farm, the City of Albany's gravel pit and old rubbish tip site. The Water Corporation is still assessing these options and is yet to determine the location and method of extraction.

The catchment boundary incorporating the proposed Elleker abstraction site has been used for the purpose of developing this Plan. Should the Reserve 801 site be selected, the catchment boundary and this Plan will be amended accordingly.

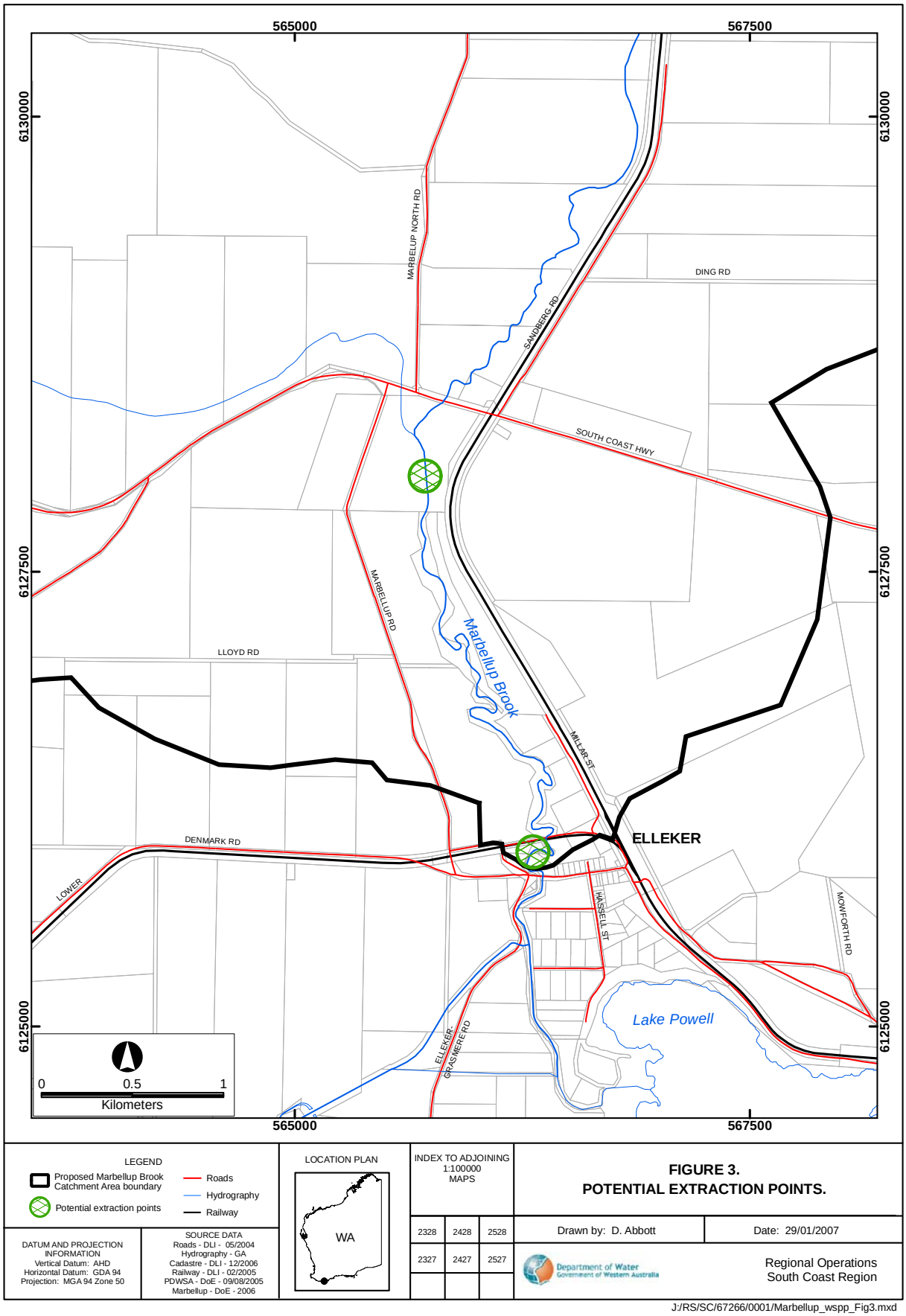


Figure 3 Potential extraction points from the Marbellup Brook

3 Catchment description

3.1 Climate

The area has a Mediterranean-type climate, characterised by warm, dry summers and cool, wet winters.

The long-term average annual rainfall varies across the catchment from about 900 mm at Elleker in the south to 800 mm at Redmond in the north. Most of the rain falls between May and September. Annual average evaporation is 1300 mm.

3.2 Physiography

Marbellup Brook is within the Denmark Drainage Division, which is part of a laterite plateau consisting of sands and ironstone gravels over mottled clays. The hilly uplands of mottled soils and gravels comprise 20 per cent of the catchment. They are dissected by incised valleys that have moderate to steep slopes of yellow podsolic soils and red earths, covering about another 15 per cent (Moulds & Bari, 1995). Swampy flats with poor drainage are found in the south and southwest sectors of the Marbellup catchment.

The natural vegetation of the catchment is dominated by low woodland and jarrah woodlands with some sheoak thickets. Reed swamps make up about 15 per cent of the vegetation cover (Public Works Department, 1984). The largest area of natural vegetation (about 80 ha) is found in the southeastern sector of the catchment. Elsewhere it is confined to small bush lots and along road verges and streamlines. About 70 per cent of the catchment has been cleared for agriculture (Donnelly, 2000).

3.3 Hydrology

The catchment for Marbellup Brook upstream of the existing weir and gauging station has an area of 125 km^2 and ranges in elevation from 5 m AHD (Australian Height Datum) at the weir to 110 m AHD at the head of the catchment. Downstream of the existing weir is Lake Powell, Lake Manarup and the Torbay Inlet. The natural drainage has been modified including diverting the lower part of the Marbellup Brook away from Lake Powell and into the Torbay Inlet consequently reducing the flow into the lake.

Surface runoff over the winter months and subsurface flow all year round contributes almost equally to water inflow to the weir.

Marbellup Brook has a long-term average annual flow of 15.5GL (calculated from the Department of Water's WIN database from 1975 to 2005) with maximum flow rates occurring during winter and spring from June to November.

Acid sulphate soils naturally occur where soils and sediments contain iron sulphides. They are usually found in waterlogged soil and sediment and are benign in their natural state. When they are disturbed or exposed to air they oxidise and produce sulphuric acid, iron precipitates and dissolved heavy metals such as aluminium, iron and arsenic (WAPC, 2003).

Acid sulphate soils are evident in the Torbay catchment in a small area around Elleker in the most southern reach of the Marbellup Brook catchment. These are classified as low risk shallow acid sulphate soils or potential acid sulphate soils less than three metres from the surface.

4 Water quality and treatment

4.1 Water quality

A wide range of chemical, physical and microbiological properties can affect the quality of drinking water. The Australian Drinking Water Guidelines (ADWG) are used in Western Australia to assess the quality of drinking water provided to consumers. The guidelines apply to treated water and give an indication of contaminants to the drinking water source. It is important to note that the guidelines are used in this document to give an indication of contaminants in untreated or 'raw water' and that treatment will be undertaken to ensure that water quality parameters are within ADWG limits before water is supplied to consumers.

Water quality sampling of raw water from Marbellup Brook has occurred since 1972. During this time sampling has been undertaken by both the Water Corporation and the Department of Water at various sites and frequencies. The Department of Water now conducts fortnightly monitoring at the gauging station near the Elleker bridge for physical characteristics, health related chemicals, aesthetic chemicals and parameters.

A summary of raw water quality results from 1972 to 2006 is shown in Appendix 2. This data is reported from the Department of Water WIN database and the Water Corporation database. For more information on water quality, see the Water Corporation's most recent Drinking Water Quality Annual Report at www.watercorporation.com.au>Water>Water Quality>Downloads>most recent Annual Report.

Halse et al (2000) stated that the Marbellup Brook was in moderately good ecological condition and supported the range of macroinvertebrates that would be expected from a lowland river in south-western Australia. However degradation of the brook due to farming and stock access was reflected in the health of macroinvertebrate communities (Halse et al, op cit). The water quality in the Marbellup Brook is reflective of a cleared rural catchment where agriculture and other development activities such as township, petrol station, railway line and wood chip mill present risks to water quality. Further information is outlined in Section 5.

4.1.1 Microbiological contaminants

Microbiological contaminants, or pathogens, are types of microorganisms that are capable of causing disease. These include bacteria (such as *Escherichia (E.) coli and Salmonella*), parasites (such as *Cryptosporidium* and *Giardia*) and viruses.

Microbiological contaminants are measured as most probable numbers per 100 mL sample (MPN/100mL) and are an indicator of faecal contamination.

In April 2006 the Water Corporation commenced comprehensive monitoring of microbiological contaminants at four different sites in the lower catchment. All samples to date have counts greater than 20 MPN/100mL which is used as a microbiological contamination benchmark (WHO, 1996). *E.coli* counts typically range from 26 MPN/100mL to 160,000 MPN/100mL with a median of 1,000 MPN/100mL.

The microbiological quality is being investigated and these initial results indicate that multiple barriers, including catchment protection, storage and treatment, will be required to address microbial contamination.

4.1.2 Health related chemicals

The pesticide, Simazine, has been detected in Marbellup Brook. This detection occurred once only at the minimum analytical level and can be interpreted as a no detection because it was so small. DDT and Dieldrin have been used in the catchment from approximately 1950 to the early 1980's and have been detected below guideline levels. The residue binds to soil particles and is practically insoluable in water, therefore posing minimal risk to the water quality of Marbellup Brook. There has been no detection of heavy metals or hydrocarbons.

4.1.3 Aesthetic characteristics

Iron, aluminium, manganese, colour and pH have exceeded the ADWG aesthetic guidelines on occasion. These occur naturally in Marbellup Brook and are not a result of land use impacts (Water Corporation, 2005). Turbidity is variable and can exceed the aesthetic guideline during high flow periods. Salinity is also variable throughout the year with levels exceeding guidelines during low flows in summer. The salinity has been gradually increasing as shown in the trend graph in Appendix 2.

4.2 Water treatment

The water treatment process has not yet been determined. However, the Water Corporation is currently investigating artificial recharge of the superficial groundwater aquifer for storage and later abstraction. Under this option water would be pumped from Marbellup Brook into the aquifer in the Werillup area (South Coast Borefield). The water would then be abstracted from the aquifer and pumped to the South Coast Treatment Plant for mixing with raw water from the South Coast borefields and then treated. Treated water would be pumped to storage tanks for later supply to customers. This is currently Water Corporation's preferred long-term option but would be subject to Department of Water and other required approvals, which would include conditions and monitoring requirements. Upgrading of the treatment plant by the Water Corporation would also be required.

5 Land use and contamination risk

5.1 Potential water quality risks

The risks to water quality associated with activities in catchments include contamination from pathogens, turbidity, pesticides, chemicals, hydrocarbons and nutrients. Pathogens pose the most significant risk to public health.

Pathogen contamination of a drinking water source is influenced by the existence of pathogen carriers (ie humans and domestic animals, such as dogs or cattle) and opportunity for their subsequent transfer to the water source, the ability of the pathogen to survive in the water source and the concentration required to cause illness.

Pathogens may enter a surface water source through activities involving the direct contact of human and domestic animals with the water body or tributaries (ie illegal fishing, swimming), primarily through the transfer of faecal material, or indirectly through the presence of humans or domestic animals near the water body and its tributaries (ie runoff transferring faecal material).

There are a number of pathogens that are commonly known to contaminate water supplies worldwide. These include bacteria (eg *Salmonella*, *Escherichia coli* and *Cholera*), parasites (eg *Cryptosporidium*, *Giardia*) and viruses. The percentage of humans in the world that carry various pathogens varies. For example, it is estimated that between 0.6 to 4.3 per cent of people are infected with *Cryptosporidium* worldwide, and 7.4 per cent with *Giardia* (Geldreich, 1996).

The ability of pathogens to survive in surface water differs between species. For example, *Salmonella* may be viable for two to three months, *Giardia* may still infect after one month in the natural environment (Geldreich, 1996) and *Cryptosporidium* oocysts (cells containing reproductive spores) may survive weeks to months in freshwater (NHMRC & ARMCANZ, 2004).

The effects of pathogen contamination in drinking water varies significantly ranging from illness to death. Preventing the introduction of pathogens into the water source is the most effective barrier in avoiding this public health risk.

Land use activities within the catchment can directly influence the effectiveness of water treatment. For example, off-road driving on unauthorised tracks contributes to erosion and the uprooting of vegetation. Erosion results in the mobilisation of soil particles, which are released into the air and tributaries and increase the turbidity within the water body. Pathogens adsorb onto these soil particles and may be shielded from the effects of disinfection. Increased turbidity also impacts upon other environmental constituents, ie smothering riparian vegetation and reducing light transfer within the water column which affects plant growth.

Pesticides are toxic and some are potentially carcinogenic. Nutrients (such as nitrates) from fertiliser are toxic to humans at high levels, with infants less than 3 months old being most susceptible. Hydrocarbons (fuels, oils, solvents) and other chemicals are potentially toxic and carcinogenic, and harmful by-products may be formed when they are combined with chlorine.

5.2 Existing land uses

Land use is illustrated in Figure 4 and photos in Appendix 3.

Land use in the Marbellup Brook catchment includes:

- general farming activities;
- native vegetation;
- nature reserves;
- gravel pits;
- old land fill sites;
- railway line;
- the townsite of Redmond;
- a wood chip mill and timber precinct, and
- plantations.

About 60 per cent of the catchment is used for agriculture, most of which was cleared before 1979 (MacNish, 2004), leaving approximately 33 per cent of the catchment in native vegetation and the remainder in plantations and urban area.

Farming activities on private land are typically pasture with sheep and cattle grazing, with several properties converted to silviculture in recent years. Other activities include a piggery, a dairy, horticulture and hobby farms. Current farming activities provide varying risks to water quality through application of fertilisers, pesticides, and pathogens from the presence of domestic animals and from septic tanks. Stock have access to many parts of the Brook. A foreshore assessment has been completed and has identified sections which remain unfenced (see Figure 5). Unfenced areas pose an increased risk of pathogen contamination from animal faecal matter, as stock are allowed access to waterways which transport pathogens into the proposed drinking water source. Pathogen risk is greatest during winter when there tends to be fresher water, greater runoff from pastures, high base flows, greater turbidity and less sunlight (Toze & Hanna, 2002).

There are two Nature Reserves within the catchment, which are managed by the Department of Environment and Conservation. These are the Down Road Nature Reserve and the Marbellup Nature Reserve. These Reserves are predominantly native bushland and therefore pose little risk to water quality in the catchment.

There is a gravel pit currently in operation in the south of the catchment and several disused gravel pit sites throughout the catchment. Given the distance from the Marbellup Brook this current gravel pit poses a low risk to water quality.

There is an old land fill site on Reserve 801 that was closed approximately ten years ago. This site has been revegetated but poses a potential risk through leaching of contaminants as it is near the Marbellup Brook. There is also an old land fill site on Redmond-Hay River Road to the east of Redmond townsite. This site has been revegetated and is now used as a waste transfer station only.

A railway line runs through the eastern portion of the catchment adjacent to the Marbellup Brook and is currently being used for transporting woodchips and grain. Due to its proximity to the Brook, the railway line poses a risk to water quality through accidents and spillages.

The townsite of Redmond is located in the north of the catchment approximately 800m from the Marbellup Brook. There are currently 10 houses with 14 lots still able to be developed. There is also a general store and a fuel outlet.

There is a small wood chip mill, which is surrounded by a large tree plantation on Down Road in the east of the catchment. A rail spur connects the mill to the main rail line. The woodchips are railed to Albany port where they are managed for export. The wood chip mill site and adjacent lots are zoned 'Special Use – Timber Precinct' and also subdivided to establish similar operations such as a Biomass Energy Plant and an Engineered Strand Lumber Plant (see Section 5.3).

There are 878 ha of plantation in the catchment area. There is also 4.7 ha of rain-fed plantation within the catchment, which makes up part of the larger Water Corporation tree farm. There is no treated wastewater irrigation of tree farm plantation within at least 200m of the catchment boundary. Until there is more evidence on the effect of plantations on both water quality and water quantity it is difficult to assess the full risks this land use poses. Water use of blue gum plantations is recognised as a potential issue, which will be dealt with by the Water Allocation Plan. Aerial spraying poses a risk but companies operating in the Marbellup Brook catchment either do not aerial spray or have not done so for at least four years and have no intentions of doing so in the future. Other risks include nutrients from fertilisers and boom spraying of herbicides and insecticides. Fertilisers, herbicides and insecticides are mostly only used in the first two years of establishment of trees and then on an as-needs basis post establishment. Plantations currently in the catchment have been planted between 1997 and 2003.

Further details on the existing land uses, their potential water quality risks and management considerations are outlined in Table 1.

The current land uses in the catchment present risks to water quality in the form of nutrients, pathogens, pesticides, turbidity, heavy metals, hydrocarbons and chemicals.

The transport of these different risks can depend upon:

- concentration and distribution at the source;
- physiography and hydrogeology of the region;
- proximity of the land use to water pathways;
- extent of vegetation and buffer zones along waterways;
- current water quality characteristics and hydrology of the region; and
- implementation of best management practices.

5.3 Future land use

Future land use should have a long term plan and adequate assessment on the potential impacts of rezoning, subdivision etc on water quality. In addition, best management practices need to be developed and implemented in the business activities. Where practical the Department of Water will negotiate with operators of existing “Incompatible” or “Compatible with conditions” activities to implement environmental best management practices that minimise risks to water sources.

Land uses and activities in the catchment are not expected to change significantly in the short term. This plan recognises the right of existing approved land uses to continue to operate, however new land uses, and expansion or intensification of existing land uses may compromise the quality of the drinking water source. As such, these are expected to be conducted in accordance with the Department of Water’s Water Quality Protection Note – *Land Use Compatibility in Public Drinking Water Source Areas* (see Appendix 4).

The townsite of Redmond has potential for expansion, with 14 lots presently undeveloped. However, limited expansion is expected and this development is projected to take place to the east of the current townsite where land has already been cleared.

There are currently no proposals for any areas to be rezoned in the catchment area under the existing City of Albany’s Town Planning Scheme. The only recent change in zoning has been the Mirambeena Timber Processing Precinct (‘Rural’ to ‘Special Use – Timber Precinct’).

The City of Albany was approached by LandCorp to develop the site adjacent to the existing wood chip mill as a future timber precinct area known as the Mirambeena Timber Processing Precinct. This site is located on Down Road, 18 km north-west of Albany and within the Marbellup Brook catchment boundary. The City of Albany has supported the amendment of the Town Planning Scheme to accommodate the timber precinct area. The zoning has changed from ‘Rural’ to ‘Special Use – Timber Precinct’ and the land has also been subdivided to allow for such land use. To date no development applications have been received for the site, but potential operations include additional timber based facilities such as a Biomass Energy Plant, an

Engineered Strand Lumber Plant, Fuel Pellet Plant and a fixed base Wood Chip Mill. An Environmental Management Plan has been prepared for the timber precinct and all future proposed operations will be subject to compliance with this plan, and to a variety of approvals from the City of Albany and Department of Environment and Conservation dependant on their type and scale.

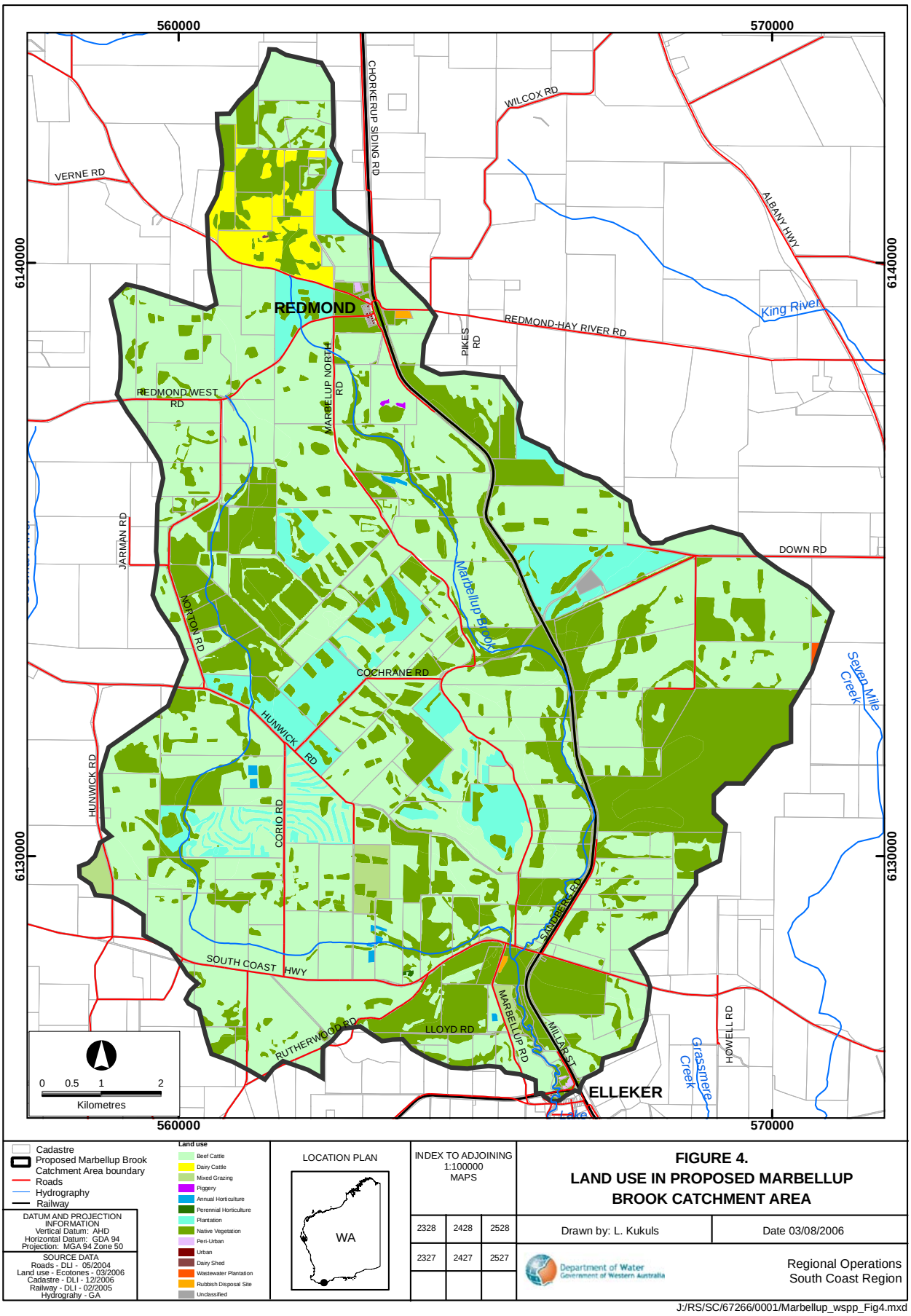


Figure 4 Land use in the Marbellup Brook Catchment Area

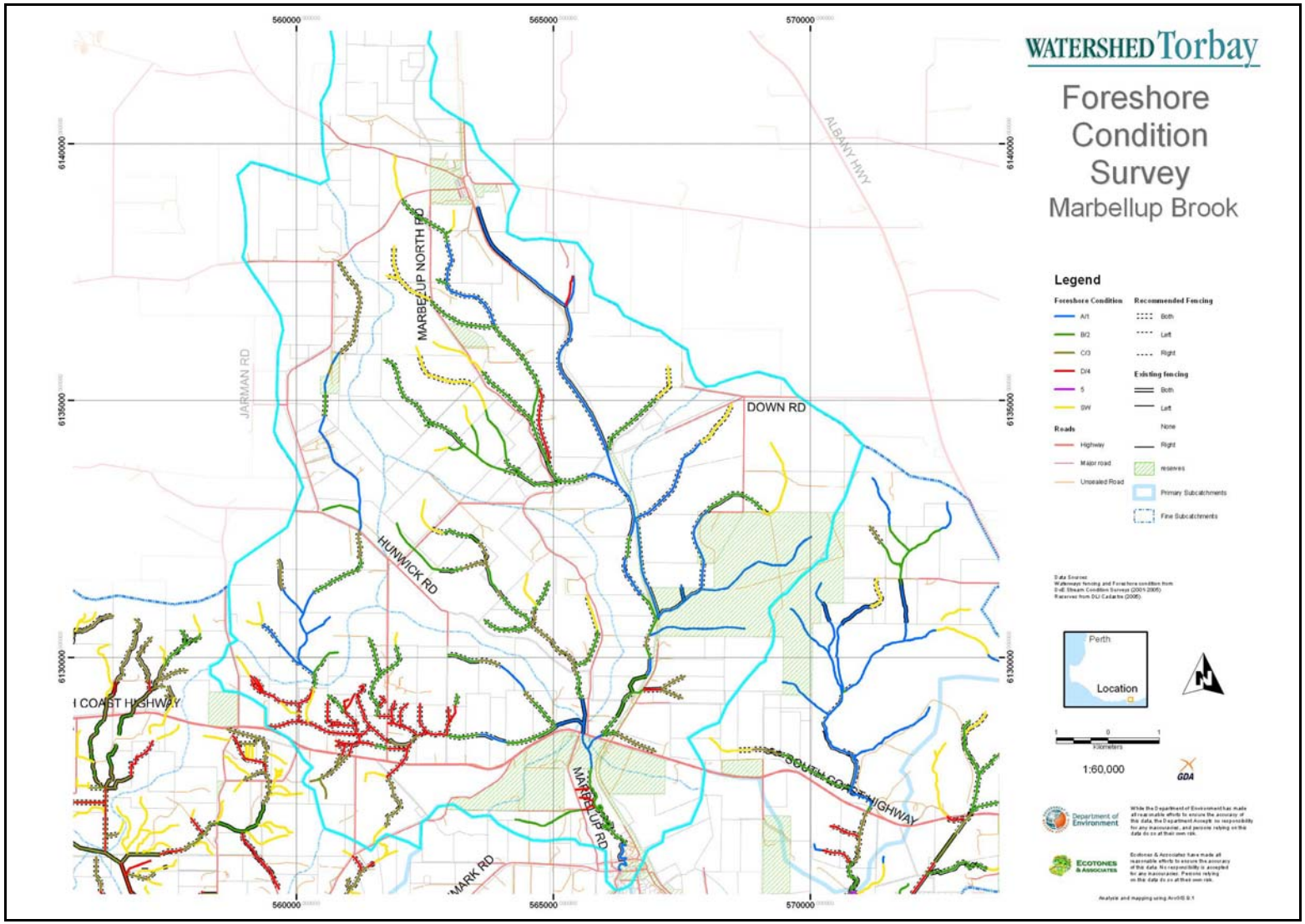


Figure 5 Foreshore condition survey for Marbellup Brook (Department of Water, 2006)

6 Catchment protection strategy

6.1 Protection objectives

The objective of water source protection is to preserve water quality at its current level and where practical, achieve an improvement, so as to provide a safe drinking water supply to the LGSTWS scheme.

This plan recognises the right of existing approved land uses to continue to operate in the catchment. However, the Marbellup Brook catchment should be managed to reduce risk to water quality from the various land uses. The minimisation of risks to water quality for public supply is imperative for the protection of public health.

6.2 Proclaimed area

The Marbelup Brook Water Reserve was proclaimed in 1986 under the *CAWS Act 1947.*

By-laws created under this Act enable the Department of Water to control potentially polluting activities, to regulate land use, inspect premises and to take the necessary steps to prevent or clean up pollution.

The catchment boundary, as proclaimed in 1986, has recently been revised and small amendments have been proposed to reflect the physical drainage area of the catchment. It is recommended that this updated catchment boundary be re-gazetted as the Marbellup Brook Catchment Area to reflect the updated boundary, correct spelling and status as a surface water source under the *CAWS Act 1947* to ensure adequate protection of the water supply.

6.3 Priority classifications

The protection of Public Drinking Water Source Areas (PDWSAs) relies on statutory measures available in water resource management and land use planning legislation. The Department of Water's policy for the protection of PDWSAs includes three risk management based priority classification areas:

- Priority 1 source protection areas have the fundamental water quality objective of risk avoidance;
- Priority 2 source protection areas have the fundamental water quality objective of risk minimisation; and
- Priority 3 source protection areas have the fundamental water quality objective of risk mitigation.

The determination of priority classifications is based on the strategic importance of the land or water source, the local planning scheme zoning, form of land tenure and the existing approved land uses or activities. For further detail, please refer to the Department's Water Quality Protection Note – *Land Use Compatibility in Public Drinking Water Source Areas* (Appendix 4).

The proposed priority classification areas for the Marbellup Brook Catchment Area have been determined in accordance with current Department of Water Policy through this Plan's development process in consultation with State Government agencies, local government and other key stakeholders. The priority areas proposed for Marbellup Brook Catchment Area are outlined below and displayed in Figure 6 and 7. The Department of Water's Water Quality Protection Note – *Land Use compatibility in Public Drinking Water Source Areas* (Appendix 4) outlines activities that are acceptable, compatible with conditions, or incompatible with the different priority classification areas.

All Crown Land throughout the catchment and the City of Albany owned land to the west of the Redmond townsite is proposed for **Priority 1** (P1) source protection. This classification is appropriate because:

- water from this source will constitute a strategic supply to the LGSTWS scheme so it should be afforded the highest feasible level of protection;
- the existing native vegetation currently provides a significant degree of water quality protection to the water source; and
- existing land uses on this Crown Land are considered compatible with P1 source protection objectives.

It is proposed to classify all rural zoned land and the railway line as **Priority 2** (P2) source protection areas. This classification is appropriate because:

- water from this source will constitute a strategic supply to the LGSTWS scheme so it should be afforded the highest feasible level of protection;
- land is privately owned and zoned rural so the compatible development rights are recognised; and
- existing land uses in these areas can be managed for P2 source protection objectives with implementation of best management practices.

It is proposed to classify the townsite of Redmond, the area to the east of Redmond and the timber precinct as **Priority 3** (P3) source protection areas because:

- the Redmond townsite land is zoned urban so the compatible development rights are recognised;
- the area east of the Redmond townsite is currently cleared and allows for future expansion of the townsite;
- the timber precinct land is zoned 'Special Use – Timber Precinct' so the development rights are recognised; and
- existing land uses are considered compatible with P3 protection objectives.

6.4 Land use planning

It is recognised under the State Planning Strategy (Western Australia Planning Commission, 1997) that the establishment of appropriate protection mechanisms in statutory land use planning processes is necessary to secure the long-term protection of water sources. As outlined in the Statement of Planning Policy No.2.7: *Public Drinking*

Water Source Policy (Western Australian Planning Commission, 2003) it is appropriate that the Marbellup Brook Catchment Area and priority classifications be recognised in the City of Albany's Town Planning Scheme. Any development proposals located within this area that are inconsistent with the Department's Water Quality Protection Note – *Land use compatibility in Public Drinking Water Source Areas*, should be referred to the Department of Water for advice and recommendations. All land use changes within the Marbellup Brook Catchment Area will be considered against the compatibility table in this Note with regard to the risk to the water source.

The existing drinking water source protection legislation, the *Country Areas Water Supply Act (CAWS) 1947*, does not contain any provision for compensation when a protection area is proclaimed, and the *CAWS Act By-laws* become applicable. In some instances the Water Corporation may consider and negotiate to lease land in buffer areas, or the Department of Water may consider and negotiate purchase of land (on a willing seller, willing buyer philosophy) in high priority areas (such as P1).

6.5 Best management practices

There are opportunities to significantly reduce risks to water quality by carefully considering design and management practices. The adoption of best management practices for land uses will continue to be encouraged to help protect water quality.

There are guidelines available for many land uses in the form of an industry code of practice, environmental guidelines or Water Quality Protection Notes. These have usually been developed in consultation with industry groups, producers, state government agencies and technical advisers. Examples include *Environmental management guidelines for animal-based industries – Dairy farm effluent* (Department of Agriculture et al, 1998), *Guidelines for Environmental Assurance in Australian Horticulture* (Horticulture Australia, 2006) and *Environmental Guidelines for New and Existing Piggeries* (Latto et al, 2000), which are listed in the References and Recommended Reading section of this Plan. The guidelines help managers reduce the risk of their operations causing unacceptable environmental impacts. These guidelines are recommended to landowners and managers as best practice for water quality protection.

Education and awareness (eg signage and information material) is a key mechanism for water quality protection, especially for those people visiting the areas who are unfamiliar with the catchment.

On freehold land, the Department of Water aims to work with landowners and to achieve best management practices for water quality protection through the provision of management advice, and assistance to seek funding if required. Watershed Torbay has secured funding to assist with the implementation of actions identified in the Restoration Plan, many of which overlap with the implementation actions for this Plan. The funding will be available for three years from 2006, to support a range of on-ground activities for all landholders in the catchment. These include such restoration works as designing stock crossings and water points, fencing, revegetation, and nutrient stripping. Funding is available through the Torbay Catchment Group by contacting the Watershed Torbay Project Officer at the Department of Water's Albany office.

6.6 Surveillance and By-law enforcement

The quality of public drinking water sources within country areas of the State is protected under the *CAWS Act (1947).* Declaration of these areas allows existing By-laws to be applied to protect water quality.

The Department considers By-law enforcement, through on-ground surveillance of land use activities in PDWSA, as an important water quality protection mechanism. Surveillance is also important in raising the general level of awareness of the need to protect water quality.

Signs are erected in PDWSA to educate the public and to advise of activities that are prohibited or regulated. This plan recommends delegation of catchment surveillance and By-law enforcement to the Water Corporation.

6.7 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency responses can result in water contamination. The City of Albany's Local Emergency Management Advisory Committee (LEMAC), through the Albany Emergency Management District, shall be familiar with the location and purpose of the Marbellup Brook Catchment Area. A locality plan will be provided to the Fire and Rescue Services headquarters for the Hazardous Materials Emergency Advisory Team (HAZMAT). The Water Corporation should have an advisory role to any HAZMAT incident in the Marbellup Brook Catchment Area.

Personnel who deal with WESTPLAN – HAZMAT (Western Australian Plan for Hazardous Materials) incidents within the area should be given ready access to a locality map of the Marbellup Brook Catchment Area. These personnel should receive training to ensure an understanding of the potential impacts of spills on the water resource.

6.8 Water Quality Protection Notes

The Department of Water has prepared Water Quality Protection Notes to provide information for land use activities that may impact on the quality of the State's water resources. These notes provide a basis for developing formal best management practice guidelines in consultation with key stakeholders.

These can be found on the Internet via the Department of Water's website at (www.water.wa.gov.au>water quality>publications>water quality protection notes).

6.9 Recommended protection strategies and implementation

Table 1 identifies the potential water quality risks associated with existing land uses in the Marbellup Brook catchment and recommends protection strategies to manage these risks. These are recommendations relevant to the specific land use or activity. Overall strategic recommendations which apply to the whole catchment are listed in Section 7.

The recommended strategies balance the need to protect water quality now and in the future with the rights of landholders to continue to utilise their land for lawful purposes.

An implementation plan has been developed for this Drinking Water Source Protection Plan. It identifies the responsible stakeholders, timeframes and main funding sources for each of the recommended protection strategies and actions outlined in Table 1. This implementation plan is included in Section 8 and will be coordinated by the Department of Water.

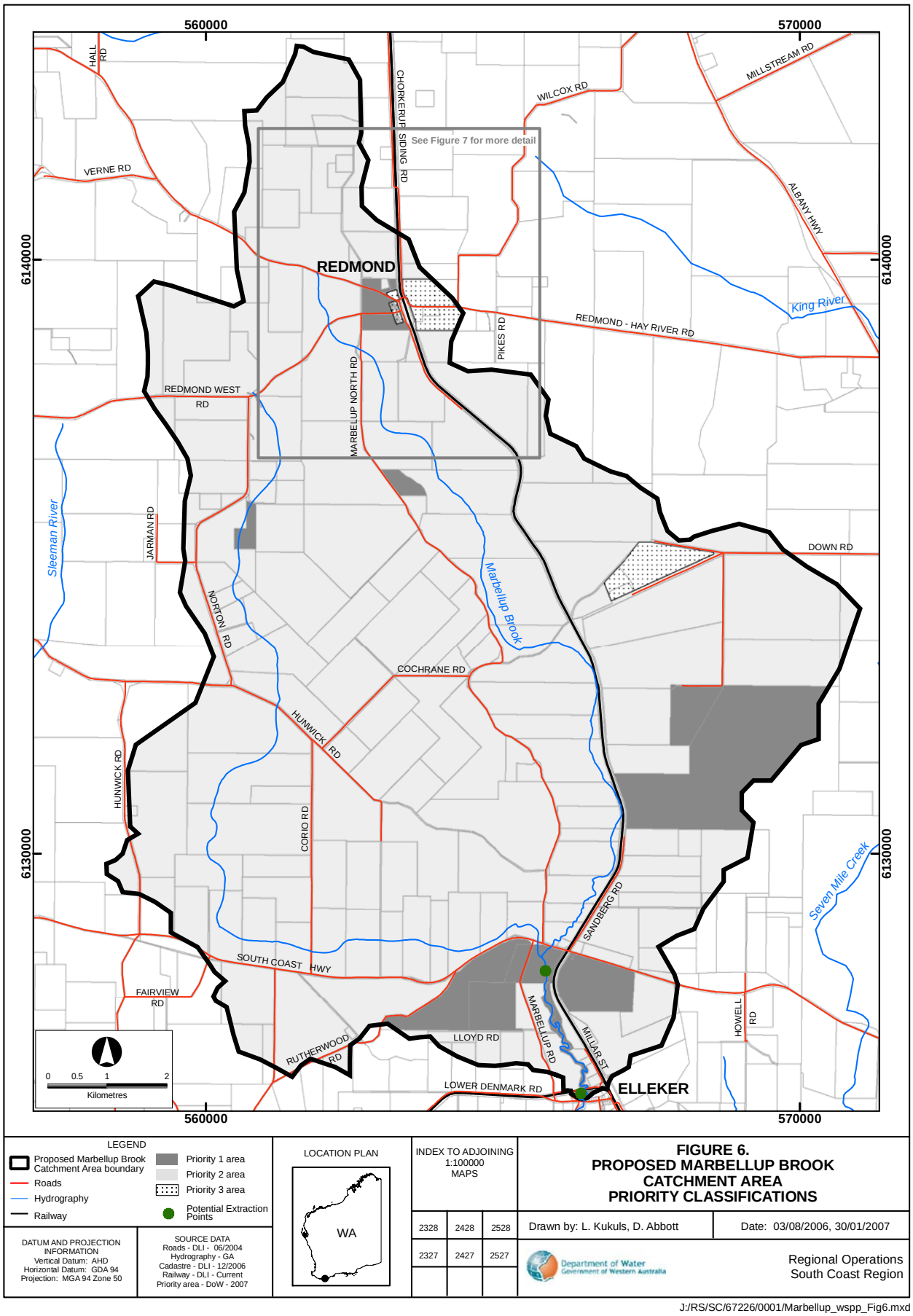


Figure 6 Priority classifications for Marbellup Brook Catchment Area

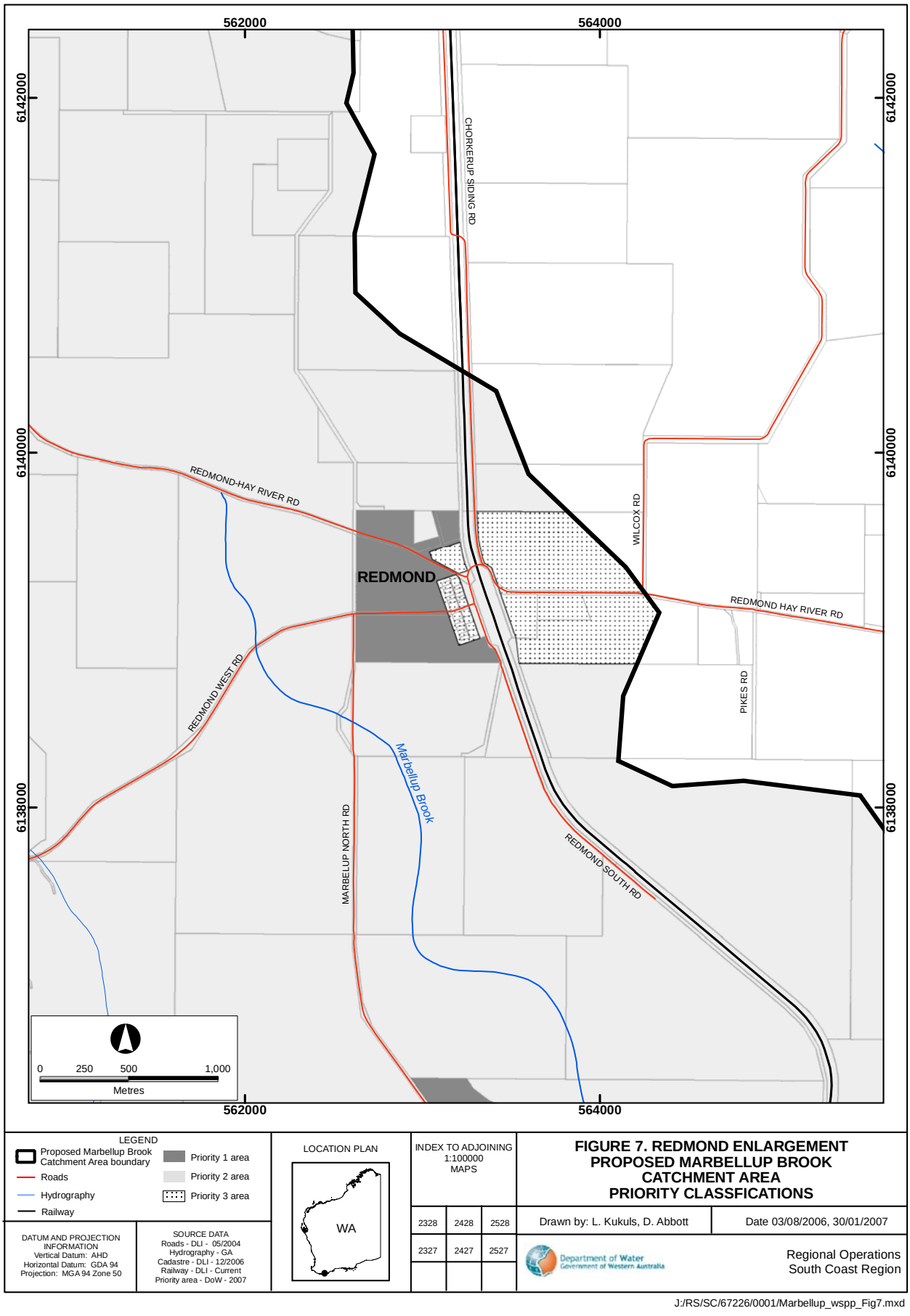


Figure 7 Priority classifications – enlargement of Redmond townsite

Table 1 Land use, potential sources of contamination and recommended protection strategies

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
RURAL LAND				
Dairy	Medium	The potential risks associated with grazing dairy cattle and a dairy shed are: • ***Pathogens*** from cattle; • ***Nutrients*** from cattle excrement and fertiliser application; • ***Hydrocarbons and chemicals*** from fuel and chemical spills; • ***Pesticides*** from pest control; • ***Turbidity*** due to erosion from paddocks tracks and cattle in waterways.	There is one dairy in the upper catchment located away from major tributaries therefore posing reduced risk. Dairies are compatible with conditions in P2 areas provided animal stocking rates and waste management practices are compatible with the water quality protection objectives and best management practices are applied. Acceptable dairying practices are guided by a Code of Practice, 'Environmental Management for animal-based industries – dairy farm effluent'. Implementation of the Code is likely to be effective in reducing the risk to water quality. Cattle excrement is a potential source of *Cryptosporidium*, *Giardia* and *E.coli.* Weeds such as blackberries are common along the Brook with weed control occasionally conducted by landholders and the Torbay Catchment Group.	• Encourage participation in the statewide DairyCatch project for effluent management and the use of DairyCatch Environmental Best Management Practise Guidelines. • Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses. • Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice –*

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
			Control of blackberry (as a declared weed) on private land is covered under the Agriculture and Related Resources Protection Act 1976 which delegates responsibility to the landowner.	*Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation. • Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.
Piggery	Medium	The potential risks associated with an intensive piggery are: • ***Pathogens*** from animal excrement and burial of dead carcasses; • ***Nutrients*** from animal excrement and burial of dead carcasses; • ***Hydrocarbons and chemicals*** from fuel and chemical spills. • ***Pesticides*** from pest control.	Piggeries are incompatible in P2 protection areas. The piggery is an existing approved land use and is therefore able to continue under this protection plan. The piggery is a small operation, which contains waste on-site. The owner has prepared an Environmental Management Plan through the industry association, Australian Pork Ltd, and is currently implementing the next phase, which is an Environmental Management System (EMS). Effluent is stored in ponds, which have not been certified to comply with permeability as set out in the Water Quality Protection Note *Animal Industry Wastewater Ponds*. The effluent was previously spread over pasture. Carcasses are buried in an open	• Encourage management of all aspects of the piggery in accordance with the *Australian Pork National Environmental Guidelines for Piggeries, August 2004.* • Effluent ponds should comply with standards in the Department of Water's Water Quality Protection Note *Animal Industry Wastewater Ponds.* • Assist with implementation of the Environmental Management Plan where appropriate. • Any future expansion or intensification of the piggery will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced. • Appropriate disposal of animal carcasses needs to be addressed through consultations between the landowner and the Department of Water and Department of Environment and Conservation (DEC)

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
			pit. Weeds such as blackberries are common along the Brook with weed control occasionally conducted by landholders and the Torbay Catchment Group. Control of blackberry (as a declared weed) on private land is covered under the Agriculture and Related Resources Protection Act 1976 which delegates responsibility to the landowner	regional offices. • Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses. • Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation. • Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
				brook.
Horticulture	Medium	The potential risks associated with horticulture are: • ***Nutrients*** from fertiliser application; • ***Pesticides*** from pest control; • ***Hydrocarbons and chemicals*** from fuel and chemical spills.	Horticulture operations are incompatible with P2 protection areas. Existing horticulture is an approved land use and is therefore able to continue under this protection plan. There are several horticulture enterprises throughout the catchment. A wide range of fertilisers and herbicides are used on a variety of crops. Chemical use and disposal of chemical containers must comply with industry standards for quality assurance, which is audited each year by relevant companies such as CropCare, WorkSafe and SQF 2000. Weeds such as blackberries are common along the Brook with weed control occasionally conducted by landholders and the Torbay Catchment Group. Control of blackberry (as a declared weed) on private land is covered under the Agriculture and Related Resources Protection Act 1976 which delegates responsibility to the landowner	• Any future expansion or intensification of horticultural operations will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced. • Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses. • Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
				• Trial Water Corporation buffer specifications for pathogen control n conjunction with the Water Corporation. • Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.
Grazing	High	The potential risks associated with grazing livestock are: • ***Nutrients*** from animal excrement and fertiliser use; • ***Pathogens*** from animal excrement; • ***Pesticides* from pest** control; • ***Hydrocarbons and chemicals*** from fuel and chemical spills.	Low density grazing covers a large portion of the catchment. Foreshore assessment has been carried out as part of the Watershed Torbay project. 85% of the waterways are unfenced and grazing stock are able to access the watercourse in many parts of the catchment contributing to nutrient and pathogen risk. Cattle excrement is a potential source of *Cryptosporidium*, *Giardia, E.coli* and other pathogens. Weeds such as blackberries are common along the Brook with weed control occasionally conducted by landholders and the Torbay Catchment Group. Control of blackberry (as a declared weed) on private land is covered under the Agriculture and Related Resources Protection Act 1976 which delegates	• Promote surface water management where necessary using shallow drains to increase time water takes to reach the main watercourse allowing for increased nutrient uptake. • Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses. • Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
			responsibility to the landowner	• Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation. • Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.
Hobby Farms	Medium	The potential risks associated with hobby farms are: • ***Nutrients*** from fertiliser use and septic tanks; • ***Pathogens*** from septic tanks and animal excrement; • ***Pesticides*** from pest control; • ***Hydrocarbons and chemicals*** from fuel and chemical spills.	Hobby farms are throughout the catchment and are considered to be properties under 10ha and where majority of income is made away from the property. Hobby farms typically have less than 20 head of stock and may grow produce such as vegetables, fruit trees to cut flowers. Weeds such as blackberries are common along the Brook with weed control occasionally conducted by landholders and the Torbay Catchment Group. Control of blackberry (as a declared weed) on private land is covered under the Agriculture and Related Resources Protection Act 1976 which delegates responsibility to the landowner	• Promote and assist with small landholder workshops – an introduction to sustainable management for hobby farmers including nutrient and waterwise landscape management, revegetation, weed and pest management, septics and stock management. • Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses. • Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
				Quality Protection Notes. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation. • Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.
Clearing for broadacre farming	Low	The potential risks associated with clearing are: • ***Turbidity*** from lack of vegetation cover increasing erosion; • ***Salinity*** • ***Reduction in vegetation*** resulting in less opportunity for filtering of surface	Historical clearing has caused some salinisation. Approximately 70-75% of the catchment is cleared most of which is used for agriculture. There is not likely to be any more broad scale clearing given changes in land use practices and clearing regulations. Vegetation clearing is subject to Environmental Protection Act 1986 clearing regulations.	• Utilise the land use planning process to achieve no net reduction in vegetation coverage as a consequence of development.

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		water flow before entering Marbellup Brook		
Plantations	Low	The potential risks associated with plantations are: • ***Pesticides*** from aerial spraying and leaching; • ***Hydrocarbons and chemicals*** from fuel and chemical spills; • ***Nutrients*** from fertilisers; • ***Turbidity*** from plantations being harvested***.***	Plantations are compatible with conditions in P1 and P2 areas. There are a growing number of plantations within the catchment. Currently 7.2% of the catchment is covered in plantation with some alley farming occurring. Plantation companies operating in the Marbellup Brook catchment either do not aerial spray insecticides or have not for at least four years with no intentions for the future. Centre of Excellence in Natural Resource Management (CENRM) are undertaking a SCRIPT funded project to investigate the effects of blue gum plantations on water quality and water quantity with monitoring sites located within the Marbellup catchment.	• Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Support CENRM's SCRIPT funded project to investigate effects of blue gum plantations on water quality and quantity in the Marbellup catchment. • Encourage the use of alley farming in association with the Watershed Torbay project to use native species and plantation timbers mixed with grazing. • Through the land use planning process, ensure buffer zones are provided between plantations and watercourses.
URBAN LAND				
Redmond townsite	Low	The potential risks associated with the townsite of Redmond are:	Redmond townsite is a small urban area at the very top end of the catchment, approximately 800m from a waterway.	• Provide advice to landholders as appropriate on best management practice for existing, proposed or upgrades to on-site waste treatment

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		• ***Pathogens*** from septic tanks; • ***Nutrients*** from septic tanks and fertiliser use; • ***Pesticides*** from pest control; • ***Hydrocarbons and chemicals*** from the fuel outlet at the General Store and household use. • ***Rubbish*** from household use.	There are 24 lots, with 10 developed and houses are serviced by septic systems. Redmond General Store fuel outlet must be licensed and requires the licensee to advise emergency services immediately of any spillages or other incidents. Service stations and fuel depots are compatible with conditions in P3 areas.	systems. • Fuel outlet should be operated in accordance with *Water Quality Protection Note – Service Stations*. • Utilise land use planning process to ensure development generally occurs on cleared rather than vegetated areas. • Department of Water to be involved in Redmond townsite development planning with the City of Albany. • Department of Industry and Resources and DEC to monitor licensee knowledge of and performance against the conditions of the Dangerous Goods License.
CROWN LAND				
Gravel and Sand Pits	Low	The potential risks associated with the use and maintenance of gravel pits are: • Increased ***turbidity*** from gravel extraction and cleared areas; • ***Hydrocarbons and chemicals*** from fuel and chemical spills from vehicles and machinery;	Extractive industries, incorporating gravel and sand pits, are compatible with conditions in P1, P2 and P3 areas provided that fuel and chemical storage is in accordance with water source protection objectives. Gravel pits used for road maintenance require effective site management to reduce the risks to water quality. Gravel and sand pits can be focal points for illegal recreational activities usually involving vehicles as well as illegal dumping of	• Approval of gravel and sand extraction proposals should include the conditions stated in *Water Quality Protection Guidelines No.1 – Water Quality Management in Mining and Mineral Processing – An Overview (2000)* and Water Quality Protection Note *Extractive Industries within Public Drinking Water Source Areas*. • Ensure gravel and sand extraction occurs in accordance with *Policy Statement No. 2 – Local Government Authority Access to Basic Raw Materials from State Forest and Timber Reserves.*

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		• ***Pathogens*** from human presence; • ***Rubbish dumping*** (such as car bodies, furniture and household goods and that associated with the illegal recreation).	rubbish.	• Ensure rehabilitation is undertaken immediately after site closure. • Draft and implement an effective management plan in conjunction with the City of Albany to ensure gravel extraction does not represent an unnecessary risk to surface water in the area. • Ensure City of Albany access tracks to old pits have sufficient barriers to prevent access for illegal rubbish dumping and recreation use.
Old rubbish disposal sites	Medium	The potential risks associated with old rubbish disposal sites are: • ***Nutrients*** • ***Heavy metals*** • ***Chemicals*** • ***Petroleum products***	Landfill sites are incompatible within PDWSAs. There is a waste transfer station to the east of the Redmond townsite which was previously used as a land fill site. All material is now stored in a bunded area. The site has been revegetated. Another previous land fill site exists on Reserve 801 to the west of the Marbellup Brook. This site has not been used for 10 years and has been revegetated.	• Investigate leaching potential from old rubbish disposal site on Reserve 801 adjacent to Marbellup Brook through monitoring.
Fire Management and wildfire	Low	The potential risks associated with fire management are: • ***Turbidity*** from runoff if land is stripped of vegetation;	DEC manages the Down Road Nature Reserve and the Marbellup Nature Reserve with fire exclusion and no controlled burning occurs. Firebreaks are maintained with chemical control every 2 to 3 years. DEC have a Fire Operations	• Liaise closely with DEC and City of Albany to ensure this protection plan is included in their Fire Operations Manual and Plans and that protocols are put in place for effective communications between agencies managing the catchment. • Establish specific points for accessing

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		• ***Nutrients*** from ash and fire retardants and fire fighting foam; • ***Pesticides*** from weed control on firebreaks.	Manual, Albany District Instant Response Plan and Chemical Users Manual for Chemical Use. Landowners and the City of Albany also conduct fire management within the catchment.	watercourses and the river for fire-fighting purposes. • Establish the degree of usage of fire retardants and firefighting foam, and restrict its use close to the water supply. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*
Nature Reserves	Low	The potential risks associated with management of reserves are: • ***Pesticides*** from weed control; • ***Nutrients*** associated with weed and feral animal control.	The bait used for fox control contains 1080 (sodium monofluroacetate), which is a naturally occurring chemical found in the plant genus *Gastrolobium*. It does not pose a risk to public drinking water supplies as it is rapidly and naturally broken down in the environment by microbial action. Protocol followed by DEC is to ensure baits are not placed near water bodies. Reserve 801 (site of one proposed uptake point) is recommended to add to the Marbellup Nature Reserve adjacent. See Fire Management and wildfires section for detail on management of fire in DEC Reserves.	• Continue to liaise with DEC regarding the inclusion of Reserve 801 in the Marbellup Nature Reserve, considering the possibility of this area being used for water supply purposes. • Ensure that the management plans for nature reserves recognise water quality protection objectives. • Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.
Railway	Medium	The potential risks	A railway line runs directly through	• Pesticide use should be in accordance

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		associated with the railway line are: • ***Herbicides*** from weed control; • ***Turbidity*** from drainage management; • ***Pathogens*** from human presence when conducting re-sleeper program; • ***Hydrocarbon and chemicals*** contamination due to fuel spills from vehicles and machinery from accidents and during any track upgrade program.	the catchment alongside Marbellup Brook. Trains carry woodchip and grain only. Weed spraying occurs twice a year with a boom spray from a vehicle on the railway track. Some slashing occurs along the railway. Drainage is essential and an excavator and grader are used for drainage maintenance. Spoil is levelled out adjacent to the railway line. WestNet Rail has a Procedure for Management of Emergencies and an ISO14001 accredited Environmental Management Plan. A track upgrade will occur in the next few years. Mobile fuel trucks will come in and out and fuel will not be stored on site. A rail spur already exists and a northern link is proposed to enable turning of trains. Extension of the rail spur to Down Road industrial area is also proposed. There are currently no restrictions of goods allowed on wagons. Applications are assessed and must comply with all relevant State transportation conditions included in such Acts as the EP Act, Dangerous Goods Act, Railway	with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.* • Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers. • Ensure appropriate ablution facilities are used during any track upgrade programs. • Have a contingency plan in place for any spills of hydrocarbons or chemicals resulting from accidents. • Ensure environmental assessment process of rail spur extension and northern line considers water source protection objectives. • Liaise with WestNet Rail on future goods being transported through the catchment to allow for emergency response planning.

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
			Act etc.	
Roads and tracks	Low	The potential risks associated with roads and tracks are: • ***Hydrocarbons and chemicals*** from fuel and chemical spills from vehicles and machinery; • ***Turbidity*** from vehicle use close to the watercourse and drainage management along road edges; • ***Pathogens*** from public access to the watercourse; • ***Pesticides*** from weedspraying along edges of roads.	There are sealed and unsealed roads throughout the catchment. South Coast Highway crosses over the lower catchment. There are 4wd tracks with access to the brook, which increases the risk of rubbish dumping and pathogen contamination. Roads are maintained with weedspraying and drainage management. Some tracks exist in the catchment for fire control purposes.	• Ensure road siting, construction and management complies with the Department of Water's *Water Quality Protection Note: Roads in sensitive environments*. • Ensure unused tracks are closed off and rehabilitated to reduce the risk of vehicles and human presence close to waterways. • Ensure sumps and run-off control measures are adequate. • Ensure contingency plans are in place for any spills resulting from accidents. • Ensure storm water management does not allow direct discharge into waterways.
RECREATION				
Marroning	Low	The potential risks associated with marroning are: • ***Pathogen*** contamination through human	Marroning can involve people staying for extended periods in the catchment with overnight camping sometimes occurring. The marron season extends between one and three weeks	• Request sustainable breeding stocks as well as water quality protection is included on signage related to marroning in the brook. • Investigate the options with the Department of Fisheries to prevent

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
		contact with the watercourse, absence of toilet facilities, camping, use of meat bait and rubbish disposal; • ***Turbidity*** from vehicle use close to the watercourse and marroning activity (ie erosion of riverbanks and disturbance of streambeds).	each year.	marroning from occurring in the Marbellup Brook Catchment Area.
INDUSTRIAL				
Existing Woodchip Mill	Low	The potential risks associated with the dry woodchip mill are: • ***Hydrocarbons and chemicals*** from fuel and chemical spills from vehicles and machinery; • ***Pathogens*** from septic systems; • ***Nutrients*** from septic systems.	Wood chip mills are incompatible with P1 and P2 areas. This is an existing approved land use and is therefore able to continue under this protection plan. The small dry wood chip mill is surrounded by a large tree plantation, which provides a buffer for a tributary to the Marbellup Brook. The wood chip mill operators undertake groundwater monitoring and have recently started surface water monitoring. A rail spur connects the mill to the	• Assist with revegetation of the tributary to provide a buffer. • Encourage ongoing monitoring of surface and groundwater resources and reporting to appropriate agencies. • Any future expansion or intensification of the wood chip mill will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced.

Current Activity	Management Priority	Potential Water Quality Hazard	Consideration for Management	Recommended Protection Strategy
			main rail line. All stormwater runoff is captured in two storage ponds and used to irrigate surrounding plantations.	
Mirambeena Timber Precinct	Medium	The potential risks associated with the proposed timber precinct are: • ***Hydrocarbons and chemicals*** from fuel and chemical spills from vehicles and machinery; • ***Pathogens*** from septic systems; • ***Nutrients*** from septic systems.	Forestry products' processing is compatible with conditions in P3 areas. Rezoning of the land adjacent to the current wood chip mill from 'Rural' to 'Special Use – Timber Precinct' zoning has occurred. This has also been subdivided to allow for establishment of similar operations. This could include – Biomass Energy Plant, Engineered Strand Lumber Plant, Fuel Pellet Plant and Wood Chip Mill. An Environmental Management Plan has been prepared for the timber precinct and all future proposed operations will be subject to compliance with this plan, as well as a variety of approvals from the City of Albany and Department of Environment and Conservation dependant on their type and scale.	• Ensure through the environmental assessment process that creek line protection area is established, fenced and vegetated. • Require ongoing monitoring to ensure water quality and availability is monitored. • Utilise environmental assessment processes and landuse planning processes to ensure new development within the timber precinct is compatible with water resource protection. • Ensure management plans from the individual industries take into account water resource protection in terms of wastewater and stormwater management.

7 Recommendations

The following recommendations apply to the entire Marbellup Brook Catchment Area. The specific recommendations outlined in Table 1 are in addition to these, and will be addressed as part of the implementation plan (see Section 8). The bracketed agencies are responsible for implementation of the relevant recommendation.

1 Implement the recommended protection strategies as detailed in *Table 1: Land use, potential sources of contamination and recommended protection strategies* through the Implementation Plan detailed in Section 8 (*Applicable stakeholders*).

2 The existing Marbellup Brook Water Reserve should be amended in accordance with Figure 2 and re-gazetted as the Marbellup Brook Catchment Area under the *Country Areas Water Supply Act 1947* (*Department of Water*).

3 Prepare a pathogen risk map based on soil-type and existing pollution hazards to assist in assigning priorities for implementation (*Department of Water and Water Corporation*).

4 Ensure the Torbay Catchment Group's Weed Action Plan recognises water quality protection objectives (*Department of Water and Torbay Catchment Group*).

5 Develop best practice guidelines specific to the Marbellup catchment for the required stream buffering for nutrient and pathogen control (*Department of Water and Water Corporation*).

6 The City of Albany Town Planning Scheme should incorporate this Plan and reflect the identified Marbellup Brook Catchment Area boundary and the Priority 1, 2 and 3 classifications (*City of Albany*).

7 Any development proposals in the Marbellup Brook Catchment Area that are inconsistent with the Department's Water Quality Protection Note – *Land use compatibility in Public Drinking Water Source Areas* or Statement of Planning Policy No. 2.7 – *Public Drinking Water Source Policy* should be referred to the Department of Water for advice and recommendations (*City of Albany, Department for Planning and Infrastructure, Department of Water and Water Corporation*).

8 Signs should be erected along the boundaries of the Marbellup Brook Catchment Area to define the location and promote public awareness of the need to protect water quality. Signs should include an emergency contact phone number (*Water Corporation*)

9 Incidents covered by WESTPLAN – HAZMAT in the Marbellup Brook Catchment Area should be addressed through the following measures (*Department of Water and Water Corporation*):

- the City of Albany Local Emergency Management Advisory Committees (LEMAC) become familiar with the location and purpose of the proposed Marbellup Brook Catchment Area;

- the locality plan for the proposed Marbellup Brook Catchment Area provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team;
- the Water Corporation provides an advisory role during incidents in the proposed Marbellup Brook Catchment Area; and
- personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Catchment Area and training to understand the potential impacts of spills on the surface water resource

10 A surveillance program should be implemented to identify any incompatible land uses or potential threats within the Marbellup Brook Catchment Area. Pursuant to Section 13(1) of the *Water and Rivers Commission Act 1995*, the Department of Water should delegate responsibility for the surveillance and enforcement of Division II of the *Country Areas Water supply Act 1947* to the Water Corporation (*Department of Water and Water Corporation*).

11 The *Country Areas Water Supply Act 1947 By-laws* should be reviewed together with those in the *Metropolitan Water Supply Sewerage and Drainage Act 1909* to create a uniform set of By-laws for the whole of the state (*Department of Water*).

12 A full review of this protection plan should be undertaken after five years (*Department of Water).*

8 Implementation plan

Table 2 Marbellup Brook Drinking Water Source Protection Implementation Plan (prepared February 2007)

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
1	Dairy	Medium	Encourage participation in the statewide DairyCatch project for effluent management and the use of DairyCatch Environmental Best Management Practise Guidelines.	Torbay Catchment Group Department of Water	2007	SCRIPT (TCRP)
2	Dairy	Medium	Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses.	Department of Water Torbay Catchment Group	Refer to TCRP for timeframes (2007-2020)	SCRIPT (TCRP)
3	Dairy	Medium	Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes.	Department of Water Torbay Catchment Group DAFWA	ONGOING	Landowner with assistance from SCRIPT (TCRP) DAFWA
4	Dairy	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
5	Dairy	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
6	Dairy	Medium	Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation.	Water Corporation Department of Water	2007	Water Corporation
7	Dairy	Medium	Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.	Landowner	ONGOING	N/A
8	Piggery	Medium	Encourage management of all aspects of the piggery in accordance with the *Australian Pork National Environmental Guidelines for Piggeries, August 2004.*	Department of Water Torbay Catchment Group Landowner	ONGOING	SCRIPT (TCRP)
9	Piggery	Medium	Effluent ponds should comply with standards in the Department of Water's Water Quality Protection Note *Animal Industry Wastewater Ponds.*	Landowner	2007	Landowner with assistance if applicable
10	Piggery	Medium	Assist with implementation of the Environmental Management Plan where appropriate.	Department of Water Torbay Catchment Group	ONGOING	SCRIPT (TCRP)
11	Piggery	Medium	Any future expansion or intensification of the piggery will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced.	Landowner	On application	N/A
12	Piggery	Medium	Appropriate disposal of animal carcasses needs to be addressed through consultations between the landowner and the Department of Water and Department of Environment and Conservation (DEC) regional offices.	Landowner Department of Water DEC	2008	Landowner
13	Piggery	Medium	Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along	Department of Water Torbay Catchment Group	Refer to TCRP for timeframes (2007-2020)	SCRIPT (TCRP)

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
			watercourses.			
14	Piggery	Medium	Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes.	Department of Water Torbay Catchment Group DAFWA	ONGOING	Landowner with assistance from SCRIPT (TCRP) DAFWA
15	Piggery	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
16	Piggery	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A
17	Piggery	Medium	Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation.	Water Corporation Department of Water	2007	Water Corporation
18	Piggery	Medium	Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.	Landowner	ONGOING	N/A
19	Horticulture	Medium	Any future expansion or intensification of horticultural operations will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced.	Landowner	On application	N/A
20	Horticulture	Medium	Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses.	Department of Water Torbay Catchment Group	Refer to TCRP for timeframes (2007-2020)	SCRIPT (TCRP)

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
21	Horticulture	Medium	Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes.	Department of Water Torbay Catchment Group DAFWA	ONGOING	Landowner with assistance from SCRIPT (TCRP) DAFWA
22	Horticulture	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
23	Horticulture	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A
24	Horticulture	Medium	Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation.	Water Corporation Department of Water	2007	Water Corporation
25	Horticulture	Medium	Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.	Landowner	ONGOING	N/A
26	Grazing	High	Promote surface water management where necessary using shallow drains to increase time water takes to reach the main watercourse allowing for increased nutrient uptake.	Torbay Catchment Group DAFWA	2009	SCRIPT (TCRP)
27	Grazing	High	Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses.	Department of Water Torbay Catchment Group	Refer to TCRP for timeframes (2007-2020)	SCRIPT (TCRP)

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
28	Grazing	High	Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes.	Department of Water Torbay Catchment Group DAFWA	ONGOING	Landowner with assistance from SCRIPT (TCRP) DAFWA
29	Grazing	High	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
30	Grazing	High	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A
31	Grazing	High	Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation.	Water Corporation Department of Water	2007	Water Corporation
32	Grazing	High	Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.	Landowner	ONGOING	N/A
33	Hobby Farms	Medium	Promote and assist with small landholder workshops – an introduction to sustainable management for hobby farmers including nutrient and waterwise landscape management, revegetation, weed and pest management, septics and stock management.	Torbay Catchment Group DAFWA (Small Landholder Information Referral Service)	2009	SCRIPT (TCRP)
34	Hobby Farms	Medium	Support and assist, where appropriate with the implementation of the Torbay Catchment Restoration Plan including promotion and implementation of waterways fencing, stock watering points, perennial pastures, nutrient management plans, soil testing and fertiliser management, farm gate nutrient audits, agroforestry, revegetation and buffers along watercourses.	Department of Water Torbay Catchment Group	Refer to TCRP for timeframes (2007-2020)	SCRIPT (TCRP)

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
35	Hobby Farms	Medium	Encourage landholders to undertake best management practices according to the relevant industry guidelines and Water Quality Protection Notes.	Department of Water Torbay Catchment Group DAFWA	ONGOING	Landowner with assistance from SCRIPT (TCRP) DAFWA
36	Hobby Farms	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
37	Hobby Farms	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A
38	Hobby Farms	Medium	Trial Water Corporation buffer specifications for pathogen control in conjunction with the Water Corporation.	Water Corporation Department of Water	2007	Water Corporation
39	Hobby Farms	Medium	Landholder to inform relevant agency of any spills or accidents in the catchment with the potential to contaminate the brook.	Landowner	ONGOING	N/A
40	Clearing for broadacre farming	Low	Utilise the land use planning process to achieve no net reduction in vegetation coverage as a consequence of development.	DEC City of Albany	ONGOING	N/A
41	Plantations	Low	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	Landowner Department of Health	ONGOING	N/A
42	Plantations	Low	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	Landowner Department of Health	ONGOING	N/A
43	Plantations	Low	Support CENRM's SCRIPT funded project to investigate effects of blue gum plantations on water quality and	CENRM	2007-2008	SCRIPT

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
			quantity in the Marbellup catchment.			
44	Plantations	Low	Encourage the use of alley farming in association with the Watershed Torbay project to use native species and plantation timbers mixed with grazing.	Torbay Catchment Group FPC	2009	SCRIPT (TCRP)
45	Plantations	Low	Through the land use planning process, ensure buffer zones are provided between plantations and watercourses.	City of Albany Department of Water	ONGOING	N/A
46	Redmond Townsite	Low	Provide advice to landholders as appropriate on best management practice for existing, proposed or upgrades to on-site waste treatment systems.	City of Albany Department of Health	2010	N/A
47	Redmond Townsite	Low	Fuel outlet should be operated in accordance with *Water Quality Protection Note – Service Stations*.	Redmond General Store owners	ONGOING	Store owner
48	Redmond Townsite	Low	Utilise land use planning process to ensure development generally occurs on cleared rather than vegetated areas.	DEC City of Albany	On application	N/A
49	Redmond Townsite	Low	Department of Water to be involved in Redmond townsite development planning with the City of Albany.	City of Albany	When required	N/A
50	Redmond Townsite	Low	Department of Industry and Resources and DEC to monitor licensee knowledge of and performance against the conditions of the Dangerous Goods License.	Department of Industry and Resources DEC	As appropriate	N/A
51	Gravel and Sand Pits	Low	Approval of gravel and sand extraction proposals should include the conditions stated in *Water Quality Protection Guidelines No.1 – Water Quality Management in Mining and Mineral Processing – An Overview (2000)* and Water Quality Protection Note *Extractive Industries within Public Drinking Water Source Areas*.	City of Albany Landowner	On application	N/A
52	Gravel and Sand Pits	Low	Ensure gravel and sand extraction occurs in accordance with *Policy Statement No. 2 - Local Government Authority Access to Basic Raw Materials from State Forest and Timber Reserves.*	City of Albany Landowner	As appropriate	City of Albany Landowner
53	Gravel and Sand Pits	Low	Ensure rehabilitation is undertaken immediately after site closure.	City of Albany	As appropriate	City of Albany

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
				Landowner		Landowner
54	Gravel and Sand Pits	Low	Draft and implement an effective management plan in conjunction with the City of Albany to ensure gravel and sand extraction does not represent an unnecessary risk to surface water in the area.	Department of Water City of Albany	2010	Department of Water City of Albany
55	Gravel and Sand Pits	Low	Ensure City of Albany access tracks to old pits have sufficient barriers to prevent access for illegal rubbish dumping and recreation use.	City of Albany	2010	City of Albany
56	Old Rubbish disposal sites	Medium	Investigate leaching potential from old rubbish disposal site on Reserve 801 adjacent to Marbellup Brook through monitoring.	City of Albany	2008	Yet to be determined
57	Fire Management and wildfires	Low	Liaise closely with DEC and CoA to ensure this protection plan is included in their Fire Operations Manual and Plans and that protocols are put in place for effective communications between agencies managing the catchment.	DEC City of Albany	2009	N/A
58	Fire Management and wildfires	Low	Establish specific points for accessing watercourses and the river for fire-fighting purposes.	DEC City of Albany	2009	DEC
59	Fire Management and wildfires	Low	Establish the degree of usage of fire retardants and firefighting foam, and restrict its use close to the water supply.	DEC City of Albany	2009	DEC
60	Nature Reserves	Low	Continue to liaise with DEC regarding the inclusion of Reserve 801 in the Marbellup Nature Reserve, considering the possibility of this area being used for water supply purposes.	Department of Water DEC	ONGOING	N/A
61	Nature Reserves	Medium	Ensure that the management plans for nature reserves recognise water quality protection objectives.	DEC	ONGOING	DEC
62	Nature Reserves	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 –*	DEC Department of Health	ONGOING	N/A

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
			Use of Herbicides in Water Catchment Areas, 2006.			
63	Nature Reserves	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	DEC Department of Health	ONGOING	N/A
64	Railway	Medium	Pesticide use should be in accordance with *Statewide Policy No.2 Pesticide use in Public Drinking Water Source Areas, 2000* and *Department of Health PSC88 – Use of Herbicides in Water Catchment Areas, 2006.*	WestNet Rail Department of Health	ONGOING	N/A
65	Railway	Medium	Ensure landholders comply with the Department of Health *Code of Practice – Disposal of Pesticide Residues from Pesticide Spray applications (2001)* when disposing of chemical containers.	WestNet Rail Department of Health	ONGOING	N/A
66	Railway	Medium	Ensure appropriate ablution facilities are used during any track upgrade programs.	WestNet Rail	As appropriate	Westnet Rail
67	Railway	Medium	Have a contingency plan in place for any spills of hydrocarbons or chemicals resulting from accidents.	WestNet Rail FESA	2008	Westnet Rail
68	Railway	Medium	Ensure environmental assessment process of rail spur extension and northern line considers water source protection objectives.	WestNet Rail City of Albany DPI Department of Water	As appropriate	N/A
69	Railway	Medium	Liaise with WestNet Rail on future goods being transported through the catchment to allow for emergency response planning.	WestNet Rail Department of Water	As appropriate	N/A
70	Roads and Tracks	Low	Ensure road siting, construction and management complies with the Department of Water's *Water Quality Protection Note: Roads in sensitive environments*.	Main Roads WA City of Albany	ONGOING	Main Roads WA City of Albany
71	Roads and Tracks	Low	Ensure unused tracks are closed off and rehabilitated to reduce the risk of vehicles and human presence close to waterways.	City of Albany	ONGOING	City of Albany

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
72	Roads and Tracks	Low	Ensure sumps and run-off control measures are adequate.	Main Roads WA City of Albany	ONGOING	Main Roads WA City of Albany
73	Roads and Tracks	Low	Ensure contingency plans are in place that take into account water source protection, for any spills resulting from accidents.	Main Roads WA City of Albany FESA	2010	N/A
74	Roads and Tracks	Low	Ensure storm water management does not allow direct discharge into waterways.	Main Roads WA City of Albany	ONGOING	Main Roads WA City of Albany
75	Marroning	Low	Request sustainable breeding stocks as well as water quality protection is included on signage related to marroning in the brook.	Department of Fisheries Water Corporation	2010	Department of Fisheries
76	Marroning	Low	Investigate the options with the Department of Fisheries to prevent marroning from occurring in the Marbellup Brook Catchment Area.	Department of Fisheries Water Corporation	2010	N/A
77	Existing Wood Chip Mill	Low	Assist with revegetation of the tributary to provide a buffer.	APEC Department of Water LandCorp	2009	LandCorp
78	Existing Wood Chip Mill	Low	Encourage ongoing monitoring of surface and groundwater resources and reporting to appropriate agencies.	APEC	ONGOING	APEC
79	Existing Wood Chip Mill	Low	Any future expansion or intensification of the wood chip mill will need to be assessed by the Department of Water and it is not likely to be supported unless it can be demonstrated that the risk to water quality is reduced.	Department of Water City of Albany	On application	N/A
80	Mirambeena Timber Precinct	Medium	Ensure through the environmental assessment process that creek line protection area is established, fenced and vegetated.	Department of Water Precinct operators LandCorp	2008	LandCorp

Action	Activity	Priority	Recommended Protection Strategy	Responsible Stakeholders	Timeframe	Main Funding Source
81	Mirambeena Timber Precinct	Medium	Require ongoing monitoring to ensure water quality and availability is monitored.	Precinct operators	ONGOING	Precinct operators
82	Mirambeena Timber Precinct	Medium	Utilise environmental assessment processes and landuse planning processes to ensure new development within the timber precinct is compatible with water resource protection.	City of Albany DPI Department of Water	On application	N/A
83	Mirambeena Timber Precinct	Medium	Ensure management plans from the individual industries take into account water resource protection in terms of wastewater and stormwater management.	Department of Water City of Albany	When submitted	Relevant operators

Appendices

Appendix 1 – Overlap of Water Corporation's DWSPA strategies and Watershed Torbay actions

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
RURAL LAND		
Intensive Horticulture	Water quality monitoring Land planning controls Riparian protection Promoting and providing specialised advice on best management practices	Theme 5, Action Target 1, Action 1 – Calculate the current nutrient surplus from intensive animal or horticultural enterprises. Theme 5, Action Target 1, Action 3 – Prepare and implement nutrient management plans for intensive animal and horticultural industries. Theme 5, Action Target 1, Action 4 – Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management. Theme 5, Action Target 2, Action 1 – Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research. Theme 5, Action Target 2, Action 2 – Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment. Theme 5, Action Target 2, Action 3 – Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment. Theme 5, Action Target 2, Action 6 – Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program. Theme 5, Action Target 3, Action 1 – Promote and encourage adoption of soil and plant testing and analysis to guide appropriate fertiliser application according to production requirements. Theme 5, Action Target 3, Action 2 – Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties. Theme 5, Action Target 3, Action 3 – Increase community understanding of efficient fertiliser use, particularly of sulphur sources and trace elements. Theme 5, Action Target 3, Action 4 – Develop a 'nutrient management' information series, including developing 'best practice' notes for a range of farming systems and interest groups. See below for relevant Riparian Protection and Enhancement Actions.

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
Hobby farms North Elleker	Water quality monitoring Land planning controls Riparian protection Small property workshops and educating hobby farmers	Theme 5, Action Target 1, Action 4 – Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management. Theme 5, Action Target 2, Action 1 – Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research. Theme 5, Action Target 2, Action 2 – Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment. Theme 5, Action Target 2, Action 3 – Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment. Theme 5, Action Target 2, Action 4 – Prepare demonstration property plans for one large and one small property within the Torbay catchment to show 'best practice' management for nutrient loss reduction. Theme 5, Action Target 2, Action 6 – Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program. Theme 5, Action Target 3, Action 1 – Promote and encourage adoption of soil and plant testing and analysis to guide appropriate fertiliser application according to production requirements. Theme 5, Action Target 3, Action 2 – Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties. Theme 5, Action Target 3, Action 3 – Increase community understanding of efficient fertiliser use, particularly of sulphur sources and trace elements. Theme 5, Action Target 3, Action 4 – Develop a 'nutrient management' information series, including developing 'best practice' notes for a range of farming systems and interest groups. Theme 5, Action Target 5, Action 1 – Develop a perennial pasture support and extension program suitable for both larger and smaller farm enterprises within the Torbay catchment. Theme 5, Action Target 5, Action 3 – Initiate large-scale demonstrations of a range of perennial pastures, shrubs and trees options. Theme 5, Action Target 5, Action 4 – Develop a series of 'pasture management' field days and information notes with support from industry organisations for perennials and annual pastures, focusing on both production and environmental benefits. Theme 5, Action Target 5, Action 5 – Undertake a catchment-scale 'roll-out' program with cost-sharing arrangements establish perennial grasses and legumes in priority areas within the catchment.

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
		Theme 5, Action Target 5, Action 8 – Undertake research into the farm production and the benefits to water quality by nutrient loss reduction through the adoption of perennial pastures, shrubs and trees. See below for relevant Riparian Protection Actions.
Clearing for broadacre farming	Water quality monitoring Government controls on clearing of land Guidance on drainage practices Riparian protection Promoting catchment rehabilitation and integrated tree farming	Theme 1, Action Target 2, Action 4 – Investigate the use of agroforestry to enhance stream restoration and provide and economic benefit. Theme 3, Action Target 5, Action 1 – Review the 'sediment risk' of public and major private drains, including further ground survey for management needs assessment. Theme 3, Action Target 5, Action 4 – provide information and advice to ensure that new drains include appropriate design to minimise risk of nutrient, sediment and acid transport. Theme 5, Action Target 3, Action 9 – Arrange integrated surface water management plans on a sub-catchment basis for priority areas with high surface water run-off and potential soil loss. See below for relevant Riparian Protection Actions.
Cropping and pastoral grazing, tree farming	Water quality monitoring Land planning controls Riparian protection Tree farming operations regulated by CALM	Theme 1, Action Target 2, Action 4 – Investigate the use of agroforestry to enhance stream restoration and provide and economic benefit. Theme 2, Action Target 2, Action 3 – Investigate the impacts of commercial plantations (e.g. blue gums) and farm forestry on water supply availability in Marbellup Brook, and determine an area limit for blue gums to maximise water availability and water quality. Theme 5, Action Target 1, Action 4 – Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management. Theme 5, Action Target 2, Action 1 – Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research. Theme 5, Action Target 2, Action 2 – Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment. Theme 5, Action Target 2, Action 3 – Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment. Theme 5, Action Target 2, Action 4 – Prepare demonstration property plans for one large and one small property within the Torbay catchment to show 'best practice' management for nutrient loss reduction. Theme 5, Action Target 2, Action 6 – Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program.

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
		Theme 5, Action Target 3, Action 1 – Promote and encourage adoption of soil and plant testing and analysis to guide appropriate fertiliser application according to production requirements. Theme 5, Action Target 3, Action 2 – Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties. Theme 5, Action Target 3, Action 3 – Increase community understanding of efficient fertiliser use, particularly of sulphur sources and trace elements. Theme 5, Action Target 3, Action 4 – Develop a 'nutrient management' information series, including developing 'best practice' notes for a range of farming systems and interest groups. Theme 5, Action Target 5, Action 1 – Develop a perennial pasture support and extension program suitable for both larger and smaller farm enterprises within the Torbay catchment. Theme 5, Action Target 5, Action 3 – Initiate large-scale demonstrations of a range of perennial pastures, shrubs and trees options. Theme 5, Action Target 5, Action 4 – Develop a series of 'pasture management' field days and information notes with support from industry organisations for perennials and annual pastures, focusing on both production and environmental benefits. Theme 5, Action Target 5, Action 5 – Undertake a catchment-scale 'roll-out' program with cost-sharing arrangements establish perennial grasses and legumes in priority areas within the catchment. Theme 5, Action Target 5, Action 8 – Undertake research into the farm production and the benefits to water quality by nutrient loss reduction through the adoption of perennial pastures, shrubs and trees. Theme 6, Action Target 4, Action 1 – Map priority areas in which commercial tree plantations should receive greater consideration due to water use and landscape amenity issues. Theme 6, Action Target 4, Action 3 – Ensure continued consideration of 'commercial tree plantations within identified priority areas' as development applications in the revised TPS. See below for relevant Riparian Protection Actions.
Piggery	Water quality monitoring Environmental and land planning controls	Theme 5, Action Target 1, Action 1 – Calculate the current nutrient surplus from intensive animal or horticultural enterprises. Theme 5, Action Target 1, Action 3 – Prepare and implement nutrient management plans for intensive animal and horticultural industries. Theme 5, Action Target 1, Action 4 – Evaluate and implement cost-sharing options and other

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
		policy instruments that provide incentives for adoption of 'best practice' management. Theme 5, Action Target 2, Action 1 – Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research. Theme 5, Action Target 2, Action 2 – Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment. Theme 5, Action Target 2, Action 3 – Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment. Theme 5, Action Target 2, Action 6 – Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program. Theme 5, Action Target 3, Action 2 – Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties. Theme 5, Action Target 3, Action 4 – Develop a 'nutrient management' information series, including developing 'best practice' notes for a range of farming systems and interest groups.
Dairies	Water quality monitoring Environmental and land planning controls	Theme 5, Action Target 1, Action 1 – Calculate the current nutrient surplus from intensive animal or horticultural enterprises. Theme 5, Action Target 1, Action 3 – Prepare and implement nutrient management plans for intensive animal and horticultural industries. Theme 5, Action Target 1, Action 4 – Evaluate and implement cost-sharing options and other policy instruments that provide incentives for adoption of 'best practice' management. Theme 5, Action Target 2, Action 1 – Develop appropriate methods for farm nutrient balance and management audit based on currently available information and research. Theme 5, Action Target 2, Action 2 – Conduct an initial farm nutrient balance and management audit for voluntary involvement by landholders within the catchment. Theme 5, Action Target 2, Action 3 – Based on information from the initial farm nutrient balance and management audit, review the nutrient surplus reduction targets set for each sub-catchment. Theme 5, Action Target 2, Action 4 – Prepare demonstration property plans for one large and one small property within the Torbay catchment to show 'best practice' management for nutrient loss reduction. Theme 5, Action Target 2, Action 6 – Identify incentives (financial and others) for voluntary engagement in the nutrient reduction program. Theme 5, Action Target 3, Action 1 – Promote and encourage adoption of soil and plant testing

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
		and analysis to guide appropriate fertiliser application according to production requirements. Theme 5, Action Target 3, Action 2 – Develop a proforma and tool for farm nutrient audit and budgets, and promote adoption of a nutrient budget approach for all priority area properties. Theme 5, Action Target 3, Action 3 – Increase community understanding of efficient fertiliser use, particularly of sulphur sources and trace elements. Theme 5, Action Target 3, Action 4 – Develop a 'nutrient management' information series, including developing 'best practice' notes for a range of farming systems and interest groups. See Cropping and pastoral grazing for perennial pasture actions (Theme 5, AT 5, Action 1,3,4,5,8)
Dry wood chip mill	Water quality monitoring Environmental and land planning controls Revegetation of streamline by landowners	Theme 5, Action Target 3, Action 9 – Arrange integrated surface water management plans on a sub-catchment basis for priority areas with high surface water run-off and potential soil loss. See below for relevant Riparian Protection Actions.
URBAN LAND		
Redmond townsite, Fuel outlet	Water quality monitoring Land planning controls HAZMAT emergency response Crown Reserves provide significant streamline buffer	Theme 6, Action Target 2, Action 1 – Map priority areas within the Torbay catchment where further development may increase risk to environmental values for consideration within the LPS, TPS and RPS including areas of high conservation value, buffers adjacent to wetlands and waterways, floodplains, and vegetation corridors.
CROWN LAND		
Roads and Railways	Water quality monitoring HAZMAT emergency response Management of stormwater and improvements to infrastructure when road upgrades occur	
Rubbish disposal sites	Water quality and groundwater flow monitoring Crown Reserves provide significant streamline buffers	

Land use/Activity	Current Catchment Preventive and Management Strategies (as listed in the Water Corporation DWSPA)	Related Watershed Torbay Restoration Plan Actions
Reserves	Water quality monitoring Managed by City of Albany, CALM and WC	
Wildfires, Fire Management, Controlled burns	Water quality monitoring Operations managed by City of Albany	
INDUSTRIAL LAND (timber precinct)		
Light industrial area	Water quality monitoring Environmental and land planning controls Riparian protection and enhancement	Theme 6, Action Target 1, Action 3 – Ensure that the requirement for nutrient management plans is prescribed in the LPS and TPS for significant development applications. See below for relevant Riparian Protection Actions.

Generic Actions:

- Theme 1, Action Target 2, Action 2 – Prepare a nutrient and pathogen 'risk map' for the Marbellup Brook sub-catchment based on soil-type and existing pollution hazards.
- Theme 1, Action Target 4, Action 1 – Develop an appropriate landuse classification that identifies potential threats to the quality of public water supply and water quality criteria relevant to the Marbellup sub-catchment.
- Theme 2, Action Target 1. Action 1 – Prepare 'environmental water requirement' assessments for Marbellup Brook, Lake Powell, Lake Manarup and Torbay Inlet.
- Theme 2, Action Target 1, Action 3 – If necessary, develop strategies to meet environmental water requirements, or determine the impact and acceptability of reduced flows.

- Theme 6, Action Target 1, Action 4 – Promote revised 'land capability' and 'net nutrient reduction' principles to landholders within the catchment through existing communication processes, and to development proponents through planning processes.
- Theme 6, Action Target 2, Action 1 – Map priority areas within the Torbay catchment where further development may increase risk to environmental values for consideration within the LPS, TPS and RPS including areas of high conservation value, buffers adjacent to wetlands and waterways, floodplains, and vegetation corridors.
- Theme 6, Action Target 2, Action 5 – Define the Marbellup Brook sub-catchment as a priority area to be considered in the RPS, LPS and TPS.
- Theme 6, Action Target 6, Action 1 – Revise current areas classified as priority agricultural and general agriculture areas within the Torbay catchment to ensure that these meet community expectations, and protect water supply and environmental values.
- Theme 7, Action Target 1, Action 6 – Arrange clear, localised 'best practice' information that is relevant and achievable.
- Theme 7, Action Target 1, Action 8 – Initiate information and skills development opportunities for 'special interest' groups (e.g. small-scale landholders).
- Theme 7, Action Target 1, Action 13 – Organise cost-sharing arrangements and publicise these in ways that ensure that they are considered available to all in the catchment, including both small- and large-scale landholders.

Riparian Protection and Enhancement Actions:

- Theme 1, Action Target 2, Action 3 – Prioritise streams within the Marbellup Brook sub-catchment for vegetated stream buffering.
- Theme 1, Action Target 2, Action 5 – Develop 'best practice' guidelines and other options for the required stream buffering for nutrient and pathogen control.
- Theme 1, Action Target 2, Action 6 – Cost sharing arrangement for landholders to be coordinated through the Torbay Catchment Group (including consideration of a trial 'auction-based' approach) to implement the vegetated stream buffers according to 'best practice' guidelines.

- Theme 4, Action Target 1, Action 1 – Combine all foreshore survey information for the Torbay catchment onto one map base showing 'stream ordering'. Establish priorities for fencing and revegetation based on: 1. Pristine and good classes (classes A and B) foreshore vegetation, 2. Third- and fourth-order streams, 3. Channel erosion risk, 4. Regional connectivity.
- Theme 4, Action Target 1, Action 2 – Prepare information sheets of local 'best practice' for riparian zone rehabilitation and management ('stream-lining').
- Theme 4, Action Target 1, Action 3 – Develop cost-sharing arrangements for vegetated stream buffering, including trial of an 'auction-based' system, considering regional and catchment priorities as well as public and private benefits.
- Theme 4, Action Target 3, Action 3 – Arrange funding and cost-sharing for management of priority remnant vegetation within the catchment.

Appendix 2 - Water quality

The Water Corporation has monitored water quality from Marbellup Brook in accordance with Australian Drinking Water Guidelines (ADWG) and interpretations agreed to with the Department of Health. Drinking water criteria that have been monitored together with ADWG health and aesthetic guideline values are available from the Water Corporation on request.

The raw water is regularly monitored for:

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

It is important to appreciate that the raw water data presented will not represent the quality of drinking water distributed to the public. Barriers such as storage and water treatment, to name a few, will 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 Lower Great Southern Town Water Supply Schcme refer to the most recent Water Corporation Drinking Water Quality Annual Report at <www.watercorporation.com.au> > Publications > Annual Reports > Drinking Water Quality Annual Report.

Microbiological contaminants

Microbiological testing of the raw water from Marbellup Brook was conducted at various locations as part of a study of water quality in 2001, and more recently on a weekly basis since April 2006. Escherichia coli counts are used as an indicator of the degree of faecal contamination of the raw water from warm-blooded animals. A count less than 20 Most Probable Number per 100 mL (MPN/100 mL) is typically associated with low levels of faecal contamination and is used as a microbiological contamination benchmark (WHO, 1996).

Escherichia coli has been recorded in all raw water samples from Marbellup Brook. All of these samples had counts greater than 20 MPN/100mL. The minimum was 26 MPN/100ml, maximum of 160,000 MPN/100mL, and a median of 1000 MPN/100mL.

Further investigation into *Escherichia coli* counts and potential sources of contamination is required to determine the need for additional catchment management and treatment barriers.

Health related chemicals

Raw water from Marbellup Brook is analysed for health related chemicals. Health related chemicals include inorganics, heavy metals, industrial hydrocarbons and pesticides. Health related water quality parameters that have been measured at detectable levels in the source since 1999 are summarised in the following table.

The pesticide, Simazine, has been detected in Marbellup Brook. This detection occurred once only at the default minimum analytical level and can be taken as no detection. DDT and Dieldrin have been used in the catchment from approximately 1950 to the early 1980's and have been detected below guideline levels. The residue binds to soil particles and is not known to leach, therefore posing minimal risk to the water quality of Marbellup Brook. There has been no detection of heavy metals or hydrocarbons.

There have been no other detections of heavy metals, hydrocarbons or pesticides. All health related water quality parameters measured at Marbellup Brook did not exceed health guideline values and therefore present no significant health risk. These parameters will continue to be routinely monitored.

Health related detections for Marbellup Brook

Parameter	Units	ADWG Health Guideline Value*	Marbellup Brook	
			Range	Median
Inorganics				
Nitrite plus nitrate as N	mg/L	11.3	No detection – 4.0	0.13
Pesticides				
Simazine	mg/L	0.02	No detection – 0.0002†#	No detection

* 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, 1996).

† One detetion only

Default minimum analytical level

Aesthetic characteristics

Aesthetic water quality analyses for raw water from Marbellup Brook are summarised in the following table. The values are taken from ongoing raw water monitoring since 1972. All values are in milligrams per litre (mg/L) unless stated otherwise. The water quality parameters that have on occasion exceeded the ADWG aesthetic guideline for supplied drinking water are shaded.

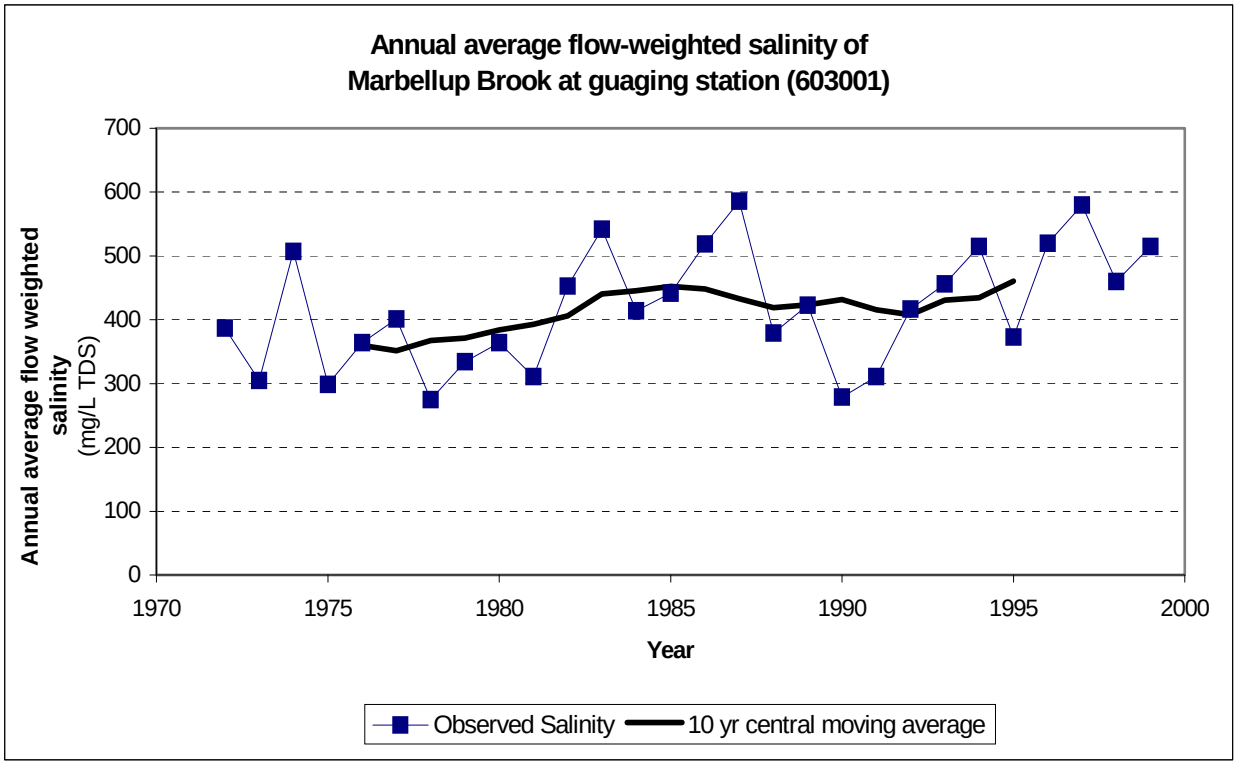
Aesthetic related detections for Marbellup Brook

Parameter	Units	ADWG Aesthetic Guideline Value*	Marbellup Brook #	
			Range	Median
Salinity (TDS)	mg/L	500	121 - 674	479
Hardness ($CaCO_3$)	mg/L	200	20 – 350	95
Turbidity	NTU	5	0.8 – 130	4
pH	no units	6.5 – 8.5	4.1 – 7.9	6.4
Colour (true)	TCU	15	35 – 650	160
Iron (total)	mg/L	0.3	0.17 – 2.14	0.86
Manganese (total)	mg/L	0.1	0.005 – 0.05	0.04
Aluminium (total)	mg/L	0.2	0.08 – 0.6	0.2

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

Data sourced from Department of Water's WIN database on 22 May 2006

Salinity levels for Marbellup Brook



Appendix 3 - Photographs

Photo 1 Gauging station weir at Elleker Bridge

Photo 2 Wood chip mill

Photo 3 Redmond general store and fuel outlet

Photo 4 Plantation

Photo 6 Railway line and access track adjacent to Brook

Photo 5 Cattle grazing near Marbellup Brook

Photo 7 Horticulture paddock near Redmond

Appendix 4 – Water Quality Protection Note

Land use compatibility in Public Drinking Water Source Areas

(June 2004)

See www.water.wa.gov.au>water quality>publications>water quality protection notes for latest version

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Purpose

The Department of Environment (DoE) is responsible for managing and protecting the State's water resources. This note provides advice on the acceptability of land uses and activities within specific catchments that are the water source for schemes supplying cities and towns. These catchments are termed Public Drinking Water Source Areas (PDWSAs) and they require comprehensive water resource quality and land planning protection measures to ensure the ongoing availability of a 'safe, good quality drinking water' supply to protect the health of consumers for now and into the future. This note supports the DoE's Public Drinking Water Resource Policy (July 2004).

The note also forms an integral part of the Western Australian Planning Commission's *Statement of Planning Policy No. 2.7- Public Drinking Water Source Policy* 2003 (relevant to approximately 140 existing PDWSAs in Western Australia) prepared by the Department for Planning and Infrastructure under Section 5AA of the *Town Planning and Development Act 1928*. It is also intended to support the proposed Statement of Planning Policy for *Water Resources* designed to guide planning decisions in future PDWSAs. This note should be used by Local Government when developing local planning strategies, structure plans and town planning schemes. It should also be used in the assessment of subdivision and other development applications. The note will also assist the development of formal guidelines on land use activities in PDWSA prepared in liaison with key stakeholders such as the Water Corporation, Department of Health, Department of Conservation and Land Management, Department of Agriculture, Department of Industry and Resources, Department for Planning and Infrastructure and local government.

A review of this note may occur within 12 months (depending on feedback) to reflect DoE's policy position (which is influenced by public consultation undertaken for PDWSAs), advances in technology or land use activity standards, and Government decisions made concerning drinking water quality protection. This note may not consider all the circumstances that exist for planning strategies, plans and schemes across the State. Accordingly, changes to this note will only be considered if they apply broadly across the State. Other means of addressing localised special circumstances may be employed and the DoE will assist in achieving this outcome provided those changes do not place the PDWSA at a higher contamination risk.

Scope

This note provides the DoE's position on a range of land uses assessed against the Department's water quality protection strategy and management objectives within PDWSAs. Where a specific land use has not been covered in the accompanying tables, it should be referred to the Department's Water Source Protection Branch for assessment and a written response concerning its acceptability or any necessary water resource protection measures.

Public Drinking Water Source Area in Western Australia is the collective description for:

- Underground Water Pollution Control Areas,

- Water Reserves, and
- Catchment Areas,

declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

This note is intended to complement the statutory role and policy of State and local government authorities, but it does not override Government policy or the need for proponents to fulfill their legal responsibilities for land use planning, and environmental, health, building or other necessary approvals.

PDWSA protection framework

The protection of PDWSAs relies on statutory measures available in water resource management and land use planning legislation. The DoE policy for the protection of PDWSAs includes three risk management based priority classification areas and two types of protection zones. The priority classification areas and protection zones are determined via specific Drinking Water Source Protection Plans (DWSPP) that are prepared in consultation with State government agencies, landowners, local government, and key industry and community stakeholders. Where a fully consulted DWSPP does not exist for a PDWSA, the DoE initially prepares Drinking Water Source Protection Assessment (DWSPA) documents to reflect readily available information for use in land use planning assessments and decision making.

Priority classification areas

Priority 1 (P1) classification areas are managed to ensure that there is **no degradation** of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is **risk avoidance**. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned or managed by State agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g. land immediately adjacent to a reservoir). Most land uses create some risk to water quality and are therefore defined as "**Incompatible**" in P1 areas.

Priority 2 (P2) classification areas are managed to ensure that there is **no increased risk** of water source contamination/ pollution. For P2 areas, the guiding principle is **risk minimisation.** These areas include established low-risk land development (e.g. low intensity rural activity). Some development is allowed within P2 areas for land uses that are defined as either "**Compatible with conditions**" or "**Acceptable**".

Priority 3 (P3) classification areas are defined to **manage the risk of pollution** to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental (risk) management for land use activities. P3 areas are declared over land where water supply sources co-exist with other land uses such as residential, commercial and light industrial development. Land uses considered to have significant pollution potential are nonetheless opposed or constrained.

Wellhead and reservoir protection zones

In addition to the three Priority Classification Areas, specific protection zones are defined to protect drinking water sources from contamination in the immediate vicinity of water extraction facilities. Within these zones by-laws may prohibit, restrict or approve defined land uses and activities to prevent water source contamination or pollution. Special conditions, such as restrictions on storage

and use of chemicals, may apply within these zones. The legislation is currently being reviewed to simplify and enhance the protection of public drinking water sources.

Wellhead protection zones (WHPZ) are used to protect underground sources of drinking water. They are circular (unless information is available to determine a different shape), with a radius of 500 metres in P1 areas, and 300 metres in P2 and P3 areas. WHPZ do not extend outside PDWSA boundaries. Reservoir protection zones (or '**prohibited zones'** as they are called in the by-laws) consist of a statutory 2 kilometre wide buffer area around the top water level of storage reservoirs in the Perth water supply area, and include the reservoir water-body. The reservoir protection zones (RPZ) apply over Crown land and prohibit public access to prevent contamination (physical, chemical and biological) of the source water. RPZ do not extend outside PDWSA boundaries. The DoE is currently considering a provision for RPZ buffer areas of less than 2 kilometres, and creation of consistent by-laws for country and Perth PDWSAs.
Special protection measures apply in WHPZ and RPZ (prohibited zones) as described in the By-laws under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*.

The determination of priority classification areas or protection zones over land in a PDWSA is based on:

- the strategic importance of the land or water source,
- the local planning scheme zoning,
- form of land tenure, and
- existing approved land uses/activities.

The land use tables in this protection note directly apply to the three types of priority classification areas identified in DWSPP or agreed in specific *Land Use and Water Management Strategy* documents. Currently there are 45 DWSPPs available to guide land use planning decisions in PDWSAs, and (nearly 100) others are in development. In the absence of a DWSPP, the DoE recommends that planning decisions within any gazetted or proposed PDWSA are guided by DWSPA documents (where they exist) and the '**potential'** priority classification area or protection zone status of a proposal identified using **Diagram 1: Assessment of potential priority classification areas and protection zones** (overleaf).

Compatibility of land uses within PDWSAs

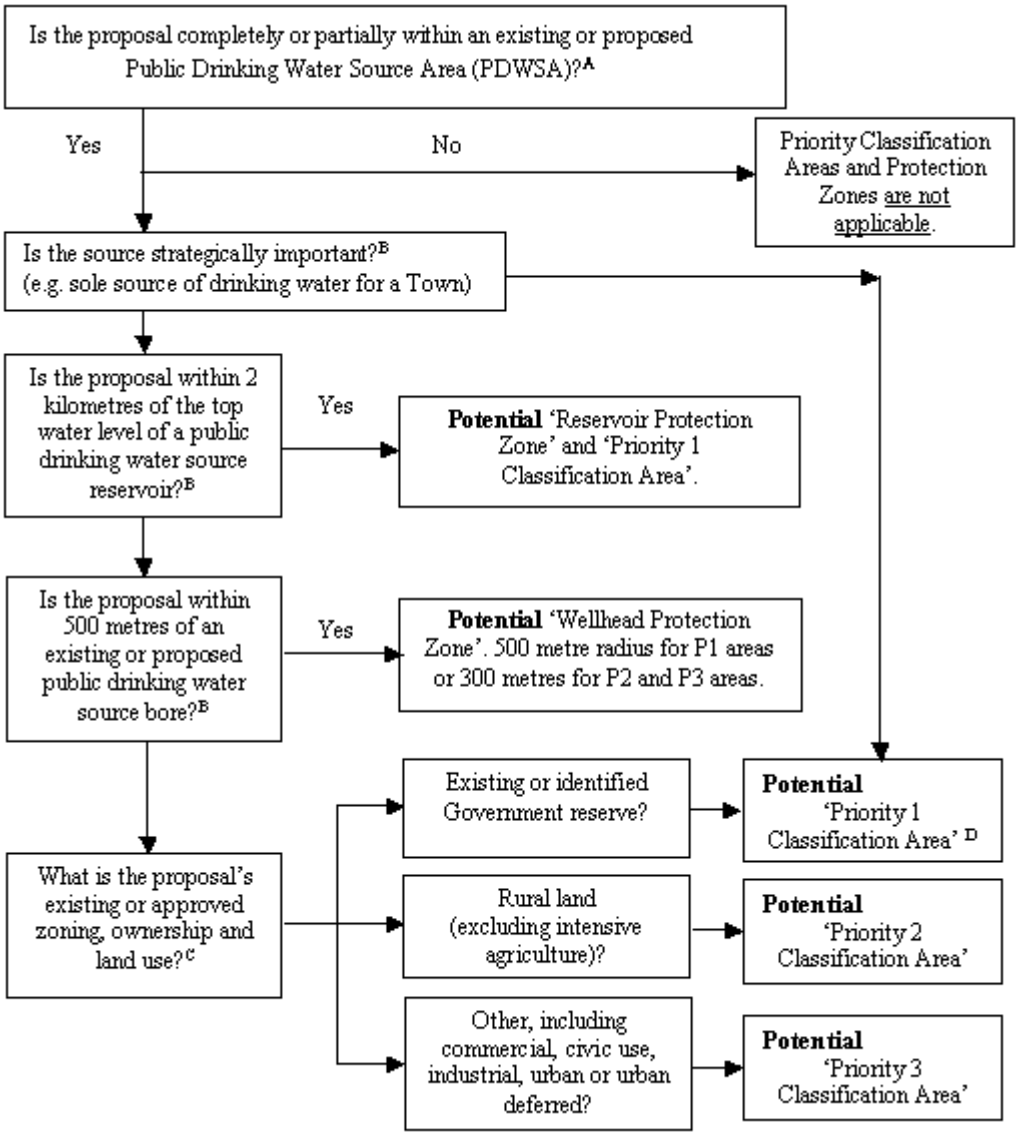
The tables in this note have been prepared for use by local governments, State planners and other agencies as a basis for regulating land use within PDWSAs. The note complements the Western Australian Planning Commission's *Statement of Planning Policy Number 2.7 (June 2003) Public Drinking Water Sources*. These tables define land uses in terms of their compatibility with the sustainable use of the drinking water source. They promote a priority for protection of the environmental value: 'drinking water' within a PDWSA over other values that may exist. The three definitions used are '**Incompatible**', '**Compatible with conditions'** and '**Acceptable**'. In previous versions of this note the definitions were 'Incompatible', 'Conditional' and 'Compatible'.

The DoE recognises that there may be special circumstances which may occasionally result in an '**Incompatible'** land use receiving approval. Where planning decisions result in this outcome it is important for project proponents to have demonstrated an overriding community benefit and that the land use will not increase the risk of contamination to the PDWSA. The DoE expects to have significant, early involvement in planning decisions of this nature to maximise the protection of the drinking water resource. It should be noted that where a water source is the sole supply for a community, or has a particularly high strategic value for the supply of drinking water, then it would be difficult to understand how that source might be put at any risk of contamination.

Detailed information on water quality protection issues and recommended best management practices for '**Compatible with conditions'** land uses are being developed in approved environmental policy, codes of practice, management guidelines and water quality protection notes. These documents, along with the most recent version of this note, can be found on the DoE Internet site http://www.environment.wa.gov.au . Information on land use and development regulation within PDWSAs can also be obtained from DoE's regional offices.

The DoE's Water Source Protection Branch, presently located in East Perth, is custodian of this water quality protection note and will provide detailed advice on its application and coordinate any suggested amendments.

Figure 1: Assessment of potential priority classification areas and protection zones



Legend

A. The location of PDWSAs can be found in DoE's Drinking Water Source Protection Assessments and Plans or through your regional DoE office, Local Government office, Water Corporation or from the Department for Planning and Infrastructure.
B. Strategically significant sources and potential contamination from land uses close to drinking water reservoirs or abstraction bores are considered first, due to these involving the highest risk of contamination reaching consumers.
C. Current zoning or land use information is available from your Local Government office.
D. Government land is protected to achieve the highest level of safety for drinking water in all parts of a catchment through a Priority 1 classification, wherever this is reasonable and practicable.

Existing approved land uses

Many land uses covered in this note may have been legally established prior to establishment/ gazettal of the PDWSA or modern protection measures being required. The DoE policy is that existing approved land uses/ activities can continue at their presently approved level, provided they operate lawfully. Where necessary, negotiations may be arranged with land owners to acquire property rights in P1 source protection areas. Where practical, this agency will also negotiate with the operators of existing '*Incompatible*', or '*Compatible with conditions'* activities to implement environmental management practices that minimise risks to water sources.

Proposed land uses

After reading this protection note, please view the DoE Internet site and/ or contact your nearest DoE Regional Office for advice on the location of PDWSAs, priority classification areas, and reservoir or wellhead protection zones. You may discuss with DoE staff any proposed land use activities that may affect water resources. The early identification of water resource protection issues in development stages of land use planning proposals is recommended in both the June 2003 *Statement of Planning Policy for Public Drinking Water Sources* and proposed *Water Resources Policy* by the Western Australian Planning Commission.

Definition of terms used in the following tables

'**Acceptable** ' (equivalent to 'compatible' in previous version of this note)- means the land use is accepted by DoE as not likely to harm the drinking water source, and is consistent with the management objectives of that priority classification. The adoption of best practice environmental management methods for new proposals to protect water quality is expected. Existing land users are also encouraged to adopt best practice environmental management methods to help protect water quality. These land uses generally do not need referral to the DoE.

'**Compatible with conditions**' (equivalent to 'conditional' in previous version of this note) - means the land use is likely to be accepted by DoE as not likely to harm the drinking water source, (and is consistent with the management objectives of the priority classification) provided best environmental management practices are used. This may result in the application of 'specific conditions' (via the planning or environmental approval processes) that must be complied with to ensure the water quality objective of the priority area is maintained.

Land uses described as 'Compatible with conditions' need only to be referred to DoE for assessment and a written response if the activity does not follow recommendations endorsed by DoE such as those made in policy, environmental management guidelines, protection notes; Ministerial Conditions, Works Approvals, Licenses or agreements (e.g. a 'Memorandum of Understanding' developed between any Local Government and DoE).

'Incompatible'- means the land use is unacceptable to DoE as it does not meet the management objectives of the priority classification area. DoE will normally oppose approval of these land uses through the planning decision making process and under legislation administered by DoE. If planning decisions are made to approve these land uses (e.g. as a consequence of a planning appeals process), then DoE should be advised of that decision and have been directly involved in providing advice to the planning decision makers on water quality protection issues. It should be noted that contentious proposals may be referred to the EPA for Environmental Impact Assessment under the *Environmental Protection Act 1986.*

'Extensive'- means limited additional inputs beyond those supplied by nature are required to support the land use, e.g. for agriculture- animal feed supplements only during seasonal dry periods, or during the final preparation of stock for the market.

'Intensive'- means regular additional inputs are required to support the desired land use, e.g. for agriculture- irrigation, fertilisers, pesticides, or non-forage animal feeding dominates.

Interpretation of land use recommendations for planning schemes and development approvals

When using the following land use compatibility tables to guide planning schemes and development approval decisions, the following relationships should be used:

a) Where the table identifies a land use as '**Acceptable**', this use is permitted by DoE within that priority classification area. It may be identified as a '**P**' (permitted) use in a scheme, providing the use complies with the relevant development standards and requirements of the planning scheme.

b) Where the table identifies a use as '**Compatible with conditions'**, this use should be a discretionary use within the priority classification area and should be identified as either a '**D**' or '**A**' (after special notice) use in the scheme. Proposals for '**Compatible with conditions'** uses should ONLY be referred to DoE for assessment and response if they do not meet existing agency policy, guidelines or protection note measures, unless prior agreement has been made between a specific local government and DoE on alternative measures.

c) Relevant environmental management guidelines, codes of practice, water quality protection notes or agreements should be used in the first instance to define DoE's position on any land-use and limit the need to refer proposals to the DoE. Where these do not exist, site specific advice may be provided by the DoE.

d) Where the table identifies a use as '**Incompatible**', that use should not be permitted within that priority source protection area, and should be identified as an '**X**' (unacceptable use) in the scheme.

Where the table does not include a proposed land use that could affect water quality, that use should be considered to be '**Incompatible**' until the proponent can demonstrate that it meets the drinking water quality protection objective of the designated priority classification area. Specific advice on the proposed land use should be obtained from the DoE's Water Source Protection Branch.

If the land use planning approval process supports a proposal that is inconsistent with this water quality protection note, then DoE Water Source Protection Branch should be advised of this situation and the reasons for that decision. This advice will trigger DoE's assessment of the significance/ consequence of that decision to the drinking water source and the outcome will be considered in future strategies for water quality protection, and in the periodic review and update of this note. A means to ensure the DoE's effective early involvement with such cases is currently being developed.

Tables defining compatibility of various land uses within PDWSA

It is important to note that this table provides the DoE's recommended compatibility of land uses for the current zoning of land. It must not be used to support rezoning of land to provide for more intensive land uses. For example, although P3 areas provide for high density urban development when the land is already zoned Urban or Urban deferred, this Table must not be read to justify a zoning change within P3 areas to allow for high density urbanisation of rural zoned land.

Model Scheme Text (MST) land uses are shown in bold in the first column. Definitions covered in the MST (see note 23) can also be found in the *Town Planning Amendment Regulations* 1999.

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Agriculture– extensive			
- pastoral leases	Compatible with conditions	Acceptable	Acceptable
- floriculture (non irrigated), stock grazing (excluding pastoral leases) and broad hectare cropping,	Incompatible	Compatible with conditions (see notes 11, 12)	Acceptable
Agriculture- intensive			
- aquaculture (fish, plants and crustaceans)	Incompatible	Compatible with conditions	Compatible with conditions
- orchards; production nurseries– potted plants; viticulture– wine and table grapes	Incompatible	Compatible with conditions	Acceptable
- floriculture; market gardens (see note 24); turf farms	Incompatible	Incompatible	Compatible with conditions
- hydroponic plant growing	Incompatible	Compatible with conditions	Compatible with conditions
- plant nurseries / garden centres	Incompatible	Compatible with conditions (see note 2)	Acceptable
Agro-forestry	Incompatible	Compatible with conditions	Acceptable
Amusement parlour	Incompatible	Incompatible	Acceptable (see note 1)
Animal establishment			
- animal saleyards and stockyards (see note 13)	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 2)
- apiaries	Compatible with conditions	Acceptable	Acceptable
- catteries	Incompatible	Acceptable	Acceptable
- dairy sheds	Incompatible	Compatible with conditions (see notes 2, 3, 12)	Compatible with conditions (see note 3)
- dog kennels	Incompatible	Compatible with conditions	Compatible with conditions
- equestrian centres (see note 17)	Incompatible	Incompatible	Acceptable
- feedlots, intensive outdoor livestock holding	Incompatible	Incompatible	Compatible with conditions
- stables (see note 18)	Incompatible	Compatible with conditions	Acceptable
Animal husbandry- intensive			
- piggeries	Incompatible	Incompatible	Incompatible
- poultry farming - housed	Incompatible	Compatible with conditions	Compatible with conditions
Bed and breakfast (accommodating a maximum of 6 guests)	Compatible with conditions (see notes 6, 16)	Acceptable (see note 23)	Acceptable
- farm stay accommodation, rural chalets)	Compatible with conditions (see notes 6, 16)	Compatible with conditions (see note 4)	Acceptable

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Betting agency	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Caravan park	Incompatible	Incompatible	Compatible with conditions (see note 1)
Caretakers dwelling	Compatible with conditions (see note 2)	Compatible with conditions	Acceptable
Car park	Incompatible	Compatible with conditions (see note 2)	Acceptable
Cemeteries	Incompatible	Incompatible	Compatible with conditions
Child care premises	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Cinema/ theatre	Incompatible	Incompatible	Acceptable (see note 1)
Civic use	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Club premises			
- sporting or recreation clubs	Incompatible	Compatible with conditions	Acceptable (see note 1)
- health centres	Incompatible	Incompatible	Acceptable (see note 1)
Community purpose			
- community halls	Incompatible	Compatible with conditions (see note 2)	Acceptable
- irrigated golf courses or recreational parks	Incompatible	Incompatible	Compatible with conditions (see note 11)
- motor-sports (permanent racing facilities)	Incompatible	Incompatible	Compatible with conditions
- public swimming pools/ aquatic centres	Incompatible	Incompatible	Compatible with conditions
- rifle ranges	Incompatible	Compatible with conditions	Acceptable
Consulting rooms	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Convenience store	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Corrective institution	Incompatible	Incompatible	Compatible with conditions (see note 1)
Educational establishment			
- community education centres, scientific research institution	Compatible with conditions (see note 2)	Compatible with conditions (see note 2)	Acceptable (see note 1)
- primary / secondary schools, tertiary education facilities	Incompatible	Incompatible	Acceptable (see note 1)
Exhibition centre	Incompatible	Incompatible	Acceptable (see note 1)

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Family day care	Incompatible	Acceptable (see note 19)	Acceptable (see note 1)
Fast food outlet	Incompatible	Incompatible	Acceptable (see note 1)
Forestry (native forest/ silviculture/ tree farming)	Compatible with conditions (see note 11)	Compatible with conditions (see note 11)	Acceptable
Fuel depot (storage/ transfer)	Incompatible	Incompatible	Compatible with conditions
Funeral parlour	Incompatible	Incompatible	Acceptable (see note 1)
Home business	Incompatible	Acceptable (see note 20)	Acceptable (see note 1)
Home occupation	Compatible with conditions (see note 15)	Acceptable (see note 21)	Acceptable (see note 1)
Home office	Compatible with conditions (see note 15)	Acceptable	Acceptable
Home store	Incompatible	Compatible with conditions	Acceptable (see note 1)
Hospital	Incompatible	Incompatible	Compatible with conditions (see note 1)
Hotel (includes hotels, hostels, resorts)	Incompatible	Incompatible	Acceptable (see note 1)
Industry			
- abattoirs	Incompatible	Incompatible	Incompatible
- cottage	Compatible with conditions	Compatible with conditions	Acceptable
- drinking water treatment plant	Compatible with conditions	Compatible with conditions	Compatible with conditions
- extractive, includes construction/ mining camps (see note 10)	Compatible with conditions	Compatible with conditions	Compatible with conditions
- food processing, dairy product factories, breweries	Incompatible	Incompatible	Compatible with conditions (see note 1)
- general (chemical manufacture/ formulation, dry cleaners, dye works, laboratories, photo-processors)	Incompatible	Incompatible	Compatible with conditions (see note 1)
- general (metal production/ finishing, pesticide operator depots, heavy or energy industry, petroleum refineries)	Incompatible	Incompatible	Incompatible
- general (concrete batching, cement products, fertiliser manufacture/ bulk storage, wrecking)	Incompatible	Incompatible	Compatible with conditions
- general (mineral processing)	Incompatible	Incompatible	Compatible with conditions (see note 9)
- light industry	Incompatible	Incompatible	Compatible with conditions (see note 1)
- milk transfer depots	Incompatible	Incompatible	Compatible with conditions
- mining (includes mineral and energy exploration, oil or gas extraction / decontamination for transport)	Compatible with conditions (see note 9)	Compatible with conditions (see note 9)	Compatible with conditions (see note 9)
- mining (tailings dams)	Incompatible	Incompatible	Compatible with conditions (see note 9)

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
- mining (includes construction/ mining camps), (see note 10)	Compatible with conditions	Compatible with conditions	Compatible with conditions
- rural (animal product rendering works, tanneries, wool scours)	Incompatible	Incompatible	Incompatible
- rural (farm supply centres, manure stockpiling/ processing facilities)	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions
- rural (forestry products processing– chip mills, pulp/ paper, timber preservation, wood/ fibre works, composting/ soil blending - commercial)	Incompatible	Incompatible	Compatible with conditions
- service industry	Incompatible	Incompatible	Compatible with conditions
Landfill (solid waste disposal)			
- class I (refer also to 'Storage - used tyres' advice)	Incompatible	Incompatible	Compatible with conditions
- class II or III	Incompatible	Incompatible	Incompatible
- class IV or V	Incompatible	Incompatible	Incompatible
Lunch bar	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Major transport infrastructure (roads, railways)	Incompatible	Compatible with conditions (see note 14)	Acceptable
Marina (includes boat moorings and servicing)	Incompatible	Incompatible	Compatible with conditions
Marine filling station (boat fuelling)	Incompatible	Incompatible	Compatible with conditions
Market (food; general produce; second–hand goods)	Incompatible	Incompatible	Acceptable (see note 1)
Medical centre	Incompatible	Incompatible	Acceptable (see note 1)
Motel	Incompatible	Incompatible	Acceptable (see note 1)
Motor vehicle, boat or caravan sales (sales yards)	Incompatible	Incompatible	Acceptable (see note 1)
Motor vehicle repair	Incompatible	Incompatible	Compatible with conditions
Motor vehicle wash	Incompatible	Incompatible	Compatible with conditions
National and regional parks and nature reserves	Acceptable	Acceptable	Acceptable
Night club	Incompatible	Incompatible	Acceptable (see note 1)
Office	Incompatible	Compatible with conditions	Acceptable (see note 1)
Park home park	Incompatible	Incompatible	Compatible with conditions (see note 1)
Place of worship	Incompatible	Incompatible	Acceptable (see note 1)
Plantation	Compatible with conditions (see note 11)	Compatible with conditions (see note 11)	Acceptable
Reception centre	Incompatible	Incompatible	Acceptable (see note 1)

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Recreation– private (within non-designated recreation areas on Crown land)	Incompatible	Incompatible	Acceptable
Residential building			
- house	Compatible with conditions (see note 16)	Acceptable (see note 4)	Acceptable (see note 1)
- group dwellings (aged and dependent persons)	Incompatible	Incompatible	Acceptable (see note 1)
Restaurant	Incompatible	Incompatible	Acceptable (see note 1)
Restricted premises (adult interests)	Incompatible	Incompatible	Acceptable (see note 1)
Rural pursuit	See Agriculture, Animal establishment or husbandry		
Service station (includes aircraft, automotive repairs, boats, mechanical plant, service stations at transport and municipal works depots)	Incompatible	Incompatible	Compatible with conditions (refer to note 1)
Shop	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Showroom	Incompatible	Incompatible	Acceptable (see note 1)
Storage			
- used tyres (see note 22)	Incompatible	Incompatible	Incompatible
- chemical storage in under ground tanks	Incompatible	Incompatible	Compatible with conditions
- chemical storage in above ground tanks	Incompatible	Compatible with conditions	Compatible with conditions
Tavern	Incompatible	Incompatible	Acceptable (see note 1)
Telecommunications infrastructure	Compatible with conditions	Compatible with conditions	Compatible with conditions
Toilet blocks and change rooms	Compatible with conditions (see note 2)	Compatible with conditions	Acceptable
Trade display	Incompatible	Incompatible	Acceptable (see note 1)
Veterinary centre	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 1)
Warehouse	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 1)
Waste transfer station (includes recycling depots)	Incompatible	Incompatible	Compatible with conditions
Wastewater infrastructure			
- sewerage – gravity sewers	Incompatible	Incompatible	Acceptable
- sewerage – pressure mains	Incompatible	Compatible with conditions	Acceptable
- sewer pump stations	Incompatible	Compatible with conditions	Compatible with conditions
- treatment plants, wastewater disposal to land	Incompatible	Incompatible	Compatible with conditions
- wastewater injection into the ground (see note 25)	Incompatible	Incompatible	Incompatible
Water treatment plants (drinking)	See Industry		

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Winery (includes wine tasting facilities)	Incompatible	Compatible with conditions (see notes 3 & 5)	Compatible with conditions (see note 3)

Table recommending compatibility of land subdivision within PDWSA: Note - This table reflects the recommended size of a subdivision based on the existing zoning and the priority classification area status of land. It should be noted that Town Planning Scheme provisions for specific zones and reserves will take precedent over the following recommended lot sizes.

Form of subdivision (specific to current zoning)	P1 areas	P2 areas	P3 areas
Rural subdivision			
- to a lot size of 4 hectares or greater	Incompatible	Acceptable	Acceptable
- to a lot size less than 4 hectares	Incompatible	Incompatible	Incompatible
Special rural subdivision			
- to a lot size of 2 hectares or greater	Incompatible	Compatible with conditions (see notes 7 & 8)	Compatible with conditions (see note 8)
- to a lot size between 1 and 2 hectares	Incompatible	Incompatible	Compatible with conditions (see notes 7 & 8)
- to a lot size less than 1 hectare	Incompatible	Incompatible	Compatible with conditions (see note 7)
Urban subdivision	Incompatible	Incompatible	Acceptable (see note 1)
Industrial subdivision	Incompatible	Incompatible	Acceptable (see note 1)

Explanatory notes related to land uses described the tables:

The following notes provide interpretive information based on the scale or type of development described in the preceding tables. They do not list all the conditions that could apply to any activity or development.

1. Must be connected to deep sewerage, except where exemptions apply under State Government Sewerage Policy. The Policy recognises that sewer connection may be impractical in some areas. Under these circumstances maximum wastewater loadings (based on people/ hectare) apply linked to the management Priority of the site.

2. The land use is normally incompatible, but may be conditionally approved where this facility is consistent with approved State and local government planning strategies or schemes.
3. The land use must incorporate best environmental management practices compatible with the management strategy for the designated priority area defined in the relevant source protection plan.
4. In Priority 2 areas: conditions may apply to density of dwellings (ie. hectares per dwelling).
5. Size of the grape crush shall not exceed 500 tonnes per year.
6. May be approved if occupancy is of equivalent size to a single dwelling household (ie. less than 10 people– defined by capacity of a septic tank based on-site wastewater treatment system).

7. An average, rather than minimum, lot size may be accepted if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats/memorials are placed on titles of specified blocks stating that further subdivision shall not occur.
8. Lots should only be created where land capability assessment shows that effective on-site soakage of treated wastewater can be achieved. Conditions apply to siting of wastewater disposal systems in areas with poor land drainage and/ or a shallow depth to groundwater, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Department of Health, may be accepted with ongoing maintenance requirements.
9. Conditions are likely to be placed via a Department of Industry and Resources mineral tenement lease, and / or as a result of Minister for the Environment's approval after an Environmental Impact Assessment.
10. Conditions apply to the storage of fuels and chemicals, the depth of excavation related to the water table and rehabilitation criteria. Underground fuel or chemical storage tanks are prohibited via DoE by-laws in Priority 1 and 2 areas within Underground Water Pollution Control Areas.
11. Conditions apply to regulate fertiliser and pesticide application.
12. Can be approved if animal stocking levels (animals per hectare, guided by the Department of Agriculture's stocking rate guidelines) are consistent with the priority source protection area objectives.
13. This does not include stockyards occasionally used on farms or pastoral leases for animal husbandry.
14. Conditions may be imposed to cover design, construction of infrastructure and the types of goods.
15. May only be approved if *Home Occupation* relates to an existing residence.
16. Limited to one residential building per property.
17. Includes land or buildings dominantly used for the showing, competition or training of horses, and riding schools.
18. Includes any land, building or structure used for equine (e.g. horses, asses, mules and donkeys) housing, keeping and feeding and associated activities.
19. In accordance with *Community Services (Child Care) Regulations 1988*: '*A child care service provided to a child in a private dwelling in a family of or domestic environment. No more than 5 children of pre-school age and no more than 7 children under 12 years old, including the children of the licensee or permit holder.*'
20. No more than 2 employees, and the home business occupies an area up to 50 square metres. Compatible if only an office/ administrative business (ie. overnight parking of only one commercial vehicle, no refuelling or repair/ maintenance of business vehicles, and no activities involving on-site use storage or disposal of chemicals or process wastewater).
21. Employees shall be members of the household, and the home business occupies an area of up to 20 square metres. No provision for refuelling, repair or maintenance of commercial/ business vehicles or on-site use or storage of chemicals.
22. Used tyre use, storage and disposal are subject to *Used Tyre Regulations 1996*, administered by this agency.
23. As defined in the *Model Scheme Text* (1997) or the *Residential Design Codes of Western Australia* (2002) prepared by the Western Australian Planning Commission, and covering local government planning schemes.

24. Applies to the commercial production of horticultural crops e.g. vegetables, flowers and fruit crops grown in contact with the ground. Does not apply to cereal or oil seed crops, perennials e.g. orchards, vineyards, nuts; or any crop grown separate from contact with soils in the natural environment e.g. hydroponics.

25. The use of recycled (reclaimed) water to address the diminishing level of scheme water supply in Western Australia is currently being investigated by Government. The social, environmental, health and economic issues related to this option are significant and need to be further progressed before its applicability in PDWSA is reconsidered.

Glossary

Abstraction	The pumping of water from a water source.
ADWG	The Australian Drinking Water Guidelines, outlining guideline criteria for the quality of drinking water in Australia.
Aesthetic guideline	NHMRC guideline level ascribed to acceptable aesthetic qualities of drinking water such as taste, smell, colour and temperature.
AHD	Australian Height Datum is the height of land in metres above mean sea level. For example this is +0.026 m at Fremantle.
Allocation	The quantity of water permitted to be abstracted by a licence, usually specified in kilolitres per annum (kL/a).
ANZECC	Australian and New Zealand Environment Conservation Council.
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand.
Augment	To increase the available water within a storage dam by pumping back water from a secondary storage/reservoir dam.
Bore	A narrow, lined hole, also known as a well, drilled to monitor or draw groundwater.
Bore field	A group of bores to monitor or withdraw groundwater.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
CENRM	Centre of Excellence in Natural Resource Managment
CFU	Colony forming units is a measure of pathogen contamination in water.
DAFWA	Department of Agriculture and Food, Western Australia
DEC	Department of Environment and Conservation
Diffuse source	Pollution originating from a widespread area eg urban stormwater runoff, agricultural infiltration.
DPI	Department for Planning and Infrastructure
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.

EC	Electrical conductivity estimates the amount of total dissolved solids (TDS), or the total amount of dissolved ions in a solution (water) corrected to 25^{o} Celcius. Measurement units include milliSiemens per metre and microSiemens per centimetre.
FESA	Fire and Emergency Services Authority
FPC	Forest Products Commission
GL	Gigalitre (1 000 000 000 litres) or 1 million kilolitres
ha	Hectare (a measure of area)
HAZMAT	Hazardous Materials
Hydrology	The study of surface water, especially relating flow and movement through the environment.
kL	Kilolitre (1000 litres) or 1 cubic metre
km	Kilometre (1000 metres)
km^2	Square kilometre (a measure of area) = 1 million square metres
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.
LEMAC	Local Emergency Management Advisory Committee
m	Metres
mg/L	Milligram per litre (0.001 grams per litre) as a measurement of a total dissolved solid in a solution.
ML	Megalitre (1 000 000 litres)
mm	Millimetre
MPN	Most probable number (a measure of microbiological contamination).
NHMRC	National Health and Medical Research Council.
NTU	Nephelometric turbidity units are a measure of turbidity in water.
Nutrient load	The amount of nutrient reaching the waterway over a given timeframe

	(usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorous (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
Point source pollution	Pollution originating from a specific localised source, eg sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances, eg effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.
Public Drinking Water Source Area (PDWSA)	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*.
Riparian Rights	The rights of landholders whose land has direct contact with a watercourse or wetland to take water for domestic and ordinary use; watering cattle or stock that are not being raised under intensive conditions; and to irrigate a 2ha household garden.
Run of the river scheme	A scheme that takes water from a flowing river. Water is taken directly from the source and there is no detention time (storage).
Run-off	Water that flows over the surface from a catchment area, including streams.
Scheme supply	Water diverted from a source or sources by a water authority of private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
SCRIPT	South Coast Regional Initiative Planning Team
Stormwater	Rainwater which has run off the ground surface, roads, paved areas etc. and is usually carried away by drains.
TCU	True colour units (a measure of degree of colour in water)
TCRP	Torbay Catchment Restoration Plan
TDS	Total dissolved salts, a measurement of ions in solution, such as salts

	in water.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Wastewater	Water that has been used for some purpose and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water quality	The physical, chemical and biological measures of water.
Water Reserve	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.
WESTPLAN HAZMAT	Western Australian Plan for Hazardous Materials.

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