QUINNINUP DAM CATCHMENT AREA
WATER SOURCE PROTECTION PLAN

Quinninup Town Water Supply

WATER AND RIVERS COMMISSION REPORT
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Water and Rivers Commission

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Resource Management Division

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Foreword

Water Source Protection Plans

Water Source Protection Plans establish the level of protection required in Catchment Areas. Catchment protection of water sources is considered a fundamental part of ensuring the provision of a safe drinking water supply.

Water Source Protection Plans identify sources of potential contamination and set out programs for managing the resource. The plans are developed in consultation with affected landowners, relevant State and local government agencies and other key stakeholders. The plans are not statutory documents.

Proclaiming Catchment Areas under the *Country Areas Water Supply Act 1947* protects the quality of water sources in country Western Australia. The Act's by-laws enable the Water and Rivers Commission to control potentially polluting activities, regulate land use, inspect premises and take steps to prevent or clean up pollution.

The Water and Rivers Commission aims to work pro-actively with planning agencies to incorporate water protection in the land planning process. Decisions on land use zoning and subdivision applications have a significant impact on the protection of water sources. The Commission supports the amendment of Town Planning Schemes and Development Strategies that reflect land use compatible with Water Source Protection Plans. A State Planning Policy for Public Drinking Water Supply Areas is currently being prepared to progress this process.

This Water Source Protection Plan provides a basis for establishing compatible land uses in the Quinninup Dam Catchment Area and is a mechanism for practical implementation of the Commission's protection strategies. Local government decision-makers, State planning authorities and operational staff are encouraged to recognise this document as a basis for ensuring the long-term protection of this groundwater resource for generations to come.

Water quality protection framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. This is consistent with the State Water Quality Management Strategy (May 2001). The Commission has developed policies to protect public drinking water source areas that include three levels of priority classification.

Priority 1 (P1) source protection areas are defined to ensure that there is no degradation of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of risk avoidance and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is no increased risk of pollution to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of risk minimisation and so some conditional development is allowed.

Priority 3 (P3) source protection areas are defined to minimise the risk of pollution to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments. Protection of P3 areas is achieved through management guidelines rather than restrictions on land use. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, Reservoir Protection Zones are defined to protect the water source from contamination in the immediate vicinity of reservoirs. Reservoir Protection Zones usually consist of a 2 kilometre buffer area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside the catchment area. Special restrictions apply in these zones.

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Summary

The town of Quinninup is located 340 km south of Perth. The water supply for Quinninup is obtained from an earth impoundment (Karri Lake), which is constructed on Little Quinninup Brook. Karri Lake is located to the east of the Quinninup townsite.

Currently the Quinninup catchment is located in the Warren River Catchment Area which was gazetted in 1978. It is recommended the Quinninup Dam Catchment Area be proclaimed as a separate catchment. The catchment area should be managed for Priority 1 and Priority 3 source protection to preserve and protect the quality of the water source.

Quinninup is a unique case situation. The dam was constructed by a developer for the dual purpose of recreation and the town's water supply. The dam formed part of a conceptual resort and residential development. Part of the residential estate has been established and bounds the southern portion of the lake. Further development is proposed for the northern bank of Karri Lake.

Other land uses in the catchment include State Forest and a decommissioned landfill site.

Recreational pursuits are a significant activity in the catchment. The reservoir and surrounding area is a popular recreational site for marroning, fishing, swimming, bushwalking, and boating.

Land use activities in the catchment may have the potential to contaminate the water source and this plan outlines strategies to manage those risks.

Potential risks posed to the water quality of this source have been carefully assessed, recognising that the treatment for this supply is disinfection. Based on the potential risk posed by human contact with the water and the number of people that could potentially be affected, activities that include body contact with the water are not considered acceptable in this catchment. Activities that do not require contact with the water body generally pose less of a risk to water quality. Thus, they are generally considered acceptable with appropriate management conditions to ensure water quality protection objectives are met.

This plan has undergone extensive consultation during its development. The Commission formed a reference group to provide key stakeholders the opportunity to raise issues for consideration. The group investigated a number of options for recreational pursuits in the catchment area, suggested strategies for water quality management and commented on those suggested by the Commission.

Taking into account the risks, equity issues, the current treatment process of the drinking water and opportunities for source options, the reference group recommended that all recreational activities were unacceptable (unless otherwise stated). This recommendation was endorsed as an interim measure to protect the town's drinking water supply. This position will be revised when a new source option is developed. It was recognise that even after a new source is developed, some form of management will be required to maintain the quality of the lake for recreational purposes.

Despite the management recommendations in this plan, some land uses and activities e.g. septic systems and disused tip site leachate, free roaming dogs may remain a risk to the water source. The risk posed by these land uses and activities need to be quantified through monitoring and investigation. This will help to understand the risk posed by these activities.

The reference group consisted of representatives from landowners from Quinninup, the Water and Rivers Commission, the Water Corporation, Department of Conservation and Land Management, Health Department of WA, Shire of Manjimup, Quinninup Community Association, Quinninup North Body Corporate and local real estate agents. The members of the reference group are listed in Appendix 4.

The Commission would like to thank all involved for their co-operation, goodwill and positive approach during the water source protection planning process.

A draft plan was released for consultation in January 2002. Submissions on the draft plan and the outcomes of discussions with key stakeholders, have been included.

Preamble

Landowners of the reference group agreed to concessions on the recreational use of Karri Lake as an interim measure, while moving towards the development of an alternative future drinking water source. These concessions were based on ensuring a safe drinking water supply for the town. Although the recommendations within this plan would minimise the risks to the town's drinking water supply, unmanageable risks remain in the catchment area. It is therefore critical to commence the process for an alternative source option. These options have been identified by the Water Corporation in *Quinninup Water Supply Scheme: Summary of Water Quality Issues and Source Options* (Water Corporation, 2001). Any option will take time to develop, with some requiring various approvals. Despite these options, the issue of who would manage the existing reservoir after the development of a new source remains and requires further investigation.

1. Introduction

Karri Lake is on Little Quinninup Brook approximately 340 km south of Perth and 35 km south of the town of Manjimup. The water supply for the town of Quinninup and Karri Lake Estate is sourced from Karri Lake. Karri Lake is located on Lot 187, which is owned and managed by the Water Corporation. The catchment located in the Shire of Manjimup (see Figure 1).

The town of Manjimup is the closest regional centre. It has a population of 5000.

Quinninup was established as a timber mill town and has since diversified into arts, crafts, tourism and cottage industries.

1.1 Existing water supply system

Karri Lake was constructed in 1986, has a height of 9 m and the reservoir has a capacity of 56 gigalitres (GL). The annual inflow to Karri Lake is estimated to be 49 GL (WRC, 1998).

1.2 Existing water source protection

The Warren River Water Reserve was proclaimed in 1978 under the *Country Areas Water Supply Act 1947* to ensure protection of the potential future water source from potential contamination. The Quinninup catchment area is within the Warren River Water Reserve.

1.3 Future water supply system

The Water Corporation has identified a number of future source options in the event that the current public water supply becomes untenable. The options identified were:

- retain Karri Lake source and construct wastewater scheme;
- retain Karri Lake and provide additional water treatment;
- construct new dam upstream of Karri Lake;
- construct new borefield;
- connect to the Manjimup or Pemberton town water supply schemes; and
- retain Karri Lake with adequate water quality protection.

Details of these preliminary options are outlined in the *Quinninup Water Supply Scheme: Summary of Water Quality Issues and Source Option*", available from the Water Corporation.

The options outlined in the document require further investigation, with some requiring relevant approvals from various agencies. The options presented in the report are not exhaustive and there may be alternatives not identified.

There are risks associated with the long-term use of the lake for drinking water supply. The time period for implementation of an alternative source option is yet to be determined. The main determining factor will be the increased risk to public health from microbiological or chemical contamination from land uses in the catchment area. It is therefore a priority to quantify the risk associated with those land uses and activities that cannot be managed in this plan.

1.4 Water resource allocation

Surface water resource use and conservation in Western Australia country areas is administered by the Commission in accordance with the *Rights in Water and Irrigation Act (RIWI) 1914*, as amended 2000. Under the RIWI Act, the right to use and control surface water is vested in the Crown. This Act requires licensing of surface water abstraction within proclaimed Surface Water Areas.

The Quinninup Dam Catchment Area is within the Warren River Surface Water Area, proclaimed in 1959.

1.4.1 Current allocation licence

The Water Corporation is licensed by the Commission to take 30 000 kilolitres (kL) per annum from Karri Lake.

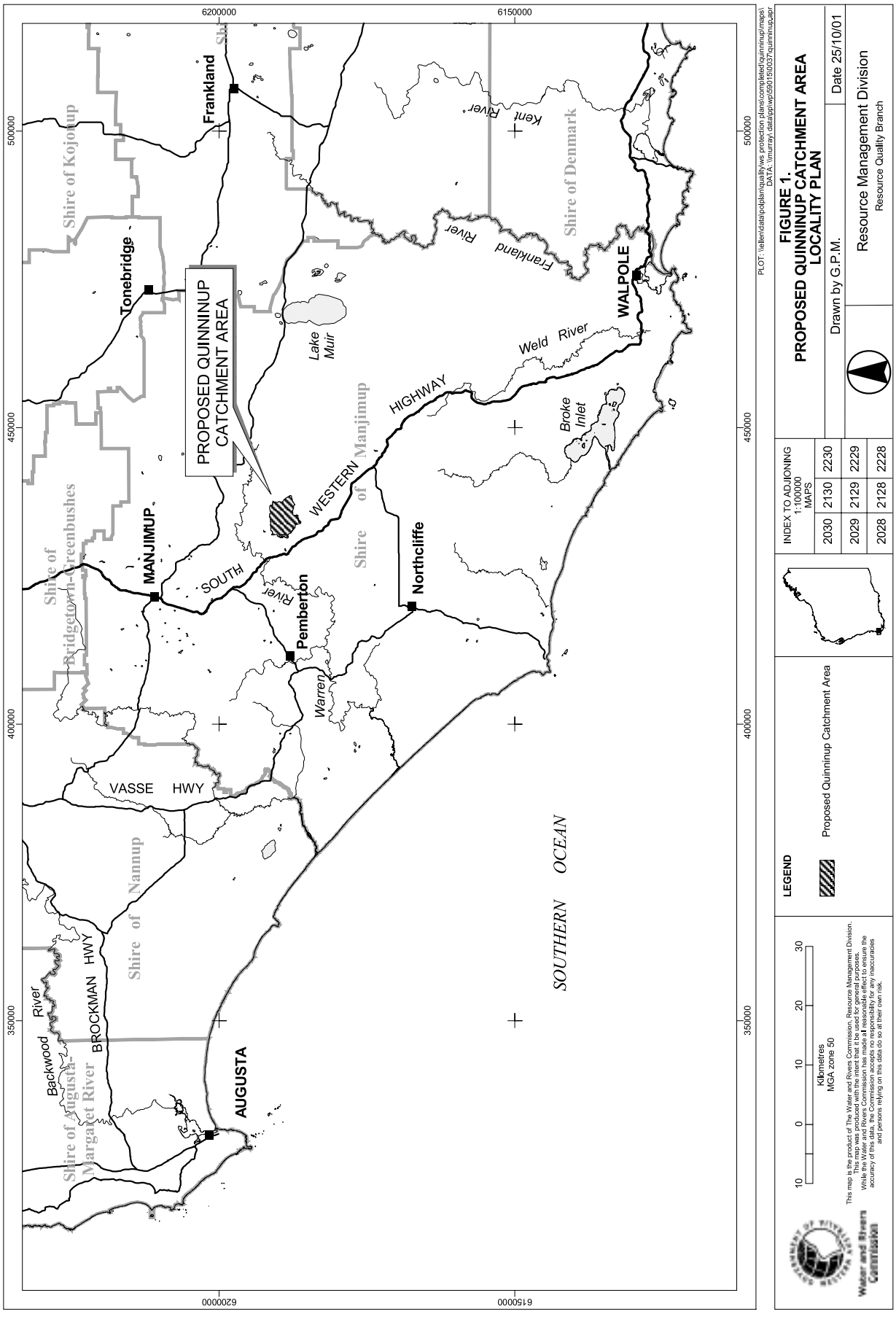

Figure 1. Proposed Quinninup catchment area locality map

2. Physiography

The Quinninup catchment is located on the Darling Plateau and consists largely of crystalline rock and quartzite and unconsolidated sediments. The topography is undulating with an array of divides, low rises, swampy tracts and minor valleys.

The weathered mantle is predominantly granite saprolite with some laterite duricrust and quartzite outcrops. Soils over the granite consist of loamy sands, yellow brown sands, laterite gravels, quartzite and granite.

3. Climate

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

The long-term average annual rainfall for the catchment is approximately 1200 mm, most of this falling between May and September. The average annual rainfall in the area has not exceeded the long-term average for the last 20 years. The decline in rainfall has led to an annual reduction in streamflow from 1975 to the present (WRC, 1998). The annual average evaporation is 1300 mm.

4. Hydrology

Quinninup Brook has an estimated annual flow of 2100 ML with a potential yield of 567 ML.

4.1 Water quality

Comprehensive water quality tests are undertaken regularly to ensure compliance with National Health and Medical Research Council (NH&MRC) guidelines (1987). Water supplied to Quinninup is currently compliant with NH&MRC guidelines.

It is recommended that the current sampling program be more comprehensive in order to indicate risk to public health that may result from surrounding land uses in the area.

4.2 Water treatment

The water from Karri Lake is treated for the removal of organic-based colour residue from local vegetation.

Water from Karri Lake is treated at the on-site water treatment plant. The process consists of treatment with alum, caustic, and polyelectrolyte and Drysand filter. The water is then disinfected by chlorination (Water Corporation).

A multiple barrier approach is used in the management of drinking water quality. Catchment management for protection of the water source is the first important stage; another stage is water treatment to ensure water is safe to supply to the public. It is important to note that treatment can improve water quality but does not remove all hazards to public health. Therefore, effective catchment protection is essential.

5. Existing and proposed land use

Land use and activities in the catchment consist of:

- Private land (special residential lots);
- State Forest; and
- Recreation.

Details of current land use and activities, including recreation, are given in Table 2. Land uses are shown in Figure 2.

5.1 Private land

There is an existing subdivision to the south and south east of Karri Lake (Plate 1). The lots are zoned special residential under the Shire of Manjimup's Town Planning Scheme. Lots range in size from 2000 m^2 to 5500 m^2. A proposal to subdivide Lot 551 (Pt Nelson Loc 13272) is currently at the Department for Planning and Infrastructure waiting determination. The proposed subdivision has a lot yield of 77 lots, with the average lot size being 2163 m^2, ranging from 2000 m^2 to 3920 m^2 (Plate 2).

5.2 Crown land

State Forest Number 38 covers the majority of the catchment. The State Forest is vested in the Conservation Commission of WA, and managed by the Department of Conservation and Land Management (CALM).

The forest is managed for multiple use that includes timber production, water production, recreation and nature conservation as well as some apiary use and wildflower and seed harvesting. There is also widespread collection of firewood for private use. Specific land management activities include hardwood and softwood timber harvesting and prescribed burning.

This general area of CALM estate is proposed National Park under the State Government Policy *Protecting our Old Growth Forests*. The exact boundary of the proposed National Park had not been determined during the consultation process for this plan. The time frame for the National Park is 2-4 years.

CALM has identified one Priority 2 species in the area. Future field checks are likely to identify more.

There is a decommissioned landfill site located in the north west of the catchment area (Figure 2). The Shire leases the site from CALM. The lease was recently renewed for the purpose of rehabilitation (Plates 3 and 4).

5.2.1 Water Corporation land

The Water Corporation owns Lot 187, which encompasses Karri Lake and the surrounding 30-metre buffer.

5.3 Recreation

A number of recreation activities occur in and around Karri Lake, as well as the surrounding catchment. For more information, refer to Tables 1 and 2.

5.3.1 Recreation in and around Karri Lake

There is an existing walk trail around Karri Lake that is used for walking, trail bike riding and horse riding predominantly in State Forest. Other recreational activities include camping, fishing marroning, and boating and swimming in the lake.

5.3.2 Recreation in the broader catchment area

Bushwalking, horse riding, 4 wheel driving and trail bike riding occur throughout the catchment mainly along forest tracks.

There are no designated camping areas in the catchment. Unauthorised camping occurs at low levels.

Recreational hunting for feral pigs also occurs within the catchment area at low levels. There are no restrictions on hunters and their dogs in State Forest, except for prohibition on the use of firearms.

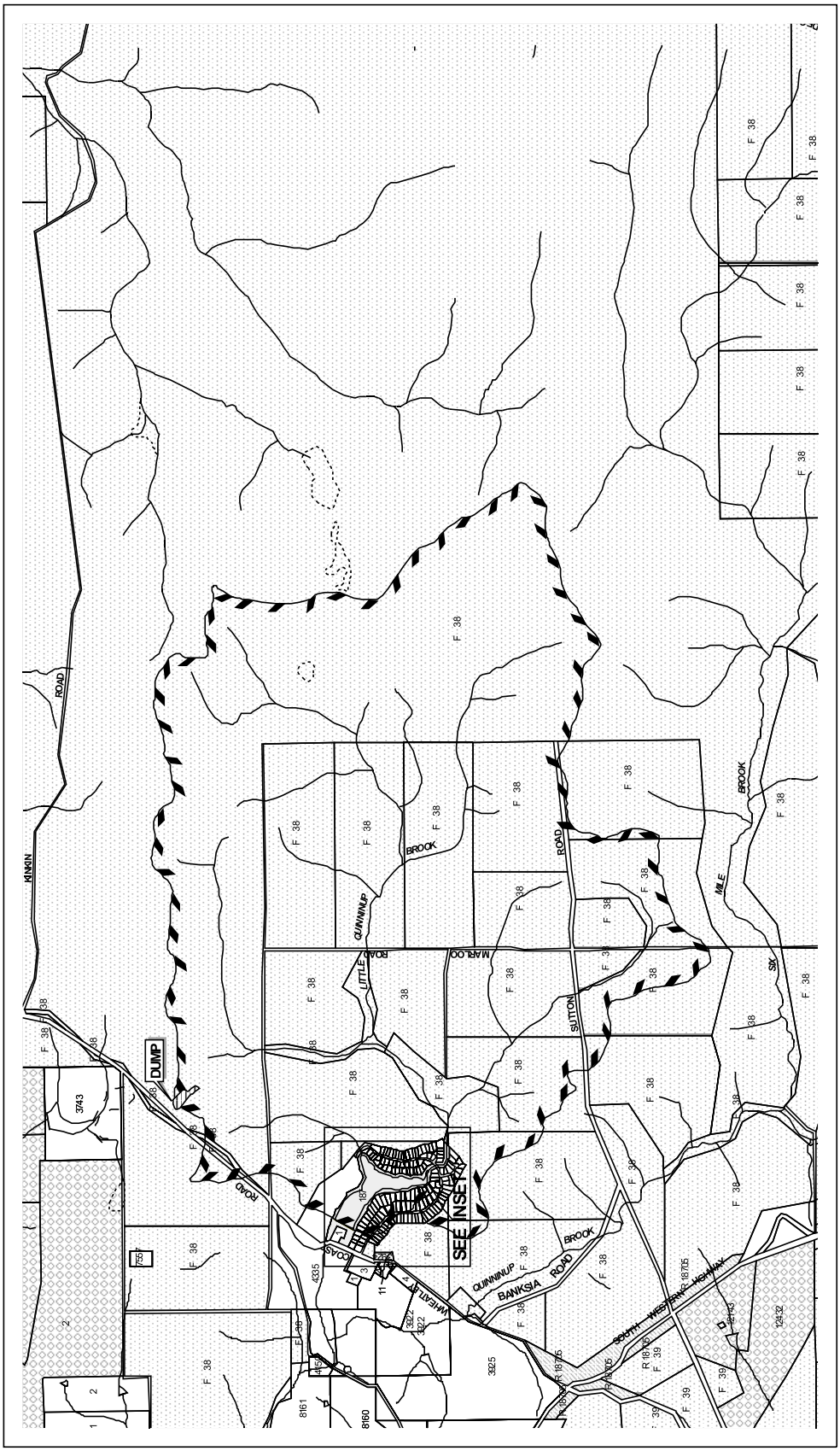

Figure 2. Existing land use and tenure

Plate 1: Existing subdivision at Quinninup

Plate 2: Site of proposed subdivision at Quinninup

Plate 3: Decommissioned landfill site.

Plate 4: Exposed rubbish at decommissioned site.

6. Proclaimed areas and priority classifications

The Warren River Water Reserve was gazetted in 1978 under the *Country Areas Water Supply Act 1947* for the protection of the potential future public drinking water supply source of Warren River. The Warren River Water Reserve includes the Quinninup catchment area. Karri Lake is a strategic public water supply to Quinninup and Karri Lake Estate. It is proposed that the Quinninup catchment be gazetted. The proposed Quinninup Dam Catchment Area is shown in Figure 3.

The source protection objective is to manage the risks in the catchment area to maintain existing water quality for as long as possible. It is recognised that current and historic land uses pose an ongoing risk to the water source that may lead to the deterioration of water quality in Kari Lake. It is therefore necessary to commence a comprehensive investigation into new source options to determine the preferred future option for development. This should be done in consultation with the community, relevant agencies and stakeholders.

It is recommended that private land in the catchment be managed for Priority 3 (P3) source protection (see Figure 3). This classification is justified on the following basis:

- Alternative water resources exist (refer to *Quinninup Water Supply Scheme: Summary of Water Quality Issues and Source Options, Water Corporation, 2001)*; and
- The area surrounding Karri Lake is zoned special residential. Associated land uses are acceptable in Priority 3 source protection areas. Some restrictions may apply to the storage of fuels and chemicals.

Protection of P3 areas is achieved through management guidelines. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

It is recommended that all Crown land in the catchment be classified as Priority 1 (P1) source protection (see Figure 3). This classification is justified based on the following:

- The land is in Crown ownership where management recognises water protection.
- Karri Lake remains a strategic water source to Quinninup and Karri Lake Estate until a new source is developed.
- Existing land uses are compatible with P1 objectives.

The details of land use compatibility for the Priority 1 and Priority 3 source protection classifications are listed in Appendix 1.

6.1 Reservoir Protection Zone (RPZ)

To protect the reservoir from immediate risks to water quality, including human contact, it is proposed that the area close to the reservoir be managed as a Reservoir Protection Zone (RPZ).

The RPZ is defined as the boundary of Lot 198, which is owned and managed by the Water Corporation.

The RPZ is shown on Figure 3.

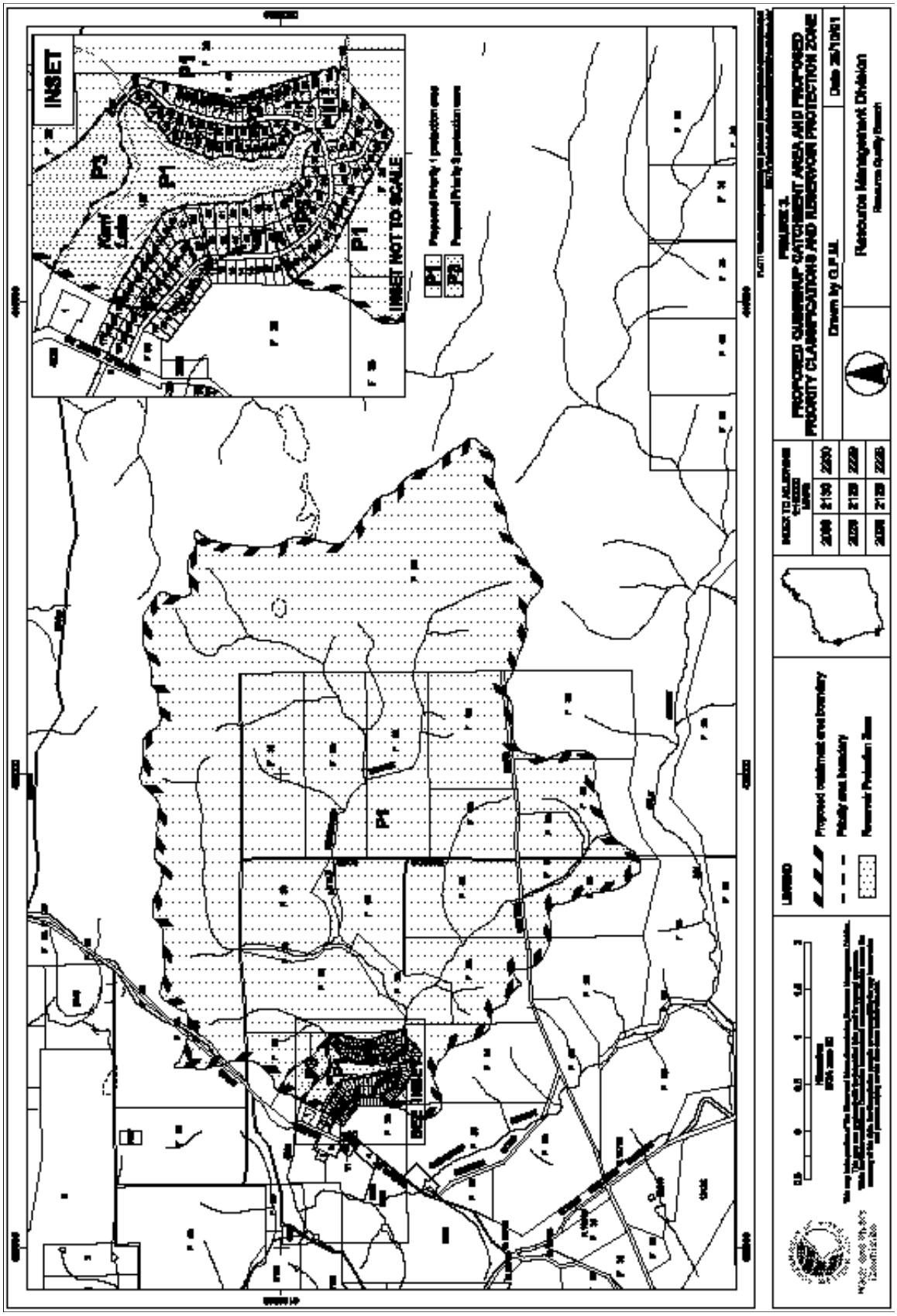

Figure 3. Proposed Quinninup Catchment Area

7. The impact of water source protection planning

General issues raised throughout the State regarding the impact of water source protection planning are addressed below.

7.1 Common areas of concern about the impact of water source protection planning

7.1.1 New restrictions on existing land uses

The Commission's water source protection planning recognises existing approvals and does not prohibit currently approved land use activities. In other words, landowners can continue to undertake currently approved land use activities. This may also be the case for activities that are considered incompatible with the assigned priority classification.

When a landowner applies to the local authority to expand an existing operation or develop the land for a particular use, the Commission will provide advice to the local authority based on the activities that may be compatible with the relevant priority classification. This applies similarly to Priority 1, Priority 2 and Priority 3 areas.

7.1.2 Compensation for development constraints

The issue of compensation is often raised through water source protection planning. The existing water source protection legislation, the *Country Areas Water Supply Act 1947*, does not contain any provision for compensation when a protection area is proclaimed and the by-laws under that Act become applicable.

Sometimes, because of the importance of the water source, land in private ownership may be designated for Priority 1 protection. Existing land uses can continue in line with planning approvals and development proposals, and will be assessed in accordance with Priority 1 objectives.

Properties can also change hands and existing approved land uses can continue following transfer.

Landowners in Priority 1 areas may approach the Commission to consider the purchase of their property. Any purchase by the Commission is subject to the availability of funds and other priorities for purchase. Sales are negotiated on fair market value and resumptions of property are not undertaken.

7.2 Specific issues raised during consultation

Specific issues raised during the consultation process are outlined in Table 1 along with the Commission's consideration of the issues. Other issues and considerations for management are addressed in Table 2.

Table 1. Consideration of issues raised by consultation

ISSUE	DETAIL	DISCUSSION
SPECIFIC ISSUES RAISED DURING CONSULTATION		
Devaluation of properties	The community members of the reference group were significantly concerned with the apparent devaluation of properties around the lake, loss of sales and the large number of blocks on the market since restrictions have been imposed.	Many aspects of public amenity may affect the value of private land, including the quality of drinking water and recreational opportunities on adjacent public land. However, regulation affecting these public amenities generally does not directly impact on the legal rights of private landholders. Most of the water quality protection strategies recommended in this plan relate to public land (including land owned by the Water Corporation), not to private land. It is difficult to quantify the effect of these proposed strategies on the long-term values of the adjacent private land, as the findings of the Valuer General's Office show below. Findings from the Valuer General's Office: The Karri Lake subdivision was developed around Karri Lake in 1989 primarily as a "hideaway lifestyle" area. The lake itself was formed by the developer in 1989 by the construction of a dam wall across the Little Quinninup Brook and provides scheme water to the subdivision and the town of Quinninup (about 30 dwellings). In 1990 the Water Supply Scheme was taken over by Water Corporation subject to the condition that recreation on the lake is limited to "activities compatible with water supply". In 1990 the developer reduced the average block price by approximately 10% to stimulate sales. This resulted in a reduction in realised sale prices across the development. At about this time (i.e. early 1990s) many comparable lifestyle subdivisions in the area were also coming onto the market. This provided potential buyers with a great variety of properties to choose from and may have held prices down in the Karri Lake development. Other factors that may have adversely affected selling prices in the development could also be the relative isolation of the area and the lack of nearby recreational and retail facilities. It is also possible that early buyers in the development may not have been fully aware of the restrictions on recreational activities. It has even been suggested that some selling agents actually highlighted the recreational potential of the area in their sales pitch. All of these factors, together or in part, (and perhaps others which we are not aware of) may have contributed to slow recovery of land sale prices in the development to their original level at the time when they first came onto the market. Due to the multifarious factors which impact on land sale prices over a period of time it is very difficult to isolate one factor (i.e. restrictions on recreation activities) and then quantify the magnitude of this factor's impact (if any). The above is therefore only an opinion and should be appreciated as such by the reader.

Table 1 contd.

ISSUE	DETAIL	DISCUSSION
SPECIFIC ISSUES RAISED DURING CONSULTATION		
Alternative drinking water source options	If new source were developed, who would assume ownership and manage the existing lake? The Shire of Manjimup decided in early 2001 that it was not prepared to assume responsibility for the existing dam based on information at the time.	The WC has provided detail on alternative water sources that may be considered in the long term. Any new source option would take at least 3 years to be operational. Therefore the existing lake and catchment requires protection to ensure a safe public drinking water supply in the interim. Before further consideration of when an alternative source may be necessary, the WRC and WC need to understand the risks to water quality. This includes some projection of when the risks from development reach unacceptable levels. This makes the water source protection planning process vital to assessing the viability of Karri Lake as a drinking water supply. In the event that the existing source is no longer used for public drinking supply, there is the need to determine the long-term future of Karri Lake. The WC has indicated that it may be willing to pass the asset to another body, whether it is the Shire or another interested body. The Shire has expressed reluctance to take over the management of Karri Lake based on information at the time. If the lake were to be used for recreation, then there would be a need to prepare a recreation management plan. This plan would need to address the type of recreation that would be acceptable in and around the lake as well as the risks to water quality, and to address occupational health and safety issues. The new owner in consultation with the local community, relevant agencies and stakeholders (see Table 2) would develop this plan.
	Suggestion of individual homes with private sources, e.g. rainwater tanks.	Under the Shire's requirement, each property would be required to have a 92, 000 litre rainwater tank for the provision of drinking water and domestic use to the house. Although most of the lots within Karri Lake Estate would be able to incorporate a 92, 000 rainwater tank within the building envelope, the houses in the town of Quinninup would not be able to accommodate such a tank. There is also the added concern that the roofs of many of these houses have been painted with lead-based paint.

Table 1 contd.

ISSUE	DETAIL	DISCUSSION
SPECIFIC ISSUES RAISED DURING CONSULTATION		
Risk in water supply system	Need to look at off-take level, retention time, treatment, holding time, and contact time with chemicals to assess risk to water quality.	The dam has a capacity of approximately 850 thousand cubic metres with only 3% used each year for town water supply. This means a long retention period, however no modelling has been done to determine the dynamics of the dam and layering. Modelling of other water bodies shows water movement is significant. The floating off-take is set to 2.3 metres below water surface level (WSL). The water is treated with caustic, alum and electrolyte to raise the pH, drop out colour and reduce turbidity respectively. The water is then passed through a Drysand filter to remove solids and is stored in a clear water tank prior to disinfection with chlorine and being transferred to the high level tank. The sands in the Drysand filter are fine to medium and only remove solids within the water.
Recreation downstream of Karri Lake	The community would like to establish picnic sites/BBQ sites that could be managed by the Quinninup Community Association (QCA).	The town has a strong community association (QCA) dedicated to looking after the area and giving the community a quality place to live. Providing activity does not involve increased access to Karri Lake, then the risk to drinking water would be negligible. WRC would encourage the establishment of recreation outside the catchment area.
Swimming facility	Option of creating a natural swimming pool downstream of Karri Lake for the town's use as in Pemberton. Questions of management, liability, insurance etc.	The Pemberton tourist bureau manages the swimming pool in Pemberton, and was unable to obtain insurance cover in the event of an accident. A natural swimming pool in the Quinninup area would most likely face similar issues. It may be possible to build a pool in the town, however this would raise questions of who would manage the site and who would maintain the pool.
National park	The general CALM estate area has been flagged as a potential national park. The time frame for the national park is 2-4 years. The boundary is not yet known.	The proposed national park will be in line with the State Government Policy *Protecting our Old Growth Forests.* As a result of the proposed national park, forestry activities in the Quinninup catchment will decrease. The extent of forestry activities in the catchment area is dependent on the final boundary of the national park. National parks are compatible with Priority 1 protection.
Management of recreation	Consider potential for QCA to manage recreation activities in and around the lake.	The town has a strong community association (QCA) dedicated to looking after the area and giving the community a quality place to live. There may be potential for the QCA to manage recreational activity in the area. WRC would consider delegation of some by-law enforcement powers to assist in management. The QCA have indicated that they would not take on a management role at this time by themselves, but could have an input.

8. Management of potential water quality risks

The objective of this plan is to protect water quality for public health, while recognising current land use rights.

Quinninup Dam Catchment Area should be managed so the quality of water from forest areas is maintained, with measures to manage the risk to water quality from private land. The minimisation of risks to water quality for public supply is imperative for the protection of public health. It is recognised that past and present land use in the catchment pose an ongoing risk to water quality and may lead to the source becoming untenable.

This plan generally recommends that activities involving human contact with Karri Lake or feeder streams are prohibited. Activities that require people to be close to these water bodies are to be discouraged and managed accordingly.

During the protection planning process, the reference group was presented with options for recreational activities in and around Karri Lake (refer to Appendix 3). It determined to recommend prohibition of these recreational activities based on responsible water quality management to minimise the risk to the town's water supply and the health of the local community. The community representatives of the working group were not prepared to accept the perceived risks associated with recreation on the lake to the water supply. This decision was based on:

- The treatment process of the lake which only removes solids, turbidity, colour and not pathogens that may be associated with recreational activities.
- The health risks associated with recreating in the town's water supply.
- The opportunities for a new source being investigated.
- Minimising the risk to the town's water supply.

The community representatives expressed concern that if agreement was reached on a "no recreation" stance, the risks to the source would be perceived as manageable and therefore pressure on obtaining a new source would be reduced until the medium to long term. However:

- Recreation can be directly managed and mitigated through the *Country Areas Water Supply Act 1947* (CAWS Act) by-laws;
- Risks posed by existing land uses such as the decommissioned landfill site, septic tank systems and the lack of control of domestic animals would remain;
- These risks cannot be managed under the CAWS Act; and
- These existing land uses and activities may pose an unacceptable risk to the water source.

Despite the plan's measures to manage the risks associated with existing and historic land uses in the catchment area, the Commission recognises that some risks will persist (e.g. septic systems, possible leachate from the decommissioned landfill site, free roaming dogs). The risk needs to be quantified through water quality monitoring of Karri Lake and the investigation of potential leachate from the decommissioned landfill site. This information would increase our understanding of the risks posed to the drinking water supply and will assist in planning for a future drinking water source option.

The future source option should consider the landowners' desire to retain recreational use of the lake and their concern regarding the water quality of their drinking water. It is therefore a priority for the landowners that the Water Corporation move towards a future source option. The landowners in the reference group endorsed the recommendations of this plan as an interim policy prior to the development of a source option.

8.1 Predominant water quality risks in the Quinninup catchment

8.1.1 Pathogens

There is a substantial potential risk to water quality from possible pathogen contamination by human and domestic animal contact with water. There are many pathogens that can contaminate water supplies and a number that are commonly known to contaminate water supplies worldwide. These common pathogens include bacteria (e.g. *Salmonella*, *Campylobacter, E. Coli.* and *Cholera*), parasites (e.g. *Cryptosporidium*, *Giardia*) and viruses. These pathogens generally arise from faecal contamination.

The percentage of humans around the world who are carriers of the various pathogens, and hence have the potential to contaminate, varies between 0.33% (*Shigella*) and 25% (*Cholera El Tor* in Asia) depending on the pathogen in question (Geldreich, 1996). For example, it is estimated that 1-3.9% of people are infected with *Salmonella* worldwide, 0.6-4.3% with *Crytosporidium* and 7.4% with *Giardia*. Estimates in Australia for *Giardia* are as high as 20% for children in child care (Grimmond et al., 1988).

Even if the lower limit were taken, as may be expected in Australia, there is significant potential risk of contamination by any of these pathogens if humans, and hence human waste, are present in or near the reservoir and feeder streams.

This contamination has the potential to last a significant amount of time in water. For example, *Salmonella* is viable for 2-3 months and *Giardia* for around 1 month (Geldreich, 1996). Other references estimate viability for longer periods.

Based on the likelihood that a person near the reservoir is infected with one type of pathogen and on the viable life of pathogens, human contact with the water and the presence of humans near the reservoir or feeder streams is a risk to public water supply quality and hence human health. While disinfection effectively kills many pathogens, it does not completely eliminate all. Preventing their presence in the water source is the most effective way of removing a public health risk.

Karri Lake is a strategic source for water supply to Quinninup town and Karri Lake Estate. The estate has the capacity to increase the population of Quinninup. The potential risks posed to water quality have therefore been carefully assessed. Based on the potential risk posed by human contact with the water and the number of people that could be affected, activities that require contact with the water body are considered not acceptable in this catchment.

Activities that do not require, and are not likely to cause, contact with the water generally pose less of a risk to water quality and public health. Consequently, activities with no water contact are generally permitted, with management conditions to ensure they do not compromise water quality objectives.

This plan is aiming to balance water quality protection and social needs and aspirations as much as possible. Where constraints are required, opportunities for these activities should be catered for in other more appropriate locations.

Table 2 summarises the water quality risks associated with land uses and activities. The table includes the reasons for accepting some of the land uses/activities in the catchment and recommends management and protection strategies.

8.1.2 Turbidity water quality risks in the Quinninup catchment area

Turbidity levels in Karri Lake are generally very low. Turbidity is the presence of suspended solids, such as soil and organic matter, in water. These particles can aid the transport of other contaminants in water.

The main sources of suspended solids are soil erosion and disturbance of the streambed.

The following practices are examples of potential contributors to turbidity:

- Excessive vegetation removal.
- Road construction and maintenance.
- Harvesting of timber using heavy machinery.
- Off-road driving.

Management practices, such as retaining deep and shallow rooted vegetation buffers to watercourses can reduce the risk of soil erosion and therefore reduce turbidity levels in the water. These practices are recommended as Best Management Practices to minimise the potential impact on water quality.

8.1.3 Specific

Specific issues raised during the consultation process are outlined in Table 2 along with the Commission's considerations for management.

8.2 Land use, potential water quality risks and recommended strategies

The following table details the existing land uses in the catchment and the potential water quality risks, and leads through a discussion to a recommended strategy to manage the risk.

The discussion and recommended strategies balance the need to protect water quality for the community in the long term, with the rights of landowners to continue to utilise land for lawful purposes.

Table 2. Land use, potential water quality risks and recommended strategies

RECREATION IN AND AROUND KARRI LAKE

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Trail bikes			
When the water is low, trail bikes are ridden around the edge of the lake. The community members of the reference group consider trail bikes an undesirable use.	The potential risks associated with this activity are erosion from soil disturbance, pathogen contamination from human waste, hydrocarbon contamination from fuel spills, and litter contamination. Bikes crossing flowing streams exacerbate the turbidity risk.	The trail bikes use the trail around the lake. This activity occurs infrequently and poses a risk to the water quality of the lake. The close proximity to the water source means that the risk of contamination from an accident is high. Alternative sites are available for trail biking (See Recreation in the Broader Catchment). The activity occurs on Water Corporation (WC) owned land. .	*Trail bike riding around the lake is unacceptable.* • No trail bike riding around the lake will be permitted. • Surveillance and enforcement through CAWS Act by-laws. • Use signage for public information on restricted areas and need to protect water quality. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.
Horse riding			
There has been some horse riding around the lake. This does not occur on a regular basis.	The potential risks associated with this activity are erosion, pathogen, and litter contamination. Erosion associated with disturbance of soil leads to turbidity. Horses crossing flowing streams exacerbate the turbidity. There are risks from pathogen contamination and nutrients from horse waste and litter associated with people.	Equestrian activity has only occurred in the catchment on a few occasions. It usually involves a couple of riders and horses around the lake and through sections of State Forest in the catchment. Roads and tracks are used. Approval from CALM is required for any event in State Forest areas and is dependent on environmental risks in the area. .	*Horse riding is not acceptable around the lake. It is acceptable with Best Management Practice in the catchment.* • No riding near the lake or around the lake. Riding only permitted within the catchment on roads and tracks (See Recreation in the Broader Catchment – Horse Riding). Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Swimming in Karri Lake			
The community representatives of the group estimated that up to 50 people used the lake per day during summer. Residents, non-residents and pets swim in the lake. There is a car park within a couple of metres of the lake making access easy. With the Water Corporation enforcing water quality protection conditions (e.g. signs), the frequency and number of people swimming has decreased. The community wants the potential for swimming to be considered.	There is a high potential risk of pathogen contamination from faecal material through full body contact. Associated activities around the water body may provide a risk from litter.	Swimming is a popular recreational activity in the catchment. Swimming is a primary water contact activity and hence poses a considerable risk to drinking water quality. Swimming is not recommended by the Health Department for public drinking supply sources. Water treatment does not adequately protect against risk from pathogens. Swimming in the lake and feeder streams is not permitted under water quality protection by-laws.	*Swimming is not an acceptable activity while the reservoir is used for drinking water supply.* • Education and awareness that swimming is prohibited through signage. • Undertake surveillance and by-law enforcement. • When a new source is operational, a review of this plan could consider swimming as part of a recreational plan for the existing lake. There may be a health risk to swimmers in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Camping			
There are no designated camping sites around Karri Lake. Camping rarely occurs in the area, mainly during marron season**.**	There is a potential risk of pathogen contamination through human and animal faeces and urine, bathing, rubbish disposal, fishing, marroning and domestic contact with the water. There is also a potential risk of turbidity and pollution through vehicle usage and disturbance of vegetation.	There are no designated camping areas and no facilities such as toilets or rubbish disposal sites around Karri Lake. Camping within 300 yards of water bodies is prohibited under the by-laws of the *Country Areas Water Supply Act 1947*.	*Camping around the lake is unacceptable.* • Prohibit campsites around the lake. • Implement surveillance and by-law enforcement to discourage camping around the lake. • Use signage to show the area is closed to camping. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.
Powered boating			
As part of the Shire's Town Planning Scheme provisions for the area, no motorised boats are permitted on the lake. There is strong community opposition to the use of powerboats.	There is a risk of pathogen contamination if body contact with the water occurs. Unstable craft increase the risk of body contact with the water. The use of boats will result in an increase of people to the reservoir and hence increase the potential risk from waste disposal. Powerboats pose a risk of hydrocarbon contamination from fuel and oils. They also cause turbidity from wash along the shoreline.	Fuel-powered craft are incompatible with water quality protection objectives. This activity requires some contact with the water. Having people in close proximity to the water body, and with the potential for body contact, poses the main risk to water quality, particularly with the level of water treatment.	*Powered boating is unacceptable on Karri Lake.* • Education and awareness that powered boating is prohibited through signage. • Undertake surveillance and by-law enforcement. • When a new source is operational, a review of this plan could consider powered boating as part of a recreational plan for the existing lake. There may be a health risk to people recreating in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Commercial boating			
No commercial boating currently occurs on Karri Lake. Commercial enterprises would require a fuel-powered boat in case of an emergency. As part of the Shire's Town Planning Scheme provisions for the area, no motorised boats are permitted on the lake.	There is a risk of pathogen contamination if body contact with the water occurs. Unstable craft increase the risk of body contact with the water. The use of boats will result in an increase of people to the reservoir and hence increase the potential risk from waste disposal. Powerboats pose a risk of hydrocarbon contamination from fuel and oils. They also cause turbidity from wash along the shoreline.	No commercial boating would be acceptable, as this would encourage greater numbers of people and a greater risk to the quality of the source.	*Commercial boating is not acceptable on Karri Lake.* • Education and awareness that commercial boating is prohibited through signage. • Undertake surveillance and by-law enforcement. • When a new source is operational, a review of this plan could consider commercial boating as part of a recreational plan for the existing lake. There may be a health risk to people in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Walk trail around Karri Lake			
A walk trail currently exists around the perimeter of the lake within the 30 m vegetated buffer and is about 4 km long. The trail is on Water Corporation land. It is used regularly by the residents for walking, and also for walking their dogs. The Quinninup Community Association (QCA) undertakes some management of the trail (i.e. weed control). The community wishes to build a crossing of the creek at the top of the water body. Continued use of the walk trail is strongly desired by the community. QCA are willing to be involved in ongoing management of the trail.	There is potential risk from this activity with regard to pathogen contamination from human and animal waste if people walk in/near the reservoir or feeder streams to the reservoir. The current treatment process for Karri Lake will only remove solids and not pathogens and smaller particles. As the dogs presently roam free in the estate, there is already a risk of contamination from faeces into the lake.	The number of people walking around the lake is low. Any human activity in direct contact with the water body poses some risk to water quality. Walking does not usually require access to water. Due to the close proximity of the housing estate to the lake, dogs are already present in the catchment area. The majority of houses do not have fences, so dogs roam free. This is different to most other drinking water catchment areas where land uses are mainly State Forest or low intensive uses such as rural. The trail is used by organised groups and could be managed through formal approval and education. Some residents use the track to walk their dogs. Risks from dogs include pathogens and parasites. To minimise this risk management controls would need to be in place, facilities and restrictions (dogs on lead), on a trial basis with an annual review, education, surveillance. Responsibilities for management would need to be identified. Risks will still exist. The community needs to understand the risk associated with walking dogs on a walk trail surrounding the water body. The risk needs to be acceptable to the community as well as the agencies involved (refer to preceding information). The WC owns the land surrounding the lake, so any access to Karri Lake would require WC permission. Without WC permission, people would be trespassing on private property. There is the need to ensure that there is no detrimental effect to the vegetated buffer around the reservoir and that the activity will	*Walking dogs on the trail around Karri Lake is not an acceptable activity.* • Education and awareness that dog walking around Karri Lake poses a risk to water quality through signage. • When a new source is operational, a review of this plan could consider dog walking around the lake as part of a recreational plan for the existing lake. There may be a health risk to people and dogs in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan. *People walking on the trail around Karri Lake is an acceptable activity.* Recommendation endorsed by reference group.

Table 2 condt.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Walk trail around Karri Lake – contd			
		not constitute a disturbance to the amenity of the area. Under the CAWS Act, there are no provisions to stop dogs entering a catchment area. In many of the previous plans, it is recommended that dogs be kept out of the catchment area. The Commission acknowledges the unique situation of Quinninup and believes any decision would not set a precedent for other catchment areas. The factors that make Quinninup unique are the history, the established recreational use of the lake, the existing surrounding estate (septics and associated human pressures) and the strong community association. If the activity were acceptable with management, the HDWA would also require a condition on the sale of properties in the area that advised prospective purchasers that specific recreational opportunities would be permitted with conditions that would need to be stated. The real estate condition would also need to stipulate that the activity does pose a risk to the water source.	

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Non-powered boating			
Prior to the Water Corporation placing restrictions on recreational use of the lake, 3-5 people a day during summer would participate in some form of passive boating, e.g. kayak, canoe.	There is a risk of contamination if body contact with the water occurs. Unstable craft increase the risk of body contact with the water. The use of boats will result in an increase of people to the reservoir and hence increase the potential risk from waste disposal.	Non-powered boats will offer a recreational opportunity for the community. Non-powered boats (i.e. canoes, rowboats) will not disturb sediment along the shoreline and do not pose the risk of a fuel spill. There is risk of pathogen contamination when people accidentally make contact with the water. There may be the temptation of swimming in the lake if non-powered boating were allowed. This activity requires some contact with the water. Having people in close proximity to the water body, and with the potential for body contact, poses the main risk to water quality, particularly with the level of treatment. To minimise this risk, management controls would need to be put in place, i.e. surveillance, facilities, education, consideration of appropriate location and timing of activity. Responsibilities for management and surveillance would need to be identified. The WC owns the land surrounding the lake, so any access to Karri Lake would require WC permission. Without WC permission, people would be trespassing on private property. Risks will still exist. The community needs to understand the risk associated with non-powered boating on the water body. The risk needs to be accepted by the community as well as the agencies involved. If the activity were accepted with management, the HDWA would require a condition on the sale of properties in the area that advised prospective purchasers that specific recreational opportunities would be permitted with conditions that would need to be stated. The real estate condition would also need to stipulate that the activity does pose a risk to the water source. The Commission acknowledges the unique situation of Quinninup and believes any decision would not set a precedent for other catchment areas. The factors that make Quinninup unique are its history, the established recreational use of the lake, the existing surrounding estate (septics and human pressures) and the strong community association.	*Non-powered boating in Karri Lake is an unacceptable activity* • Education and awareness that non-powered boating around Karri Lake is prohibited through signage. • Undertake surveillance and by-law enforcement. • When a new source is operational, a review of this plan could consider non-powered boating on the lake as part of a recreational plan for the existing lake. There may be a health risk to people in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Fishing			
The lake was originally stocked with trout, however this practice has not occurred in recent years. There have been no trout in the lake for at least 10 years. Some fishing for perch does occur with lures and baits. Relatively small numbers of fishers use the lake. Upstream of Karri Lake is not suitable for fishing. Fishing is a desired use of the lake by the community.	The potential risk of pathogen contamination is through direct human contact with the water body arising from people being in and around the reservoir for extended periods without toilet facilities. There are also contamination risks from the use of bait, litter and other fishing refuse.	Relatively low numbers of people are involved in fishing in Quinninup catchment The lake was stocked with fish when constructed. It is understood that only red fin perch are caught now. Both lure and bait fishing currently occur on the lake. The owner of the land abutting a river or stream has the exclusive common law right of fishery from the river or stream. In the case of Karri Lake, the exclusive right of fishing belongs to the Water Corporation. Members of the public would therefore need the permission of the Water Corporation to access Karri Lake across their land as well as permission to fish from the lake. The Commission may prescribe restrictions on fishing in the catchment area under the CAWS Act by-laws. To minimise the risks posed by fishing, management controls would need to be put in place i.e. lure only fishing, provision of facilities, surveillance, education, consideration of appropriate location and timing of activity. Responsibilities for management and surveillance would need to be identified. Risks will still exist. The community needs to understand the risk associated with fishing in the water body. The risk needs to be acceptable to the community as well as the agencies involved. If the activity were acceptable with management, the HDWA would also require a condition on the sale of properties in the area that advised prospective purchasers that specific recreational opportunities would be permitted with conditions that would need to be stated. The real estate condition would also need to stipulate that the activity does pose a risk to the water source. The Commission acknowledges the unique situation of Quinninup and believes any decision would not set a precedent for other catchment areas. The factors that make Quinninup unique are the history, the established recreational use of the lake, the existing surrounding estate (septics and associated people pressures) and the strong community association.	*Fishing in the reservoir or any streams in the catchment is an unacceptable activity.* • The Quinninup Dam Catchment Area to be proclaimed under the *Catchment Area Water Supply Act 1947.* Close catchment to fishing through the CAWS Act by-laws. • Advertise closure widely to ensure public awareness. • Education and awareness that fishing in Karri Lake is prohibited through signage. • Undertake surveillance and enforcement. • When a new source is operational, a review of this plan could consider fishing in the lake as part of a recreational plan for the existing lake. There may be a health risk to people recreating in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Marroning			
Marron are a natural feature of the lake. Prior to current restrictions, about 100 residents and non-residents would marron during the marron season. Drop nets would be used with dog biscuits and pellets as bait. There was associated overnight camping. There are currently no camping facilities or toilets around the lake. Marroning is a desired use of the lake. Snare only marroning may be appropriate.	The potential risk of pathogen contamination is through direct human contact with the water body arising from people being in and around the reservoir for extended periods without toilet facilities. There are also contamination risks from the use of bait, litter and erosion through vehicle use.	Marroning on the lake and feeder streams is an important activity for the community. Marroning can involve people staying for extended periods in the catchment and overnight camping is sometimes associated with the activity. Baits are used to lure the marron. To minimise the risks posed by marroning, management controls would need to be put in place, i.e. snare only marroning, provision of facilities, surveillance, education, consideration of appropriate location and timing of activity. Responsibilities for management and surveillance would need to be identified. Risks will still exist. The community needs to understand the risks associated with marroning on the water body. The risk needs to be acceptable to the community as well as the agencies involved. The owner of the land abutting a river or stream has the exclusive common law right of fishery from the river or stream. In the case of Karri Lake, the exclusive right of fishing belongs to the Water Corporation. Members of the public would therefore need the permission of the Water Corporation to access Karri Lake across their land as well as permission to fish from the lake. The Commission may prescribe restrictions on marroning in the catchment area under the CAWS Act by-laws. If the activity were acceptable with management, the HDWA would also require a condition on the sale of properties in the area that advised prospective purchasers that specific recreational opportunities be permitted with conditions that would need to be stated. The real estate condition would also need to stipulate that the activity does pose a risk to the water source. The Commission acknowledges the unique situation of Quinninup and believes any decision would not set a precedent for other catchment areas. The factors that make Quinninup unique are the history, the established recreational use of the lake, the existing surrounding estate (septics and associated human pressures) and the strong community association.	*Marroning in the reservoir or any streams in the catchment is an unacceptable activity.* • The Quinninup Dam Catchment Area to be proclaimed under the *Catchment Area Water Supply Act 1947*. Close catchment to marroning through the CAWS Act by-laws. • Advertise closure widely to ensure public awareness. • Education and awareness that fishing in Karri Lake is prohibited through signage. • Undertake surveillance and by-law enforcement. • When a new source is operational, a review of this plan could consider marroning in the lake as part of a recreational plan for the existing lake. There may be a health risk to people in the reservoir, and there will be liability issues that must be addressed in recreational planning. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Walk trail			
There are 4 walk trails through the catchment area. The community would like to retain use of these trails.	There is potential risk from this activity with regard to pathogen contamination from human and animal waste if people walk in/near the reservoir or feeder streams to the reservoir.	The number of people using the trails for walking is low. Any human activity in direct contact with water poses some risk to water quality. Walking does not usually require access to water. It is possible to locate new walking trails away from watercourses. Some residents use the tracks to walk their dogs. This can be managed through education and providing appropriate facilities. The trail is also used by organised groups and self-guided walkers and can be managed through approval and education.	*Acceptable activity with conditions.* • Use signage for public information on the need to protect water quality. • Organised groups to obtain approval for events. Ensure proper management of the group is a condition of approval. • Dogs to be walked on leads and kept out of watercourses. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.
Camping			
There are no designated camping sites in the catchment area. Camping rarely occurs in the area and mainly during marron season around Karri Lake (see Recreation in and around Karri Lake).	There is a potential risk of pathogen contamination through human and animal faeces and urine, bathing, rubbish disposal and domestic contact with the water. There is also a potential risk of turbidity and pollution through vehicle usage and disturbance of vegetation.	There are no designated camping areas and therefore no facilities such as toilets or rubbish disposal sits in the catchment area. Parts of the catchment area are subject to logging. There would be a safety issue with people camping in undesignated areas. Camping within 300 yards of water bodies is prohibited under the by-laws of the *Country Areas Water Supply Act 1947.*	*Camping in the catchment is unacceptable.* • Prohibit campsites in the catchment area. • Implement surveillance and by-law enforcement to discourage camping in the catchment. • Use signage to show the area is closed to camping. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Wildflower picking/apiarists/seed collection/firewood collection			
There is some CALM licensed and some illegal wildflower picking within the catchment area. Some casual firewood collection occurs within the catchment area. This is legal. There is the desire to retain access for legal activities.	The potential risk from these activities is from pathogen contamination and litter through the presence of people near streams and the reservoir and the risk of rubbish dumping as a precursor to casual firewood collection. However, the numbers of people involved are low and all these activities, except the collection of less than one tonne of firewood, are subject to conditional approval by CALM.	The main concern from these activities is the potential for people to be in close proximity to the reservoir or feeder streams, hence this needs to be controlled. The permit conditions imposed by CALM for apiarists cater for water quality protection.	*Acceptable with controls such as CALM licence/permit conditions.* • Activities to be restricted to areas away from feeder streams. • Apply conditions for apiarists, wildflower picking and seed collection that meet water quality protection objectives. • Casual firewood collection areas to be defined with consideration for water quality protection. • Inform public on protection of water quality through signage. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.
Horse riding			
There has been some horse riding activity in the catchment area. This does not occur on a regular basis.	The potential risks associated with this activity are erosion, pathogen and litter contamination. Erosion associated with disturbance of soil leads to turbidity; horses crossing flowing streams exacerbate this turbidity. Pathogen contamination and nutrients from horse waste, and litter risk associated with people.	Equestrian activity has only occurred in the catchment on a few occasions. It usually involves a couple of riders and horses around the lake and through sections of State Forest in the catchment. Roads and tracks are used. Approval from CALM is required for any event in State Forest areas and is dependent on environmental risks in the area.	*Horse riding is acceptable in the catchment subject to conditions.* • Riding only permitted within the catchment on roads and tracks. Events subject to CALM, Water Corporation and Water and Rivers Commission (WRC) approval. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
4 wheel driving			
The community advised that there have been occasions when 4 wheel drives have entered the catchment area along roads and tracks.	Potential risks of erosion from unsealed roads and tracks and fuel spillage. There is also a risk from waste disposal.	Organised group 4 wheel driving in the catchment area requires approval from CALM. Water quality risks can be managed through conditional approval that aims to minimise the impact of their activities on the environment. 4 wheel driving during wet months will need to be carefully considered to manage risks. CALM would not approve "off-road" 4 wheel driving due to the environmental impacts associated with the activity. Any individual 4 wheel driving in the catchment area would need to remain on tracks and roads.	*4 wheel driving is acceptable in the catchment area with conditions.* • CALM approval needs to address risks to water quality. • No 4 wheel driving to be approved around Karri Lake or off-road. • 4WD vehicles must remain on existing tracks and roads. • Driver education through signage and training. • Approvals to include conditions on ongoing track maintenance and waste management. • Advise participants of need to protect water quality and conditions of approval. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.
Trail bikes on forest tracks			
Some trail biking occurs on forest tracks.	The potential risks associated with this activity are erosion associated with disturbance of soil and bikes crossing flowing streams, resulting in increased turbidity risk, particularly if riding off-road on forest tracks; pathogen contamination and litter risk associated with people staying for extended periods and possibly camping; and fuel contamination from an accident or spill.	The risk posed by trail bike riding may be substantially reduced if biking occurs in low rainfall periods. Water quality risks from trail bikes are considered acceptable if Best Management Practice (BMPs) are adopted, given other risks in the catchment (e.g. residential development around the lake) and the level of water treatment.	*Trail bikes are acceptable within the catchment area subject to conditions.* • No trail bike riding is to occur around the lake shoreline or off-road. • Trail bike riding would be permitted in the catchment area on existing tracks and roads only. • Any waste, discarded rubbish and other material should not be left in the catchment. • Signs to raise awareness of water quality protection. • No organised events in the catchment. • Vehicle and rider must be licensed for road use. Recommendation endorsed by reference group as an interim measure for the protection of drinking water supply to Quinninup. This position may be reviewed when an alternative drinking water supply option is developed as part of the recreation management plan.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Septic systems			
Houses in Karri Lake Estate have a standard septic system where 2 leach drains are employed on a rotational basis. The soils in the area are Karri Loam, and are suitable for septic tanks. There is no record of any overflow occurring. The septic tanks have a normal pump out rate. There may be some variation in soil type within the estate; some clay areas coinciding with Jarrah stands. Desire for more investigation into the risk the septic systems pose to the water quality of the lake, e.g. when will the effluent impact on the water body? Assess potential to encourage the use of Ecomax/Environ Safe waste treatment systems with new development. Suggestion of government subsidising the removal of existing septic system to Ecomax/Environ Safe waste treatment systems.	The main risks to water quality associated with septic systems are: nitrate and other pollutant contributions to groundwater and nearby surface waters; public health problems from direct overflow to surface water if system fails. Contaminants in effluent from septic systems include nitrate, organic chemicals, metals, bacteria and viruses. The presence of septic tanks can add to nitrate loadings in groundwater and surface waters that can lead to algal growth and other problems if the water is used as a supply of drinking water.	Wood and Grieve Engineers report (1987) has the results of soil testing for septic system effluent systems in Quinninup. The results indicated that the soils are regarded as excellent for septic tank leach drain disposal systems. The soil has a high phosphorous adsorption capacity. There is a requirement under the CAWS Act for a 46 m separation of septic tanks from a drinking water body. The systems in the estate are further away than the separation distance requirement. Although the septic systems meet the setback requirement and the soil has a high PRI, the density of the lots is not consistent with the recommended 1 septic per hectare ratio. Therefore, nutrient and other contaminant loading is an issue. The time period for the contaminants to reach the water body is not known at this stage. Increased pumping of septic tanks would not negate the risk as pumping only removes the solids in the system. Alternative treatment units perform the same as septic tank systems. Alternative treatment systems such as Environ Safe and Ecomax remove phosphorous, however no system has been certified by HDWA as nitrogen removing. Health Department (HDWA) has not recommended any other alternative waste systems for drinking water areas. The Shire of Manjimup now requires phosphorous removing on-site wastewater systems for all new dwellings in Karri Lake Estate. Existing septic systems are to remain.	*Septic systems to remain.* • Water Corporation to undertake investigation into effluent flow from septics, to establish risk levels under various development scenarios. • Shire to undertake surveillance of septic system performance. • Advise residents of Best Management Practice for septics including advice not to use system to dispose of chemicals. The community members of the reference group were concerned about the risk to water quality that the septic tanks posed to Karri Lake even if a new source were developed. It was recognised that the water quality of Karri Lake would need to be maintained to ensure recreation could occur on the lake when a new source is developed.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Current Subdivision			
The existing subdivision is to the south and south east of the lake. Lots range in size from 2000 m^2 to 5500 m^2. Under the provisions of the Town Planning Scheme, clearing may only occur within the building envelope, no fences are allowed unless they are within the building envelope, and lots are to have a conventional on-site effluent disposal system which is constructed within the building envelope. Approximately 30 lots have been developed to date. Gardens are permitted within the building envelope. The community questioned the risk from pesticides and fertilisers to the water quality of the lake. Houses are treated for termite control. Chemicals used for termite control may pose a risk to the water quality of the lake.	Water quality risks associated with the existing subdivision are nutrient and pathogen contamination from household septics, nutrient and chemical contamination from the use of fertilisers and pesticides on gardens, and hydrocarbon contamination from fuel and oil spills. Worldwide experience has shown that development at these densities in catchment areas will result in water contamination.	Urban land use is consistent with a Priority 3 source protection classification. With development and clearing limited to the building envelope, the vegetation and setback from the lake give some protection from contamination. Most lots do not have fences, therefore pets are allowed to roam freely and could enter the water body. The other main source of risk is associated human pressure from the surrounding development. This can be managed to a degree (see also water quality risks from septic systems).	*Acceptable activity with controls:* • Promote water quality protection through information to the community. For example, inform landowners of risks posed by over-fertilising, pesticide use and appropriate waste disposal. • Encourage the erection of fences within building envelopes where landowners have domestic pets, especially dogs. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Future subdivision			
The proposed subdivision has a lot yield of 77 lots, with the average lot size being 2163 m^2, with the range from 2000 m^2 to 3920 m^2. The Water Corporation and the Water and Rivers Commission have recommended to the Western Australian Planning Commission that all lots should be connected to deep sewer as a condition of subdivision. The future subdivision will affect the water quality of the lake in the long term through increased development density e.g. fertiliser and pesticide use, construction of dwellings, roads.	The potential water quality risks associated with the future subdivision are nutrient and other contamination if septic systems are used, nutrient and chemical contamination from the use of fertilisers and pesticides on gardens, and hydrocarbon contamination from fuel and oil storage and spills. Use of reticulated sewerage poses less of a risk than septics. Reticulated sewerage can leak and overflows may occur during power failures.	The proposed subdivision is located in a proposed P3 protection area. Urban development is a conditional activity within P3 areas and can be managed to meet water quality objectives.	*Acceptable activity with controls such as connection to deep sewerage.* • Ensure appropriate water quality protection conditions are provided to the development through the planning approval process (e.g. deep sewerage). • Promote water quality protection (see Current subdivision). This position may be reviewed when an alternative drinking water supply option is developed. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Leaching of pine log treatment			
Many houses in the area have pine logs treated with CCA. Is this an issue for water quality?	Copper chrome arsenic (CCA) is used as a preservative (chromium fixes chemicals in the wood), fungicide (copper) and insecticide (arsenic). CCA treated pine can suffer from checking and some level of instability due to the effects of wetting and drying during the service. Under normal atmospheric conditions, the CCA preservative is fixed in the wood after 6 weeks and will not leach out.	CCA is the most common pine preservative used. It is low in cost, paintable and highly effective. The oil-based variant improves resistance to surface weathering. The wood preservative must conform to a number of standards such as AS 1604-1997. Pine treated with CCA cannot be disposed of safely except as landfill. The product has been banned in Japan and some European countries. Research shows that pine treated with CCA has minimal leaching due to the treatment process. CCA treated wood has been used in oyster farms, as marine pylons and in Queens Park Lake with no detected detrimental effects. The main risk envisaged by the EPA would be fire. The chemicals may be freed due to the intense heat. However, given the relatively small amount of chemical compounds in the wood, it is thought that the chemicals would become fixed in the soil in the same way they are fixed in the wood. The ash could then be disposed via burial.	*Use of CCA treated wood is acceptable.* • CCA treated wood is not viewed as a water quality risk in the catchment. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Roads and tracks – Shire of Manjimup			
There is some concern regarding stormwater drainage from nearby roads and the subdivision affecting the water quality of the lake.	Shire roads include Karri Lane, Wattle Walk and Rainbow Trout Court. The main risk to water quality from these roads is from a spill of a contaminating substance such as oil, diesel or chemical, and erosion from stormwater runoff. Erosion from stormwater runoff poses a turbidity risk on unsealed roads. Wheatley Coast Road crosses over Little Quinninup Brook and Quinninup Brook. There is little erosion or turbidity in the area. Traffic data obtained from the Shire for 1999 shows the average number of cars travelling on Wheatley Coast Road in Quinninup was six per day with the occasional truck.	These roads are necessary for transportation so the best approach would be to take measures to minimise the impact of a spill or erosion. Stormwater drainage for the proposed subdivision can be addressed at subdivision stage. The proposal would be referred to relevant agencies for comment.	*Best Management Practices are required for all roads in the catchment.* • Undertake risk assessment of roads and develop a road maintenance and management plan that minimises risk to water quality. • Emergency contact number on signs along road (in case of spill) and with QCA. • Ensure emergency response process is in place and the local emergency management advisory committee is aware of Karri Lake as a drinking water catchment. Recommendation endorsed by reference group.

LAND USES IN THE BROADER CATCHMENT

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Logging of State Forest			
Forest Products Commission (FPC) manages logging (ongoing thinning) within the catchment area. The reference group has concerns regarding the effect logging has on Little Quinninup Brook.	The potential risk from hardwood timber harvesting is turbidity from erosion associated with tree felling practices and machinery using unsealed roads and tracks. There is also a risk of fuel spillage from vehicles and machinery.	Timber harvesting of State Forest does potentially pose a risk to water quality in terms of increased turbidity. However, research has shown that if proper management is in place (including vegetated buffers along watercourses) timber harvesting does not necessarily lead to increased turbidity in watercourses (Borg, Loh and Bell, 1988). Water quality protection is a requirement of the *Conservation and Land Management Act*, which recognises the importance of water as a resource. Therefore, timber harvesting is considered an acceptable activity if properly managed. Forest management activities are considered to be compatible with Priority 1 source protection, with the use of best practice (i.e. relevant codes of practice and management manuals).	*Acceptable activity with Best Management Practices*. • Timber harvesting and management to be in line with the Code of Practice for Timber Harvesting and the Manual of Management Guidelines for Timber Harvesting • The 1-year and 5-year timber harvesting plans for the catchment to be reviewed to ensure water quality protection objectives are included. • Inspect protection measures on the ground as part of catchment surveillance (as per FPC Environmental Monitoring System). Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Feral animal control on Crown land			
CALM currently use trapping to control feral pigs, and undertake carcass disposal. There may be a feral animal program in the future with 1080 baiting, using ground and aerial spreading. This would be at a very low level.	*Feral pig control*: Feral pigs pose a risk to water quality through pathogens and turbidity from foraging. Feral pig control reduces the number of feral pigs in the catchment but may pose similar risks to hunting if not carefully controlled and managed (see Recreational hunting). *Fox baiting*: The risk posed is minimal, as the poison used is 1080 which is a naturally occurring poison from a native plant. The natural quantity of this poison in the catchment would far exceed the quantity used in baiting. However, the carcasses of poisoned animals may pose a risk of bacterial contamination.	Feral pig control would help to reduce the risk to water quality posed by these animals. However, in order to minimise the risk to water quality it would need to be undertaken in a well-managed and organised manner. Fox baits are not considered to have an impact on water quality.	*Organised control of feral pigs is an acceptable activity in the catchment with conditions.* • Remove any carcasses near watercourses, where practical as per current operation. • Develop guidelines for the managed control of feral pigs, which may include hunting under strict requirements. Guidelines to include water quality protection requirements. Controls could include, among other requirements, removal of carcasses from the catchment. • Fox baiting is an acceptable activity. Recommendation endorsed by reference group.
Recreational hunting on Crown land			
Some illegal shooting, in particular of feral pigs, occurs within the catchment area.	The presence of hunters in the catchment increases the risk of pathogen contamination from pig carcasses, humans, dogs, litter and turbidity through erosion from vehicles.	Feral pigs pose a threat to water quality, however the risk to water quality presented by uncontrolled hunting is considered unacceptable. Any hunting should be part of the CALM feral animal control program.	*Uncontrolled hunting is not an acceptable activity.* • Catchment to be closed to uncontrolled hunting through the CAWS Act by-laws. • Signs should be placed throughout the catchment indicating that hunting is illegal. • Undertake surveillance and by-law enforcement of the catchment. • Support CALM managed feral animal control program. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Fire management on Crown land			
Prescribed burning is part of CALM forest management.	Maintaining firebreaks may lead to erosion, spread of dieback, and possibly pesticide and/or herbicide contamination, depending on the method used. However, a serious wildfire would strip the land of vegetation, potentially resulting in significant erosion and turbid runoff into the reservoir. Also, extraction of water from the reservoir and the river for fire fighting could impact on water quality.	Controlled burning and firebreak maintenance may pose some risk to water quality, but must be balanced with the potentially greater impact of a wildfire. Landowners have a legal obligation to put in firebreaks. CALM currently does not use herbicides on firebreaks. If this practice were to change, CALM would be subject to the Public Service Circular 88 (PSC 88)-*Use of herbicides in water catchment areas*, which currently exists to control use of herbicides by government agencies in catchment areas. All activities are controlled by detailed job prescriptions to ensure minimal environmental impacts. The detailed burn prescriptions compiled at the local level and approved at a regional level include criteria for effective fire management that accounts for water quality protection.	*Accepted as a necessary activity in proper forest management.* • Consider water quality implication for water access points for fire-fighting purposes. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Weed control on Crown land			
CALM sprays for blackberry within the catchment area. Blackberry infestation is also an issue around the lake.	Weed control may lead to erosion, spread of dieback, and possible pesticide and/or herbicide contamination, depending on the method used. However, maintaining the integrity of the vegetation and ecosystems is also important. CALM weed management occurs within the catchment area away from the waterbody, therefore posing less of a risk than around the lake.	Controlled weed management may pose some risk to water quality, but must be balanced with the floral integrity and preservation of the area. HDWA PSC 88 controls the use of pesticides by government agencies in catchment areas.	*Weed management is acceptable with Best Management Practice.* • Avoid the use of pesticides and herbicides where possible. Pesticide use must follow the guidelines outlined in HDWA PSC 88 and Statewide Policy No. 2: *Pesticide Use in PDWSAs*. Recommendation endorsed by reference group.
Roads and tracks – State Forest			
There are a number of access roads within the CALM estate that are used for forest management.	The likely risk to water quality is turbidity from erosion of unsealed roads and tracks	While some roads and tracks are necessary for proper forest management, it is essential that they be well maintained. Management of roads and tracks is covered by relevant codes of practice. Tracks are assessed while planning activities such as burning or harvesting. Tracks no longer required are closed.	*Roads and tracks are acceptable but require Best Management Practice.* • Manage roads in the plantation and State Forest in accordance with the relevant Codes of Practice. Recommendation endorsed by reference group.

Table 2 contd.

DETAIL / ASPIRATION	WATER QUALITY RISK	CONSIDERATION	RECOMMENDED PROTECTION STRATEGIES
Decommissioned landfill site			
The decommissioned landfill site in the catchment was used up until 2-3 years ago. There was also a septage pit at the site. The tip was licensed by the Department of Environmental Protection. There was no control over the types of waste placed in the tip. Access was uncontrolled. There is some minor ongoing illegal dumping. The site is not fenced, however the road into the site has some form of access control. The Shire Ranger regularly visits the site to attempt to control illegal dumping. The tip site can be accessed through a back route. The Shire leases the area from CALM. The lease was recently renewed for the purpose of rehabilitation.	The tip site was subject to uncontrolled dumping. Waste received varied from hydrocarbons to nightsoil, furniture and inert building materials. There is a risk of contamination from leachate.	Items dumped at the site include inert building waste, furniture, timber, old chemical drums (full or otherwise), batteries, oil, tyres and more. The elements would break down or compost over time, and others stabilise through complex chemical reactions. Little research has been conducted into the complex chemical reactions that occur in landfills. The landfill site was allegedly clay-lined. There may be minimal leachate despite the clay lining. It may be necessary to monitor the groundwater down gradient to detect any leachate movement. There is no requirement for the area to be rehabilitated at this time. The DEP and the HDWA have no powers to request the site be remediated. The responsibility and initiative rests with the local government. When the new Contaminated Sites legislation is enacted, local governments may be required to survey these sites. The Commission conducted a preliminary desktop survey. The results were inconclusive and further investigation is required.	*Actions needed to be taken:* • Water Corporation/Shire to investigate potential for leachate movement from the tip site. • Consideration of further rehabilitation to depend on the results of the investigation. • Continue Ranger surveillance. • Signage to inform community of site closure. Recommendation endorsed by reference group.

8.3 Best Management Practices

Best Management Practices for land use activities are encouraged to help protect water quality.

Best Management Practices can be developed for an individual enterprise or have a local or regional focus and must consider the full range of economic, social and environmental issues associated with land, water and vegetation use. Development of Best Management Practices must also take into consideration the needs and concerns of users, consumers and the wider community (ARMCANZ & ANZECC, 1996).

These are often in the form of an industry code of practice or environmental guideline. They are usually developed in consultation with industry groups, producers and State government agencies. Examples include the Dairy Guidelines, Draft Cattle Feedlot and Viticulture Guidelines. These guidelines incorporate a practical, commonsense approach to environmental management issues and are aimed at avoiding any unreasonable burden to the industry.

The Commission is reviewing key guidance documents related to forest harvesting and plantation management practices. These are the Code of Practice for Timber Plantations, Code of Practice for Timber Harvesting and the Manual of Management Guidelines for Timber Harvesting. This review will consider appropriate water quality protection measures and is to be undertaken in consultation with CALM and FPC.

On freehold land, the Commission aims to inform landowners and managers about the protection of public drinking water through environmental management guidelines and other material. The Commission recommends the use of Best Management Practice for water quality protection through provision of management advice in the form of environmental guidelines and the Commission's Water Quality Protection Notes.

Education and awareness (e.g. through signage and informative material) are key mechanisms for water quality protection for those who visit the catchment and for landowners in the catchment.

8.4 Land use planning

It is recognised that the establishment of appropriate protection mechanisms in statutory land use planning processes is necessary to secure the long-term protection of water sources.

It is therefore appropriate that the proposed catchment area and priority classifications be recognised in the Shire of Manjimup's planning strategies and incorporated into the Town Planning Scheme.

8.5 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause groundwater contamination. The Shire of Manjimup's Local Emergency Management Advisory Committee, through the Bunbury Emergency Management District, should be familiar with the location and purpose of the Quinninup Catchment Area. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. The Water Corporation should have an advisory role in any HAZMAT incident in the Quinninup Dam Catchment Area.

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the catchment area. These personnel should receive training to ensure an understanding of the potential impacts of spills on the surface water resource.

8.6 Surveillance and by-law enforcement

The quality of water sources within country areas of the State is protected within Public Drinking Water Source Areas proclaimed under the *Country Areas Water Supply Act 1947*. Declaration of these areas allows by-laws to be established to protect water quality.

The Commission considers by-law enforcement, through on-ground surveillance of land use activities in water supply catchments, as an important water quality protection mechanism.

Catchment surveillance, and subsequent contact with visitors to the catchment, is also important in raising the general level of awareness of the need to protect water quality.

Education (e.g. through signage and informative material) is a key mechanism for water quality protection for those who visit the catchment and for landowners in the catchment.

The responsibility for catchment surveillance for water quality protection currently rests with the Commission, however surveillance should be delegated to the Water Corporation. The powers for by-law enforcement should be assigned to the Water Corporation as part of this delegation. The Water Corporation would report annually to the Commission on the surveillance program and associated issues.

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Recommendations

1. The Water Corporation should initiate investigation into future drinking water source options for Quinninup.

2. The proposed Quinninup Dam Catchment Area should be proclaimed under the *Country Areas Water Supply Act 1947*.

3. The Shire of Manjimup's Town Planning Scheme should incorporate the management principles outlined in this plan and reflect the priority classifications given to the catchment area.

4. All development proposals in the Quinninup Dam Catchment Area which are likely to impact on water quality should be referred to the Water and Rivers Commission for advice and recommendations.

5. Signs should be erected along the boundaries of the proposed catchment area to define the areas and promote public awareness of the need to protect water quality.

6. Incidents covered by WESTPLAN – HAZMAT in the Quinninup Dam Catchment Area should be addressed through the following measures:
   - The Manjimup Local Emergency Management Advisory Committee being familiar with the location and purpose of the Quinninup Dam Catchment Area.
   - The locality plan for the Quinninup Dam Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.
   - The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Quinninup Dam Catchment Area.
   - Personnel dealing with WESTPLAN – HAZMAT incidents in the area 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.

7. A surveillance program should be established to identify any incompatible land uses or potential contaminant threats within the catchment area. This includes an investigation of the decommissioned landfill site to determine the possible risk of leachate.

8. Review the surface water quality monitoring program of Karri Lake to ensure key characteristic parameters are included. Routinely review water quality analysis results to detect any increasing trends.

9. The strategies detailed in Table 2. Land use, potential water quality risks and recommended strategies should be adopted.

10. Implementation of these recommendations should be reviewed annually after this plan is endorsed. A full review of this protection plan should be undertaken after three years.

Implementation strategy

No	Description	Implemented by	Timing
1.	Investigation into future drinking water source options for Quinninup.	Water Corporation.	2002 - 03
2.	Gazettal of Quinninup Dam Catchment Area under the *Country Areas Water Supply Act 1947*.	Program Manager, Protection Planning (WRC).	2002-03
3.	Town Planning Strategies to incorporate the management principles outlined in the Water and Rivers Commission's Land Use Compatibility in Public Drinking Water Source Areas (see Appendix 1) and to reflect the Priority 3 and Priority 1 classifications given to land in the catchment area.	Shire of Manjimup, Department of Planning and Infrastructure.	2002 – 03
4.	Referral of development proposals to the Water and Rivers Commission for advice and recommendations. .	Shire of Manjimup, Department fof Planning and Infrastructure, Department of Environmental Protection. .	ongoing

(contd)

5.	Erections of signs: (i) development of guidelines for signage; (ii) determine number and location of signs required; (iii) erect and maintain signs.	(i) Program Manager, Protection Planning (WRC), Water Corporation, Shire of Manjimup, Department of Conservation and Land Management and the community. (ii) Regional Manager, South West region (WRC) in consultation with Water Corporation, Shire of Manjimup, Department of Conservation and Land Management and the community. (iii) Regional Manager, South West region (WRC), Water Corporation, Shire of Manjimup, Department of Conservation and Land Management and the community.	(i) 2002 – 03 (ii) on completion of signage guidelines. (iii) on completion of signage guidelines.

(contd)

No	Description	Implemented by	Timing
6.	Incidents covered by WESTPLAN – HAZMAT in the Quinninup Dam Catchment Area should be addressed through the following measures:		
	(i) the Local Emergency Management Advisory Committee (through the Bunbury Emergency Management District) being familiar with the location and purpose of the Quinninup Dam Catchment Area.;	(i) Local Emergency Management Advisory Committee (through the Bunbury Emergency Management District).	(i) 2002 – 03
	(ii) the locality plan for the Quinninup Dam Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team;	(ii) WRC (South West region).	(ii) 2002 – 03
	(iii) the Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Quinninup Dam Catchment Area;	(iii) Water Corporation.	(iii) ongoing
	(iv) personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Quinninup Catchment Area and training to understand the potential impacts of spills on the surface water source.	(iv) Local Emergency Management Advisory Committee.	(iv) ongoing
7.	Surveillance program:		
	(i) develop guidelines for the surveillance of catchment areas;	(i) Program Manager, Protection Planning (WRC).	(i) 2002 – 03
	(ii) delegate surveillance and by-law enforcement to the Water Corporation;	(ii) Program Manager, Protection Planning (WRC). (iii) Water Corporation.	(ii) on completion of surveillance guidelines.
	(iii) implement the surveillance program.		
8.	Water quality monitoring program:		
	(i) review the monitoring program as per the recommendations;	(i) Water Corporation.	(i) ongoing
	(ii) review water quality data regularly and advise Water and Rivers Commission of any adverse trends;	(ii) Water Corporation.	(ii) ongoing
	(iii) if necessary, determine appropriate action.	(iii) Water Corporation/Water and Rivers Commission.	(iii) ongoing

(contd)

No	Description	Implemented by	Timing
9.	Landowner consultation and advice on recreational activities and human pressures.	Landowners, Water and Rivers Commission, Water Corporation and Health Department of WA.	ongoing
10.	Shire roads: (i) undertake risk assessment of roads and develop a road maintenance and management plan that minimises risk to water quality; (ii) emergency contact number on signs along the road; (iii) ensure emergency response process is in place and the local emergency management advisory committee is aware of the Quinninup Dam Catchment Area.	(i) Water and Rivers Commission and Shire of Manjimup. (ii) Water Corporation. (iii) Water and Rivers Commission.	(i) 2002-03 (ii) 2002 (iii) 2002
11.	Recreation: (i) invoke provisions of the CAWS Act by-laws to prohibit fishing, marroning and uncontrolled hunting in the catchment. (ii) advertise the change to fishing and marroning on Karri Lake. (iii) erect signs in the Quinninup Dam Catchment Area to promote public awareness of the need to protect water quality and define controlled activities. Signs will refer to prohibited activities, provisions for permitted activities and undesirable activities.	(i) Water and Rivers Commission. (ii) Water and Rivers Commission with support from: Water Corporation, Fisheries Western Australia, RecFishWest. (iii) Water Corporation to resource in consultation with: Water and Rivers Commission, Department of Conservation and Land Management, Fisheries Western Australia.	(i) 2002 (ii) summer 2002-2003 (iii) 2002-03

(contd)

No	Description	Implemented by	Timing
12.	Ensure transitory activities (i.e. organised bushwalking, 4WD groups, apiarists, wildflower collection, seed collection and military activities) are approved with water quality protection measures.	Department of Conservation and Land Management, Water and Rivers Commission, Water Corporation.	ongoing
13.	Forest management activities (i) Manual of Management Guidelines for Timber Harvesting, Codes of Practice for Timber Plantations and Timber Harvesting and associated contract specifications to include provisions for water quality protection; (ii) the controlled burning program to include provisions for water quality objectives; (iii) regular review of harvesting plans for the catchment; (iv) manage roads in accordance with relevant Codes of Practice; (v) review of operating performance of water quality protection measures.	(i) Department of Conservation and Land Management, Forest Products Commission, Water and Rivers Commission, Water Corporation. (ii) Department of Conservation and Land Management, Forest Products Commission, Water and Rivers Commission, Water Corporation. (iii) Department of Conservation and Land Management, Forest Products Commission, Water and Rivers Commission, Water Corporation. (iv) Department of Conservation and Land Management, Forest Products Commission. (v) Water and Rivers Commission, Water Corporation (under delegation).	(i) ongoing (ii) 2002-2003 (iii) ongoing (iv) ongoing (v) ongoing
14.	Ensure the Department of Conservation and Land Management program for control of feral animals on Crown land addresses water quality protection.	Department of Conservation and Land Management, Water and Rivers Commission, Water Corporation.	2002-2003

(contd)

No	Description	Implemented by	Timing
15.	Investigate potential risk of the abandoned tip site to Karri Lake.	Water Corporation.	2002-03
16.	Ensure appropriate water quality protection conditions are provided to the proposed future subdivision through the planning approval process.	Department for Planning and Infrastructure, Water and Rivers Commission.	2002-2003
17.	In the event that Karri Lake is no longer used for public drinking water supply, a recreation plan could be established to consider and implement opportunities for recreation. The plan could be initiated by the QCA in consultation with WRC, Health Department WA, Shire of Manjimup, Department of Conservation and Land Management and other relevant stakeholders.	QCA in consultation with Water and Rivers Commission, Department of Conservation and Land Management, Health Department WA, Water Corporation, Shire of Manjimup and other relevant stakeholders.	when source is no longer used for public drinking water supply.
18.	Review of this plan and implementation strategy: (i) review implementation strategy annually; (ii) full review after 3 years.	 (i) Resource Quality Branch (WRC). (ii) Resource Quality Branch (WRC).	 (i) 2003 – 04 (initial review). (ii) 2006 – 07 (full review).

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Glossary

Abstraction	Pumping groundwater from an aquifer.
Allocation	The quantity of groundwater permitted to be abstracted by a well licence, usually specified in kilolitres/year (kL/a).
Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
Bore	A narrow, lined hole drilled 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.
Confined Aquifer	An aquifer that is confined between shale and siltstone beds and therefore contains water under pressure.
Diffuse Source Pollution	Pollution originating from a widespread area, e.g. urban stormwater runoff, agricultural runoff.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Groundwater	Water which occupies the pores and crevices of rock or soil.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
Leaching / Leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater; the material washed out is known as leachate. Leachate can pollute groundwater and waterways.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (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	Specific localised source of pollution, e.g. sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances, e.g. 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.
Recharge	Water infiltrating to replenish an aquifer.
Recharge Area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
Saltwater Intrusion	The inland intrusion of saltwater into a layer of fresh groundwater.
Scheme Supply	Water diverted from a source (or sources) by a water authority or private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
Storage Reservoir	A major reservoir of water created in a river valley by building a dam.
Stormwater	Rainwater which has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Unconfined Aquifer	An aquifer containing water, the upper surface of which is lower than the top of the aquifer. The upper surface of the groundwater within the aquifer is called the watertable.
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.
Watertable	The upper saturated level of the unconfined groundwater.
Wellfield	A group of bores to monitor or withdraw groundwater.

Acronyms

ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BMPs	Best Management Practices
CALM	Department of Conservation and Land Management
CAWS	*Country Areas Water Supply Act 1947*
CCA	Copper Chrome Arsenic
DEP	Department of Environmental Protection
DPI	Department for Planning and Infrastructure
EPA	Environmental Protection Authority
FPC	Forest Products Commission
HAZMAT	Hazardous Materials
HDWA	Heath Department of Western Australia
LEMAC	Local Emergency Management Advisory Committee
NH&MRC	National Health and Medical Research Council
PDWSA	Public Drinking Water Source Area
QCA	Quinninup Community Association
RPZ	Reservoir Protection Zone
WC	Water Corporation
WRC	Water and Rivers Commission
WSPP	Water Source Protection Plan

Appendices

Appendix 1. Land use compatibility in Public Drinking Water Source Areas

Appendix 2: Letter from the resident representatives of the Quinninup Reference Group

Appendix 3: Options presented for recreational activities

Appendix 4. Quinninup Dam Catchment Reference Group

Appendix 1. Land use compatibility in Public Drinking Water Source Areas

LAND USE COMPATIBILITY IN PUBLIC DRINKING WATER SOURCE AREAS

Purpose

These notes provide the Commission's views on practices and activities related to the quality of the State's water resources. They are recommendations only, and may be varied at the discretion of the Commission.

The notes provide a basis for developing formal guidelines in consultation with key stakeholders.

Scope

These notes provide guidance on land use within Public Drinking Water Source Areas (PDWSAs).

PDWSAs include Underground Water Pollution Control Areas, Water Reserves and public water supply Catchment Areas declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, and the *Country Areas Water Supply Act 1947*.

The notes are not intended to override the statutory role and policy of other State or local government authorities. Project proponents will need to fulfil their legal responsibilities including those covering land use planning, environmental, health and building permit matters.

PDWSA Protection Framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. The Commission has policies for the protection of public drinking water source areas that include three levels of priority classification of lands within PDWSAs.

Priority 1 (P1) source protection areas are defined to ensure that there is **no degradation** of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of **risk avoidance** and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is **no increased risk of pollution** to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of **risk minimisation** and so conditional development is allowed.

Priority 3 (P3) source protection areas are defined to **manage the risk of pollution** to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments.

Protection of P3 areas is achieved through **management guidelines** for land use activities. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, **well-head protection zones** and **reservoir protection zones** are defined to protect the water source from contamination in the immediate vicinity of production wells and reservoirs. Well-head protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. Reservoir protection zones usually consist of a 2 kilometre buffer area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside water reserves. Special conditions apply within these zones.

Tables showing land use compatibility with the Commission's PDWSA protection strategy

These tables should be used as a guideline only. More detailed information on the Commission's recommendations as activity guidelines or notes is available for some land uses. These can be found on the 'Protecting Water' web page on the Commission's Internet site (www.wrc.wa.gov.au). Alternatively information relating to land use and development within PDWSAs, including those not listed in the tables, can be obtained from the Commission's Water Quality Protection Branch.

Existing activities

The Commission recognises that many activities were established before the introduction of these tables. The Commission will negotiate with the operators of non-conforming activities to develop agreed management practices to minimise the impact on water resources. The Commission may also provide information to operators on Best Management Practices for existing compatible and conditional activities.

Proposed activities

These tables do not replace the need for assessment of proposed activities by the Commission. Please consult the Commission for advice on any land use proposals in Public Drinking Water Source Areas that may impact on water resources.

Definitions used in the following tables

Compatible	The land use is compatible with the management objectives of the priority classification.
Conditional	The land use can be compatible with the management objectives of the priority classification, with appropriate site management practices. All conditional developments / activities should be referred to the Commission for assessment on a case specific basis.
Incompatible	The land use is incompatible with the management objectives of the priority classification. Any such development proposals received may be referred for formal Environmental Impact Assessment under the Environmental Protection Act.
Extensive	Where limited additional inputs are required to support the desired land use, e.g. supplementary animal feed only during seasonal dry periods.

Intensive	Where regular additional inputs are required to support the desired land use, e.g. irrigation, fertilisers and non-forage animal feed dominates.

More information

We welcome your comment on these notes. They will be updated from time to time as comments are received or activity standards change. The Commission is progressively developing Water Quality Protection Notes and Guidelines covering land uses described in the following tables. Advice on available guidance documents may be obtained by contacting the Commission.

If you wish to comment on the notes or require more information, please contact the Commission's Water Quality Protection Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours) or Fax:(08) 9278 0585.
E-mail: use the {feedback} section at our Internet address (http://www.wrc.wa.gov.au) citing the topic and version.

Tables showing landuse compatibility with PDWSA protection objectives

AGRICULTURE - ANIMALS

Land use	Priority 1	Priority 2	Priority 3
Animal saleyards and stockyards[14]	Incompatible	Incompatible [7]	Conditional [7]
Apiaries on Crown land	Conditional	Conditional	Conditional
Aquaculture e.g. crustaceans, fish, algae	Incompatible	Conditional	Conditional
Dairy sheds	Incompatible	Incompatible[11, 15]	Conditional [15]
Feedlots	Incompatible	Incompatible	Conditional
Livestock grazing - pastoral leases	Conditional	Compatible	Compatible
Livestock grazing - broad acre (extensive)	Incompatible	Conditional [11]	Compatible
Livestock grazing (intensive)	Incompatible	Incompatible	Conditional [11]
Piggeries	Incompatible	Incompatible	Incompatible
Poultry farming (housed)	Incompatible	Conditional	Conditional
Stables	Incompatible	Conditional	Compatible

AGRICULTURE - PLANTS

Land use / practices	Priority 1	Priority 2	Priority 3
Broad land cropping i.e. non-irrigated	Incompatible	Conditional [1]	Compatible
Floriculture (extensive)	Incompatible	Conditional	Compatible
Floriculture (intensive)	Incompatible	Incompatible	Conditional
Horticulture- hydroponics	Incompatible	Conditional	Conditional
Horticulture - market gardens	Incompatible	Incompatible	Conditional
Orchards	Incompatible	Conditional	Compatible
Nurseries (potted plants)	Incompatible	Conditional	Compatible
Silviculture (tree farming)	Conditional	Conditional	Compatible
Soil amendment (clean sand, loam, clay, peat)	Incompatible	Conditional	Compatible
Soil amendment (industry byproducts & biosolids)	Incompatible	Incompatible	Conditional
Turf farms	Incompatible	Incompatible	Conditional
Viticulture (wine & table grapes)	Incompatible	Conditional	Compatible

DEVELOPMENT - COMMERCIAL

Land use	Priority 1	Priority 2	Priority 3
Aircraft servicing	Incompatible	Incompatible	Conditional [6]
Airports or landing grounds	Incompatible	Incompatible	Conditional [6]
Amusement centres	Incompatible	Incompatible	Compatible [6]
Automotive businesses	Incompatible	Incompatible	Conditional [6]
Boat servicing	Incompatible	Incompatible	Conditional [6]
Catteries	Incompatible	Compatible	Compatible
Caravan and trailer hire	Incompatible	Incompatible	Conditional [6]
Chemical manufacture / formulation	Incompatible	Incompatible	Conditional [6]
Consulting rooms	Incompatible	Incompatible [7]	Compatible [6]
Concrete batching and cement products	Incompatible	Incompatible	Conditional
Cottage industries	Conditional	Conditional	Compatible

Land use	Priority 1	Priority 2	Priority 3
Dog kennels	Incompatible	Conditional	Conditional
Drive in / take-away food shops	Incompatible	Incompatible	Compatible [6]
Drive -in theatres	Incompatible	Incompatible	Compatible [6]
Dry cleaning premises	Incompatible	Incompatible	Conditional [6]
Dye works	Incompatible	Incompatible	Conditional [6]
Farm supply centres	Incompatible	Incompatible [7]	Conditional
Fertiliser manufacture / bulk storage depots	Incompatible	Incompatible	Conditional
Fuel depots	Incompatible	Incompatible	Conditional
Garden centres	Incompatible	Incompatible	Compatible
Laboratories (analytical , photographic)	Incompatible	Incompatible	Conditional [6]
Markets	Incompatible	Incompatible	Compatible [6]
Mechanical servicing	Incompatible	Incompatible	Conditional [6]
Metal production / finishing	Incompatible	Incompatible	Incompatible
Milk transfer depots	Incompatible	Incompatible	Conditional
Pesticide operator depots	Incompatible	Incompatible	Incompatible
Restaurants and taverns	Incompatible	Incompatible	Compatible [6]

Land use	Priority 1	Priority 2	Priority 3
Service stations	Incompatible	Incompatible	Conditional [6]
Shops and shopping centres	Incompatible	Incompatible [7]	Compatible [6]
Transport & municipal works depots	Incompatible	Incompatible	Conditional
Vehicle parking (commercial)	Incompatible	Incompatible	Compatible
Vehicle wrecking and machinery	Incompatible	Incompatible	Conditional
Veterinary clinics / hospitals	Incompatible	Incompatible [7]	Conditional [6]
Warehouses	Incompatible	Incompatible [7]	Conditional [6]

DEVELOPMENT - INDUSTRIAL

Land use	Priority 1	Priority 2	Priority 3
Heavy industry	Incompatible	Incompatible	Incompatible
Light or general industry	Incompatible	Incompatible	Conditional [6]
Power stations / gasworks	Incompatible	Incompatible	Incompatible
Petroleum refineries	Incompatible	Incompatible	Incompatible

DEVELOPMENT - URBAN

Land use	Priority 1	Priority 2	Priority 3
Aged and dependent persons group dwellings	Incompatible	Incompatible	Compatible [6]
Cemeteries	Incompatible	Incompatible	Conditional
Civic buildings	Incompatible	Conditional [7]	Compatible [6]
Clubs -sporting or recreation	Incompatible	Conditional	Compatible [6]
Community halls	Incompatible	Conditional [7]	Compatible
Family day care centres	Incompatible	Incompatible [7]	Compatible [6]
Funeral parlours	Incompatible	Incompatible	Compatible [6]
Health centres	Incompatible	Incompatible	Compatible [6]

Land use	Priority 1	Priority 2	Priority 3
Hospitals	Incompatible	Incompatible	Conditional [6]
Medical, veterinary, dental centres	Incompatible	Incompatible	Compatible [6]
Toilet blocks and change rooms	Incompatible[7]	Conditional	Compatible

EDUCATION / RESEARCH

Land use	Priority 1	Priority 2	Priority 3
Community education centres	Conditional [7]	Conditional [7]	Compatible [6]
Primary / secondary schools	Incompatible	Incompatible	Compatible [6]
Scientific research	Conditional	Conditional	Compatible
Tertiary education facilities	Incompatible	Incompatible	Conditional [6]

EXPLORATION, MINING AND MINERAL PROCESSING

Land use	Priority 1	Priority 2	Priority 3
Extractive industries (sand, clay, peat and rock)	Conditional [2]	Conditional [2]	Conditional [2]
Mineral and energy source exploration	Conditional [4]	Conditional [4]	Conditional [4]
Mining	Conditional [4]	Conditional [4]	Conditional [4]
Mineral processing	Incompatible	Incompatible	Conditional [4]
Oil or gas extraction / decontamination for transport	Conditional [4]	Conditional [4]	Conditional [4]
Tailings dams	Incompatible	Incompatible	Conditional [4]

PROCESSING OF ANIMALS / ANIMAL PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Animal product rendering works	Incompatible	Incompatible	Incompatible
Abattoirs	Incompatible	Incompatible	Incompatible
Dairy product factories	Incompatible	Incompatible	Conditional [6]
Food processing	Incompatible	Incompatible	Conditional [6]
Manure stockpiling /processing facilities	Incompatible	Incompatible [7]	Conditional
Tanneries	Incompatible	Incompatible	Incompatible
Wool-scourers	Incompatible	Incompatible	Incompatible

PROCESSING OF PLANTS / PLANT PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Breweries	Incompatible	Incompatible	Conditional [6]
Composting / soil blending (commercial)	Incompatible	Incompatible	Conditional
Forestry product processing- chip-mills, pulp / paper, timber preservation, wood / fibre works	Incompatible	Incompatible	Conditional
Vegetable / food processing	Incompatible	Incompatible	Conditional [6]
Wineries	Incompatible	Conditional [15, 18]	Conditional [15]

SUBDIVISION

Land use	Priority 1	Priority 2	Priority 3
Rural subdivision to a minimum lot size of 4 ha	Incompatible	Compatible	Compatible
Rural subdivision to a lot size less than 4 ha	Incompatible	Incompatible	Incompatible
Special rural subdivision to a minimum lot size of 2 ha	Incompatible	Conditional [8, 9]	Conditional [8]
Special rural subdivision to a lot size between 1 and 2 ha	Incompatible	Incompatible	Conditional [8, 9]
Special rural subdivision to a lot size less than 1 ha	Incompatible	Incompatible	Incompatible [9]
Urban subdivision	Incompatible	Incompatible	Compatible [6]
Industrial subdivision	Incompatible	Incompatible	Conditional [6]

Note: Subdivision of lots to any size within Priority 1 areas is incompatible

SPORT AND RECREATION

Land use	Priority 1	Priority 2	Priority 3
Equestrian centres	Incompatible	Incompatible	Compatible
Golf courses	Incompatible	Incompatible	Conditional [1]
Motor sports i.e. permanent racing facilities	Incompatible	Incompatible	Conditional
Public swimming pools	Incompatible	Incompatible	Conditional
Recreational parks -irrigated	Incompatible	Incompatible	Conditional [1]
Rifle ranges	Incompatible	Conditional	Compatible

STORAGE/ PROCESSING OF TOXIC AND HAZARDOUS SUBSTANCES (THS)

Land use	Priority 1	Priority 2	Priority 3
Above ground storage of THS	Conditional	Conditional	Conditional
Underground storage tanks for THS	Incompatible	Incompatible	Conditional

TOURISM ACCOMMODATION

Land use	Priority 1	Priority 2	Priority 3
Bed and breakfast accommodation	Incompatible	Conditional [16]	Compatible
Caravan parks	Incompatible	Incompatible	Conditional [6]
Farm stay accommodation, rural chalets	Incompatible	Conditional [16]	Compatible
Motels, hotels, lodging houses, hostels, resorts	Incompatible	Incompatible	Compatible [6]

WASTE TREATMENT AND MANAGEMENT

Land use	Priority 1	Priority 2	Priority 3
Injection of liquid wastes into groundwater	Incompatible	Incompatible	Incompatible
Landfills -Class I, II or III	Incompatible	Incompatible	Conditional
Landfills -Class IV and V	Incompatible	Incompatible	Incompatible
Recycling depots	Incompatible	Incompatible	Conditional
Refuse transfer stations	Incompatible	Incompatible	Conditional

Land use	Priority 1	Priority 2	Priority 3
Sewers (gravity)	Incompatible	Incompatible	Compatible
Sewers (pressure mains)	Incompatible	Conditional	Compatible
Sewage pump stations	Incompatible	Conditional	Conditional
Used tyre storage / disposal facilities	Incompatible	Incompatible	Incompatible
Wastewater treatment plants	Incompatible	Incompatible	Conditional
Wastewater application to land	Incompatible	Incompatible [17]	Conditional

OTHER DEVELOPMENTS

Land use	Priority 1	Priority 2	Priority 3
Caretaker's housing	Incompatible [7]	Conditional	Compatible
Communications receivers / transmitters	Conditional	Conditional	Conditional
Construction projects (not shown elsewhere)	Conditional	Conditional	Conditional
Drinking water treatment plants	Conditional	Conditional	Conditional
Forestry	Conditional [1]	Compatible	Compatible
Major transport routes	Incompatible	Conditional [10]	Compatible
Construction /mining camps,	Conditional	Conditional	Conditional
Prisons	Incompatible	Incompatible	Conditional [6]
National and Regional Parks[13]	Compatible	Compatible	Compatible
Nature reserves	Compatible	Compatible	Compatible

Table reference notes:

1. Conditions may limit fertiliser and pesticide application.

2. Conditions cover the storage of fuels and chemicals, and the depth of excavation in relation to the watertable with specified guidelines for rehabilitation.

3. Conditions cover the storage and use of fuel and other chemicals.

4. Conditions placed via the Department of Minerals and Energy lease and / or Environment Minister's /Department of Environmental Protection approval.

5. Special rural development must have appropriate provisions under the Town Planning Scheme, to prevent introduction of land uses and practices that pose an unacceptable risk to water resources.

6. Must be connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy.

7. May be accepted if this facility is necessary to support acceptable land use in the area and is consistent with State and local government planning strategies.

8. Lots should only be created where land capability allows effective on-site soakage disposal of treated wastewater. Conditions apply to siting of wastewater disposal systems in areas with poor land drainage and / or a shallow depth to groundwater, or where animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Health Department, may be accepted with maintenance requirements.

9. An average rather than minimum lot size may be acceptable if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats are placed on titles of specified blocks stating that further subdivision cannot occur.

10. Conditions cover road design, construction and the types of goods that may be carried.

11. May be permitted if animal stocking levels (number of animals per hectare) are consistent with source protection objectives.

12. May be permitted if the type, volume and storage mechanisms for chemicals are compatible with water quality protection objectives.

13. Visitor and management infrastructure and facilities must be appropriately sited and maintained.

14. This does not include on-farm / pastoral lease stockyards used for animal husbandry.

15. Waste management practices must be compatible with source protection objectives.

16. Conditions apply on density of accommodation in Priority 2 areas.

17. May be permitted if the quantity and quality are compatible with water quality protection objectives.

18. Size of annual grape crush does not exceed 500 tonnes and grapes sourced from operator's vineyards within the P2 area.

Appendix 2: Letter from the resident representatives of the Quinninup Reference Group

LETTER FROM RESIDENTS/OWNERS REPRESENTATIVES
QUINNINUP REFERENCE GROUP

RE: KARRI LAKE/WATER SOURCE PROTECTION PLAN

The Quinninup Community representatives (Residents and Owners) of the Quinninup Reference Group (QRG) wish to place on the record their appreciation of the positive approach taken by the Waters & Rivers Commission (WRC) to addressing the situation we presently face with Karri Lake. The draft Quinninup Dam Catchment Area Water Source Protection Plan has now been completed and is being distributed for public comment. The QRG meetings have been conducted in a manner which has allowed all representatives (both Government and non-Government) to contribute constructively. In addition to the WRC, the Government departments represented were Water Corporation (WC), Health Department (HD) and CALM. The Shire was also represented.

The QRG has met on three occasions since the public meeting which was convened on 12 May 2001 by the WRC and the Shire. The first meeting discussed the issues surrounding the conflicting use of Karri Lake as both a public water source and for recreational purposes. The second meeting considered recommendations on the appropriate use of the Lake and its environs. The third meeting considered the Draft Plan which, after several key amendments, has now been endorsed by the Community representatives of the QRG.

Briefly, the background is that Karri Lake was formed in 1989 by damming Little Quinninup Brook. In 1990 ownership of the Lake was transferred to the WC by the Developer of Karri Lake Estate. The Lake is owned in fee simple by the WC. It is the water supply for Karri Lake Estate and the township of Quinninup. The sales materials for Karri Lake Estate promoted the Lake as being available for recreational purposes and, presumably, in part, this influenced purchasers in their decision to buy land.

The Lake was taken over by the WC as a water supply source subject to the condition that "recreation on the Lake was limited to activities compatible with a water supply." Since human contact is one of the principal contaminants of a potable water supply, recreational use of the Lake was never going to be a compatible activity. However, low level recreational use of the Lake was allowed to continue until the Cryptosporidium scare in the Sydney water supply in 1999. Towards the end of 2000 the WC sought to prevent any recreational use of the Lake. This led to the public meeting held in May, the formation of the QRG to provide a forum for the various stakeholders to discuss the matter and, ultimately, the preparation of the Draft Plan.

Fundamental to the Plan is the provision of a new water supply for Quinninup. Even if there was no human activity in or around Karri Lake, it could still become unacceptable as a water supply as the result of ground water contamination from the septic systems in Karri Lake Estate. No problem exists at present but the potential for contamination will increase as further development occurs. No decision has yet been made on whether a new water supply will be provided and, if so, what form it will take. However, the QRG has had to deal with both the interim position (while the Lake is the only water source) and also consider a long term solution to having the Lake available for recreational use.

The Community representatives on the QRG were unanimous that the Lake should be available for recreational use in the longer term (even though no one has expressed any intention of increasing the present low level of use). Once a decision on the new water supply has been made, consideration can be given to the management of the recreational use of Karri Lake. The WRC has agreed to assist in the development of a management plan.

The reality is that, as long as the Lake is a public water source, the WC is within its rights to ban recreational activities in Karri Lake. It is the legal responsibility of the WC to deliver safe water for human consumption. If it wished, the WC could prosecute people using the Lake as trespassers since the body of water is owned by the WC. If the safety of the water source could not be guaranteed then the WC could withdraw from managing the water supply. It is simply not an option to allow any ongoing or expanded recreational use of the Lake while it is a water source.

It is anticipated that it will take 2 to 3 years to determine what form the new water supply should take and for it to be constructed. In the interim, water quality in the Lake must be maintained. Even after a new water supply has been constructed, and Karri Lake becomes available for recreational use, it will be essential to monitor and manage activities in and around the Lake to avoid adversely affecting water quality. It has not yet been determined how that will be done.

Table 2 of the Draft Plan contains Recommendations. Some are applicable immediately and others are for the long term. The Community representatives were not happy about the proposed restricted use of Karri Lake (until a new water source is available) but there was no alternative if we are to achieve a sustainable long term solution to the present conflict between water source and recreational use.

The Community representatives wish to commend the WRC, the WC, the HD, CALM and the Shire for the frank and open manner in which discussions at the QRG meetings have taken place. We are optimistic that a satisfactory long term solution will be found to the present situation.

December 2001.

Appendix 3. Options presented for recreational activities

Options concerning recreational activities, namely boating, fishing, marroning, and walking dogs on the walk train around Karri Lake, were discussed by the reference group as part of the protection planning process. These options should be read with Table 2. Options presented to the group were as follows:

Walking dogs on walk trail around Karri Lake

Option 1: Prohibition of walking dogs on the trail around Karri Lake

Based on the Shire's experience, people do not walk their dogs on a lead despite the fact it is a requirement in towns. There is the risk that management controls would not be adhered to. The risk of dogs having contact with the waterbody is great when dogs are not on leads. This increases the risk and probability of the water source becoming contaminated with excreta, pathogens, parasites and hair.

There was also the question of whether people would use poo bags if they were supplied.

When a new water source is operational, a review of this plan could consider unrestricted access as part of a recreational plan for the existing lake. There may be a health risk to people recreating in the reservoir, and there will be liability issues that must be addressed in recreational planning.

Option 2: Walking dogs with conditions

Allowing dogs to be walked around Karri Lake with strict management strategies and signage.

Dogs would need to be walked on a lead and kept out of the water. Poo bags would be provided and must be used and disposed of appropriately (at home or public bins).

Surveillance to enforce management controls. Responsibilities need to be identified.

Review adherence to controls on an annual basis. If controls were not being observed, the activity could be revoked.

Issues of trespass need to be resolved.

Passive boating, fishing and marroning

Option 1: Activity to continue with no controls

No restrictions on the activity in or around the lake. In all cases, this option was considered unacceptable due to the high risk posed by the activities to water quality.

Option 2: Controlling the water distribution system

Activity may be acceptable if the water supply could be taken off-line for a period of time to allow for a "season" of recreational activities (e.g. fishing, marroning or boating). The period of time available would depend on the capacity of the storage tank, the demand for water and the retention/detention time required to ensure any risk posed by the activity would be minimised. With the current level of development, there is a 3-day storage period of water. When the estate is fully developed, this will decrease to 1 day. This option was therefore not seen as viable.

Option 3: Activity with management controls

Activity may be acceptable with appropriate controls. To minimise the risk posed by the recreational activities, strict management controls would need to be in place, i.e. facilities, restriction (e.g. activities to be restricted to a designated area, activities only to occur for certain times of the year, lure only fishing, snare only marroning, passive boating only), activities allowed on a trial basis only, surveillance, enforcement and education.

Minimising the risks posed by the activities relies heavily on appropriate management practices. Responsibilities for management and therefore liability would need to be identified.

Risks would still exist. The community needs to understand the risk associated with the activity. The risks need to be acceptable to the community as well as the agencies involved.

Adherence to controls would need to be reviewed annually. If controls were not being observed, the activity could be revoked using by-laws under the *Country Areas Water Supply Act 1947.*

Issues of trespass would need to be resolved before this option could be considered further.

Option 3 would be acceptable with on strict management controls. The reference group needed to explore the management strategies available, whether they were possible and practical, and who would be responsible for the management and, as a consequence, for liability.

Option 4: Prohibition of activity

The activity poses an unacceptable risk to the water source and could be prohibited under the by-laws of the *Country Areas Water Supply Act 1947.*

Option 4 would provide the maximum protection to the town's water supply by minimising the risks to the water source.

If a new source were to become operational, this plan would need to be reviewed and could consider access to walk dogs on the walk trail around Karri Lake, swimming, boating, fishing and marroning, as part of a recreational plan for the existing lake. There may be a health risk to people recreating in the reservoir, and there will be liability issues that must be addressed in recreational planning.

Appendix 4. The Quinninup Dam Catchment Reference Group

The Water and Rivers Commission would like to thank the following individuals for their participation in the development of this plan as representatives on the Quinninup Dam Catchment Reference Group and to acknowledge the high level of commitment and integrity displayed by the local members.

Representative	Agency/Interest Group
Ross Sheridan (Chair)	Water and Rivers Commission
Tony Laws (Chair)	Water and Rivers Commission
Richard Murton	Water Corporation
Murray Stallard	Water Corporation
Richard Theobald	Health Department of Western Australia
Andrew Campbell	Shire of Manjimup
John Gillard	Department of Conservation and Land Management
Vern McKay	Shire of Manjimup (CEO)
Marion Burchell	Water and Rivers Commission
Sylvie Swallow	Quinninup Community Association
Liz Bursey	Quinninup Community Association
Sharon Keillar	Quinninup North Body Corporate
Keith Smith	L J Hooker
Lisa Parr	Ray White Manjimup
Ron Norris	Landowner
Ray Cranfield	Landowner
Sue McCallum	Landowner
Keith Lester	Landowner
George Williams	Landowner
Trelesa Weatherald	Landowner
John Austin	Landowner

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