39.

BRUNSWICK CATCHMENT AREA
WATER SOURCE PROTECTION PLAN

WATER AND RIVERS COMMISSION REPORT
WRP 39
2001
WATER RESOURCE PROTECTION SERIES

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COMMISSION

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Water and Rivers Commission
Policy and Planning Division

WATER AND RIVERS COMMISSION
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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 contamination that should be investigated and set out programs for management of the resource. The plans are developed in consultation with affected landowners, industry groups and relevant government agencies.

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, to regulate land use, to inspect premises and to 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 uses compatible with Water Source Protection Plans.

This Water Source Protection Plan provides a basis for establishing compatible land uses within the Brunswick 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 surface water 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. The Commission has developed policies for the protection of 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 broad hectare 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 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 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 (RPZ) are defined to protect the water source from contamination in the immediate vicinity of reservoirs. Reservoir protection zones usually consist of an area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside the catchment area. Special conditions apply in these zones.

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Summary

The Brunswick Junction Regional Water Supply Scheme serves the towns of Brunswick Junction, Burekup and Roelands. The main source of water for the scheme is the Beela Dam on the Brunswick River. Some water is also taken from irrigation water released from Wellington Dam.

This water source protection plan aims to provide appropriate protection for the water sourced from Beela Dam.

The Brunswick Water Supply Catchment Area was proclaimed in 1957 to protect the water source for Beela Dam. This Catchment Area predominantly followed cadastral boundaries. Following consultation during the preparation of this plan, the proclaimed Catchment Area was modified to represent the physical catchment of the Beela Dam and renamed the Brunswick Catchment Area.

State Forest 15 covers the majority of the proposed Brunswick Catchment Area. Worsley Alumina Pty Ltd refinery lease is located within the Brunswick Catchment Area within State Forest 15. A Special Mining Lease covers all of the State Forest that is located in the catchment. It was granted to Alcoa World Alumina Australia for the purposes of bauxite extraction. No mining activity associated with this lease has occurred in the catchment to date. The remainder of the catchment is freehold land.

There is significant recreation activity in the catchment. The catchment is a popular site for marroning, fishing, camping, picnicking and motorsports.

The majority of freehold land within the Catchment Area is used for cattle grazing. Land is also used for plantations, such as blue gums. Some small scale orchards exist and gravel is also extracted from the catchment.

The Catchment Area is proposed to be managed for Priority 1 and Priority 2 water source protection, based on the current land uses and activities. A Reservoir Protection Zone is also proposed to protect the reservoir from immediate risks to water quality.

The current land uses are compatible with the proposed level of protection. The Water and Rivers Commission encourages the adoption of best management practices to protect water quality.

A draft plan was released for consultation in July 2000. Submissions on the draft plan and the outcomes of discussions with key stakeholders, including landowners, the Water Corporation, Shires of Harvey and Collie, Agriculture Western Australia, Department of Conservation and Land Management, Fisheries Western Australia, RecFishwest, Worsley Alumina Pty Ltd, Department of Resources Development and Confederation of Australian Motorsport were considered in the preparation of this plan.

1. Introduction

The Brunswick Junction Regional Water Supply Scheme serves the towns of Brunswick Junction, Burekup and Roelands (see **Figure 1**). The scheme is principally sourced from Beela Dam on the Brunswick River. Beela Dam is located on Lot 5303, which is owned and managed by the Water Corporation. The catchment area for the Beela Dam is located within the Shire of Collie and Shire of Harvey (see **Figure 1**).

Brunswick Junction is located approximately 20 km north east of Bunbury. Roelands and Burekup are approximately 5 km and 10 km south of Brunswick Junction, respectively. The three towns are at the centre of a major beef and dairy industry. Peter's Creamery operates a dairy products factory in Brunswick Junction and is a major consumer of scheme water (Water Corporation, 1997).

1.1 Existing water supply system

Water from Beela Dam, which is approximately 10 km upstream of Brunswick Junction, is occasionally supplemented with water from Wellington Dam, which is approximately 20 km south east of Brunswick Junction. The water from Wellington Dam is introduced via an irrigation channel and blended with water from Beela Dam during periods of high consumption, when Beela Dam reservoir does not have sufficient water in storage. There is a diverse range of land uses in the Wellington Dam catchment and along the alignment of the irrigation channel. The Water Corporation should therefore consider the water quality risks associated with the use of the irrigation channel water.

When demand is high, water may also be released from the Worsley Freshwater Lake, which is located on the Augustus River, upstream of Beela Dam. Risks and management of activities in the catchment of the lake are addressed in this plan.

This plan aims to provide appropriate water quality protection for the water sourced from Beela Dam.

1.2 Existing water source protection

The Brunswick Water Supply Catchment Area was proclaimed in 1957 under the *Country Areas Water Supply Act 1947* to protect the public water supply from Beela Dam (see **Figure 2**). This Catchment Area predominantly followed cadastral (i.e. road and property) boundaries.

Following consultation with affected landowners, the Brunswick Water Supply Catchment Area was abolished and the Brunswick Catchment Area was proclaimed in November 2000 (see **Figure 2**). The new catchment boundary follows the physical catchment of Beela Dam. As Beela Dam also receives water from Worsley Freshwater Lake, the catchment for this dam is included within the Brunswick Catchment Area.

1.3 Water resource allocation

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

1.3.1 Brunswick River and tributaries

In 1954, the Brunswick River and its tributaries were proclaimed under the RIWI Act. All surface water abstraction from the river and tributaries, other than for stock and domestic use, requires a licence from the Water and Rivers Commission.

1.3.2 Current allocation licence for public supply

The Water Corporation is licensed by the Commission to take 560 000 kilolitres (kL) per annum from the Beela Dam.

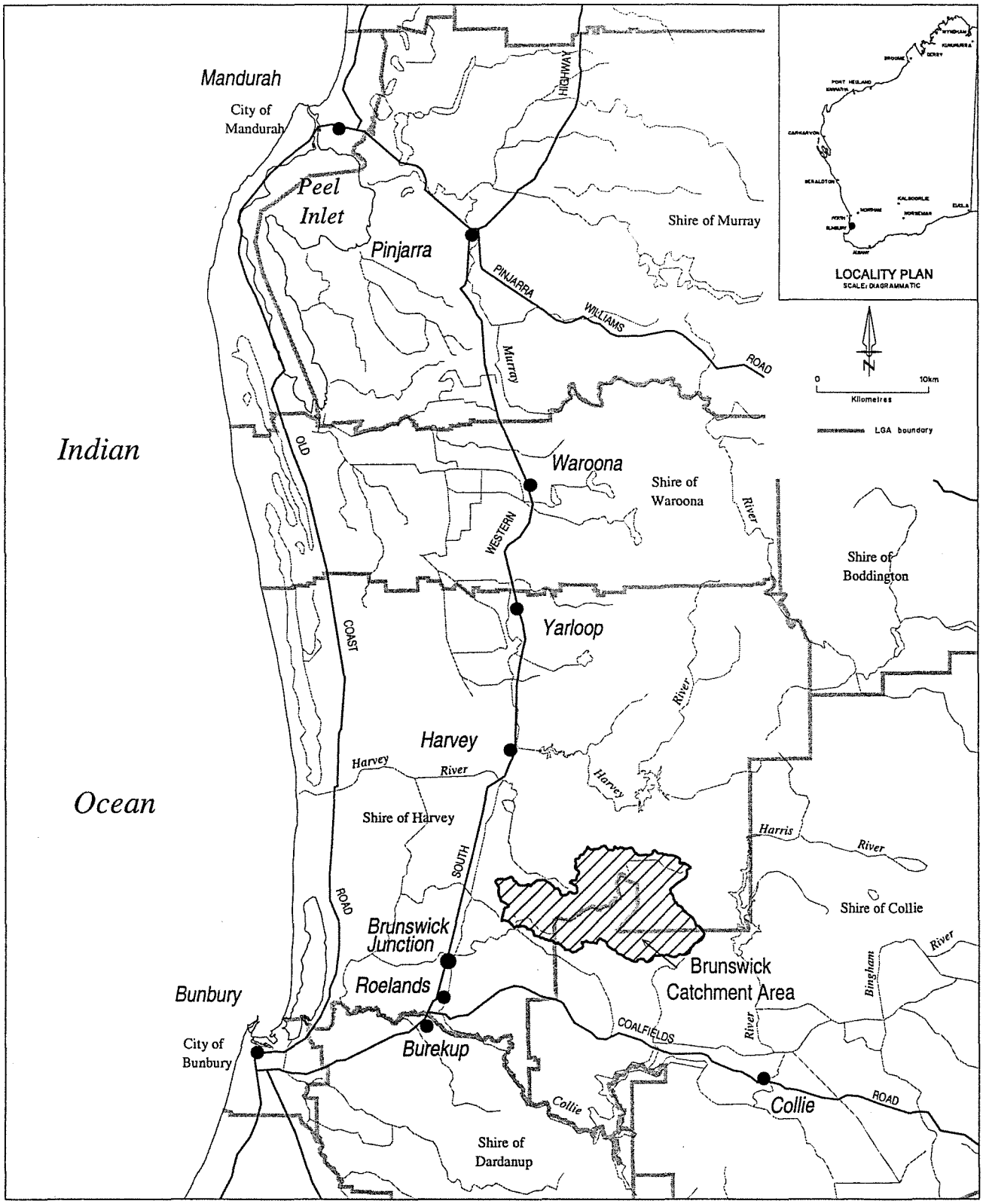
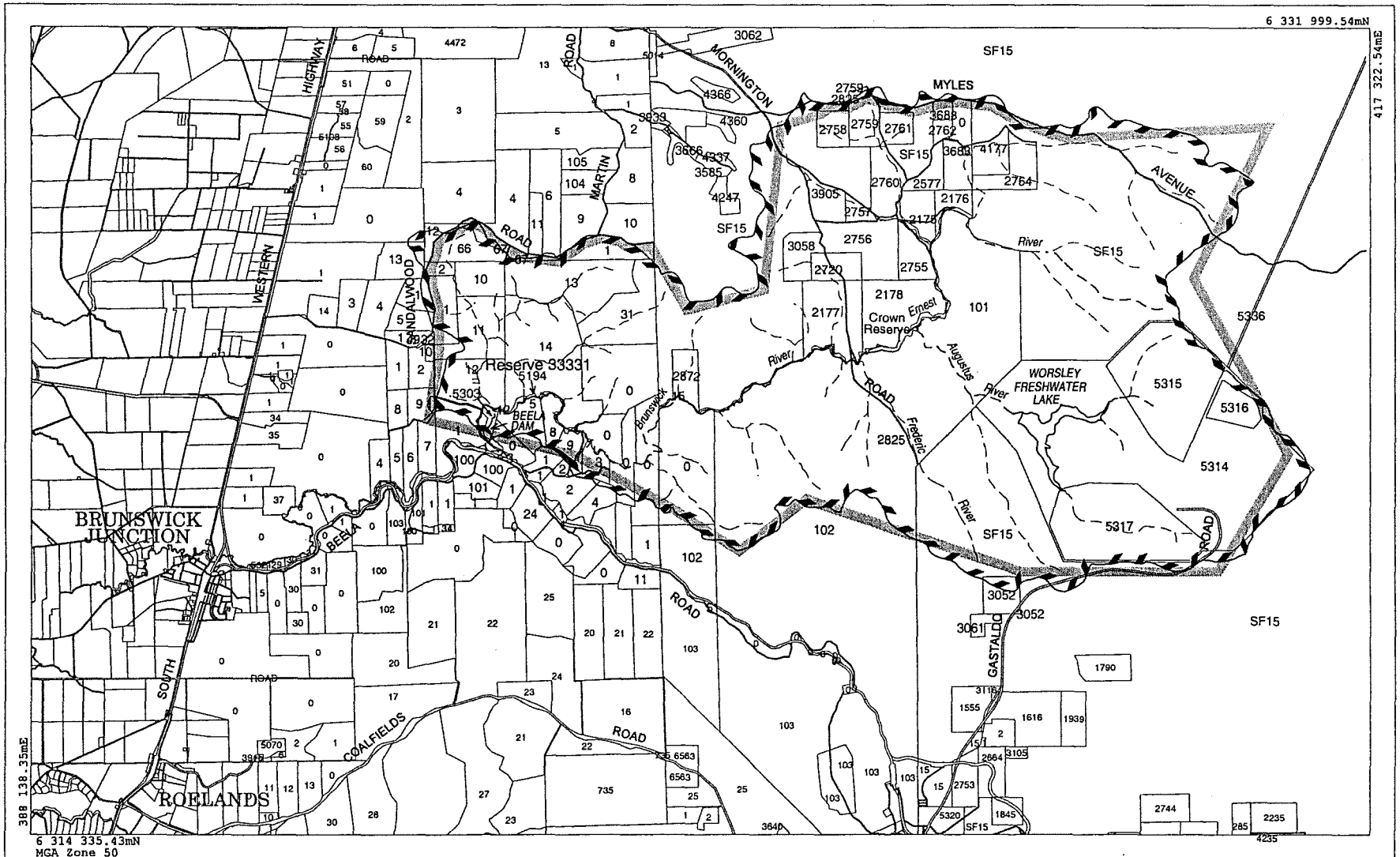


Figure 1. Brunswick Catchment Area locality map


6 331 999.54mN
417 322.54mE
388 138.35mE
6 314 335.43mN
MGA Zone 50
BRUNSWICK JUNCTION
ROELANDS
MYLES
WORSLEY FRESHWATER LAKE
Reserve 33331
Crown Reserve
Augusta
Brunswick
Frederic
Ernest
River
ROAD
AVENUE
HIGHWAY
WESTERN
SOUTH
COALFIELDS
MORNINGTON
MARTIN
BEELA
DAM
GASTALDO
SF15
LEGEND:
Scale
Streamline
Former Brunswick Water Supply Catchment Area
Brunswick Catchment Area
INDEX TO ADJOINING 1:100000 MAPS
2032 2132 2232
2031 2131 2231
2030 2130 2230
WATER AND RIVERS COMMISSION
FIGURE 2.
BRUNSWICK CATCHMENT AREA
Drawn by N.J.A. & G.M.
Date 17/01/01
Policy and Planning Division
Water Quality Protection Branch

2. Physiography

The Brunswick Catchment Area is located in the Darling Range. The catchment has moderate relief and consists of a dissected plateau with lateritic soils over Archaean granite and metamorphic rocks (Public Works Department, 1984).

The landforms of the catchment consist of 30 % duricrust, gravels and sands over mottled clay soils; 30 % sandy gravels on slopes with orange earths on swampy valley floors; and 40 % steep slopes with rock outcrops and red and yellow earths (Public Works Department, 1984).

3. Climate

The area has a Mediterranean-type climate, characterised by warm, dry summers and cool, wet winters. The average yearly rainfall is 1200 mm and the Class A pan evaporation is 1430 mm (Water Authority of Western Australia, 1988).

4. Hydrology

The catchment area of Beela Dam is approximately 135 km^2 (Water Corporation, 1997). It includes the catchments of the Brunswick, Frederic, Ernest and Augustus Rivers.

Water inflow to Beela Dam is mostly from surface run-off over the winter months. However, there is subsurface flow all year due to the gravelly nature of the geology in the catchment. The average monthly flow in winter months is significantly greater than in the summer (Public Works Department, 1984).

Beela Dam is 4 m high and has a reservoir storage capacity of 0.02 gigalitres (GL) (Water Corporation, 1998). The estimated annual average streamflow of the Brunswick River at Beela Dam is 37 GL, with a current annual draw of 0.54 GL (Water Corporation, 1998).

The reservoir storage capacity of the Worsley Freshwater Lake is 5.8 GL (Water Corporation, 1998). The estimated annual average streamflow of the Augustus River at Worsley Freshwater Lake is 5.2 GL, with an annual draw by Worsley Alumina of 4.8 GL (Water Corporation, 1998).

4.1 Water quality

With the exception of turbidity, iron, aluminium and colour, all physical and chemical parameters for the untreated water from Beela Dam for the period 1987 to 1997 were within the national drinking water guidelines (Water Corporation, 1997).

More recent sampling of pre-treated water shows that turbidity, iron, aluminium and colour levels continue to exceed the national drinking water guidelines (see **Appendix 1**).

Turbidity is caused by suspended particles, such as soil and organic matter, in the water. Elevated iron, aluminium and colour levels may be due to soil and vegetation characteristics. The water is treated to reduce the concentrations of turbidity, iron, aluminium and colour and meet drinking water standards.

4.2 Water treatment

Water from Beela Dam and the Wellington Dam irrigation channel is treated at the Brunswick Junction Water Treatment Plant. The water treatment process consists of a clarifier and two parallel sand filters. The water is then disinfected by chlorination (Water Corporation, 1997).

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. Water treatment is another stage used 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:

- State Forest, including the Brunswick Plantation and the Worsley Alumina Refinery;
- freehold rural land; and
- recreation.

Land use and activities are shown in **Figure 3**.

5.1 Crown land

State Forest 15 covers the majority of the catchment. The State Forest is vested in the Conservation Commission and managed by the Department of Conservation and Land Management (CALM) on their behalf.

The Brunswick Plantation forms part of the State Forest. Forest Products Commission (FPC), under supervision of CALM, conducts silviculture operations in the plantation. The plantation is mostly pine, but also includes a small area of blue gums and trial plots of other *Eucalypt* species.

The State Forest is managed for multiple uses that include timber harvesting, water production, recreation and nature conservation, as well as some apiary use and wildflower and seed harvesting. There is also firewood collection for private use. Specific management activities include prescribed burning and feral animal control.

The Worsley Alumina Pty Ltd (Worsley) refinery Crown lease area, which includes the alumina refinery, and the overland conveyor Crown lease area, which includes the overland bauxite conveyor, are located in State Forest 15. Activities within these lease areas are managed through environmental conditions applied under the *Alumina Refinery (Worsley) State Agreement Act 1973*, the Worsley Alumina Project Environmental Review and Management Program 1979, the Worsley Alumina Project Consultative Environmental Review 1995 and the *Environmental Protection Act 1986*. Conditions under these approvals alleviate risk of contamination of the water source from refinery and bauxite conveying operations.

The Worsley overland bauxite conveyor corridor passes through a small part of the eastern side of the catchment, transporting bauxite from a mine-site that is located outside of the Brunswick catchment, near Boddington.

Worsley also holds a mining lease within the refinery Crown lease area. This contingency area is for emergency bauxite extraction.

Special Mining Lease 1SA covers all of the Crown land in the catchment, with the exclusion of the Worsley Crown leases. This State Agreement tenement was granted to Alcoa World Alumina Australia (Alcoa) in 1961. Under the State Agreement Act, Alcoa has rights to extract bauxite from Crown land, with associated responsibilities to protect environmental values and rehabilitate mine-sites. Alcoa has not conducted bauxite mining in the catchment to date.

Four Western Power transmission lines, the Muja-Southern Terminal, Picton-Worsley, Worsley-Wagerup and Muja-Worsley, pass through the catchment. An underground Epic Energy gas line also passes through the catchment.

5.1.1 Land vested with the Water and Rivers Commission

Reserve 33331 (Lot 5194) is vested with the Water and Rivers Commission (see **Figure 3**). This stream reserve separates some freehold land that is located near Beela Dam from the Brunswick River. The Commission has the responsibility for management of the reserve.

An unvested Crown stream reserve is located on Ernest River.

5.2 Freehold land

The majority of freehold land within the catchment area is used for cattle grazing (run-off blocks, which are winter grazing pastures for dairy cattle - see **Plate 1**). Land is also used for plantations, such as blue gums. Some small-scale orchards exist and gravel is also extracted.

There is some potential for development of farm-stay accommodation in the future.

The freehold land within the Shire of Harvey is zoned 'General Farming' under the District Planning Scheme (DPS) No. 1. Freehold land within the Shire of Collie Town Planning Scheme (TPS) is not currently zoned. It is proposed to be zoned 'Agriculture' in the proposed TPS.

Most of the freehold land within the Brunswick catchment is part of the Shire of Harvey DPS Precinct 24 – Inner Hills Area. This recommends the area should generally be retained as a broad hectare winter

refuge grazing area and no subdivision or zoning for non-agricultural purposes should be permitted. The remainder of the freehold land in the Shire of Harvey is part of DPS Precinct 25 – Darling Plateau State Forests No. 14 and No. 15. This specifically refers to the State Forests and no recommendations are made about freehold land in this precinct.

The Worsley Joint Venturers (owners of Worsley Alumina Pty Ltd) have recently purchased a large portion of forested freehold land, adjacent to the Worsley refinery lease area. Worsley have advised that for the short to medium-term, this area will be used as a buffer between other freehold and Crown land, and the refinery and ancillary activities. Possible uses for this property in the long-term include retention as a buffer to the refinery, possible bauxite extraction, or relocation of the Worsley Freshwater Lake. These activities can be compatible with the proposed protection strategy.

5.2.1 Water Corporation land

The block of land surrounding the reservoir, Lot 5303, is owned by the Water Corporation. The property is fenced.

5.3 Recreation

A number of recreation activities occur in the catchment and on the Brunswick River and its tributaries. The Beela Dam reservoir is generally not accessible to the public because it is on fenced Water Corporation owned land and surrounded by freehold land.

CALM manages organised recreation activities (such as motorsport events, 4WD clubs and orienteering events) that occur in the State Forest areas of the catchment.

Motorsport events run by Rally Australia, Confederation of Australian Motorsport (CAMS) and Motorcycling Australia are held in the catchment.

Trout fishing occurs in the Brunswick River, upstream of the dam. Fisheries Western Australia periodically stocks the Brunswick River with trout. The Brunswick River is also fished for marron, mostly using drop-nets. Marroning is a significant activity during the January-February season.

Recreational hunting for feral pigs occurs in the catchment. There are no restrictions on hunters and their dogs in State Forests, except for prohibition on the use of firearms.

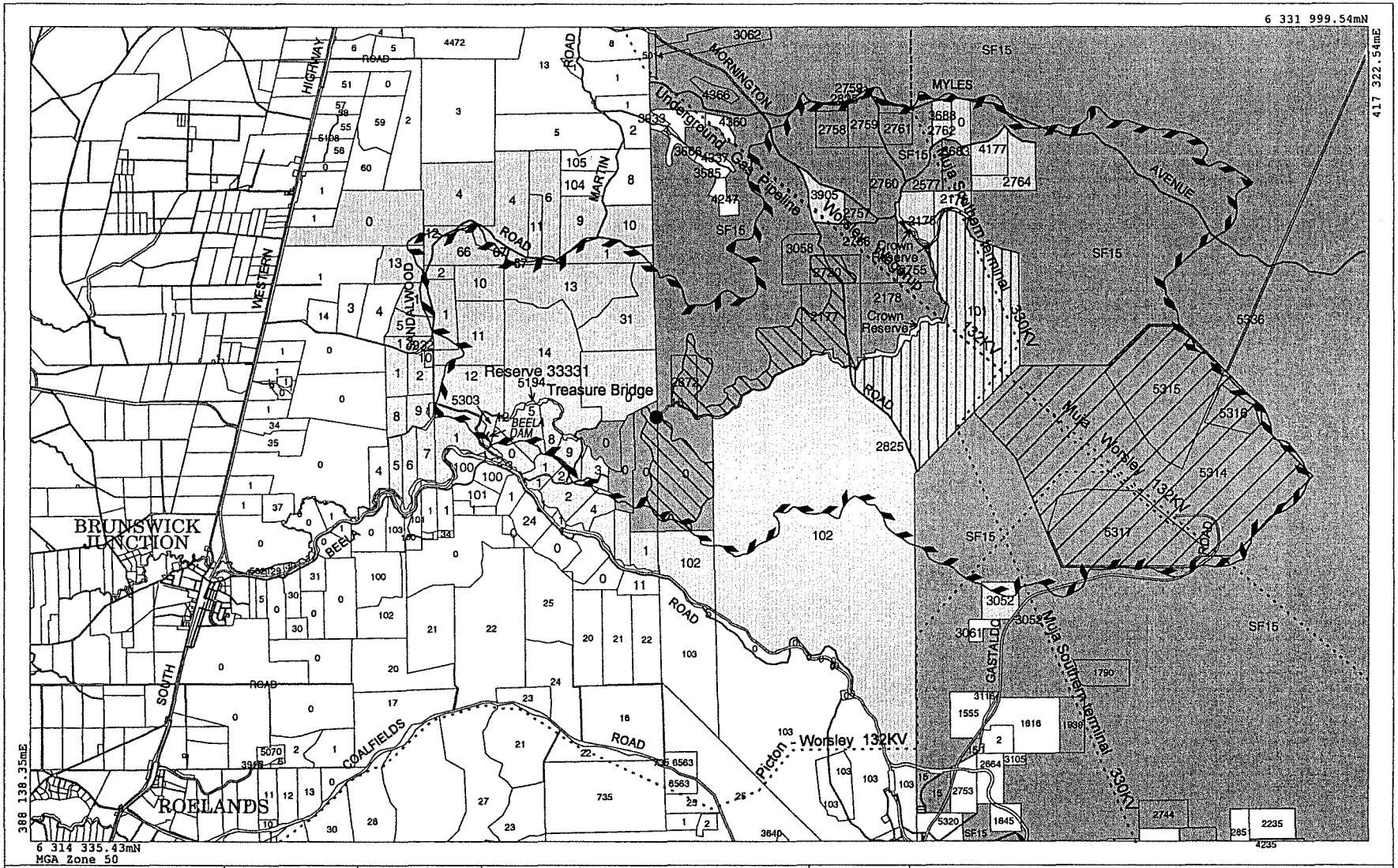
There are no designated camping areas. However, unauthorised camping is evident within the catchment, especially along the Brunswick River. One popular site known as Treasure Bridge is located beside Brunswick River, approximately 7 km upstream of Beela Dam (see **Plate 2**).

Picnicking occurs in the catchment, although there are no designated picnic areas.

Swimming in the Brunswick River and its tributaries is a popular activity.

Plate 1. Cattle grazing in the Brunswick Catchment Area

Plate 2. Unauthorised camping area, Treasure Bridge



WATER AND RIVERS COMMISSION

FIGURE 3.
BRUNSWICK CATCHMENT AREA
EXISTING LAND USE & ACTIVITIES

Drawn by	N.J.A. & G.M.	Date	17/01/01

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6. Proclaimed area and priority classifications

The overall source protection objective for the catchment is to maintain existing water quality and initiate measures to improve water quality where possible.

In accordance with this objective, it is recommended all freehold land in the catchment be managed for Priority 2 (P2) source protection (see **Figure 4**). This classification is justified as:

- the land tenure is freehold;
- the reservoir is a strategic water source for the towns of Brunswick Junction, Burekup and Roelands; and
- existing land uses on freehold land are compatible with P2, and can be managed for P2 objectives to minimise the risk of contamination.

As rural land in the catchment is largely developed, the Commission considers Priority 1 protection over freehold land is inappropriate. A P1 classification would unnecessarily limit development options for landowners as the objective is to maintain existing water quality.

It is recommended that all Crown reserved land in the catchment be classified for Priority 1 (P1) source protection (see **Figure 4**). This classification is justified as:

- the land is in Crown reserves, where management recognises water protection;
- the reservoir is a strategic water source for the towns of Brunswick Junction, Burekup and Roelands; and
- forest management and some recreation is compatible with P1 objectives.

A priority classification has not been assigned to the area covered by the *Alumina Refinery (Worsley) Agreement Act 1973*, to avoid inconsistencies with the State Agreement. The existing environmental controls provide the necessary measures to ensure water quality is protected. When the Agreement ceases, the Commission would apply a P1 classification to avoid the risk of contamination of the water source.

The Commission considers these source protection objectives will effectively protect the source for long-term public drinking water supply.

The detail of general land use compatibility under each classification is outlined in the guidance document titled *Land Use Compatibility in Public Drinking Water Source Areas* (see **Appendix 2**). This document provides general guidance on the compatibility of future land use development. It is not an exhaustive list of land uses and will be updated as clarification of uses is requested and industry standards change. The term conditional is used where the land use can usually be compatible with the objectives of source protection, with adoption of appropriate site management practices. Generally, these are practical steps to protect water resources from potential contaminants and cover issues such as fuel and chemical storage, nutrient application and waste disposal. This document is available at the Commission's website: www.wrc.wa.gov.au /water/policies/water quality protection notes, where it is periodically updated.

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 in the immediate vicinity of the dam be managed as a Reservoir Protection Zone (RPZ).

The RPZ is defined as the boundary of Lot 5303, which is owned and managed by the Water Corporation.

The proposed RPZ is shown on **Figure 4**.

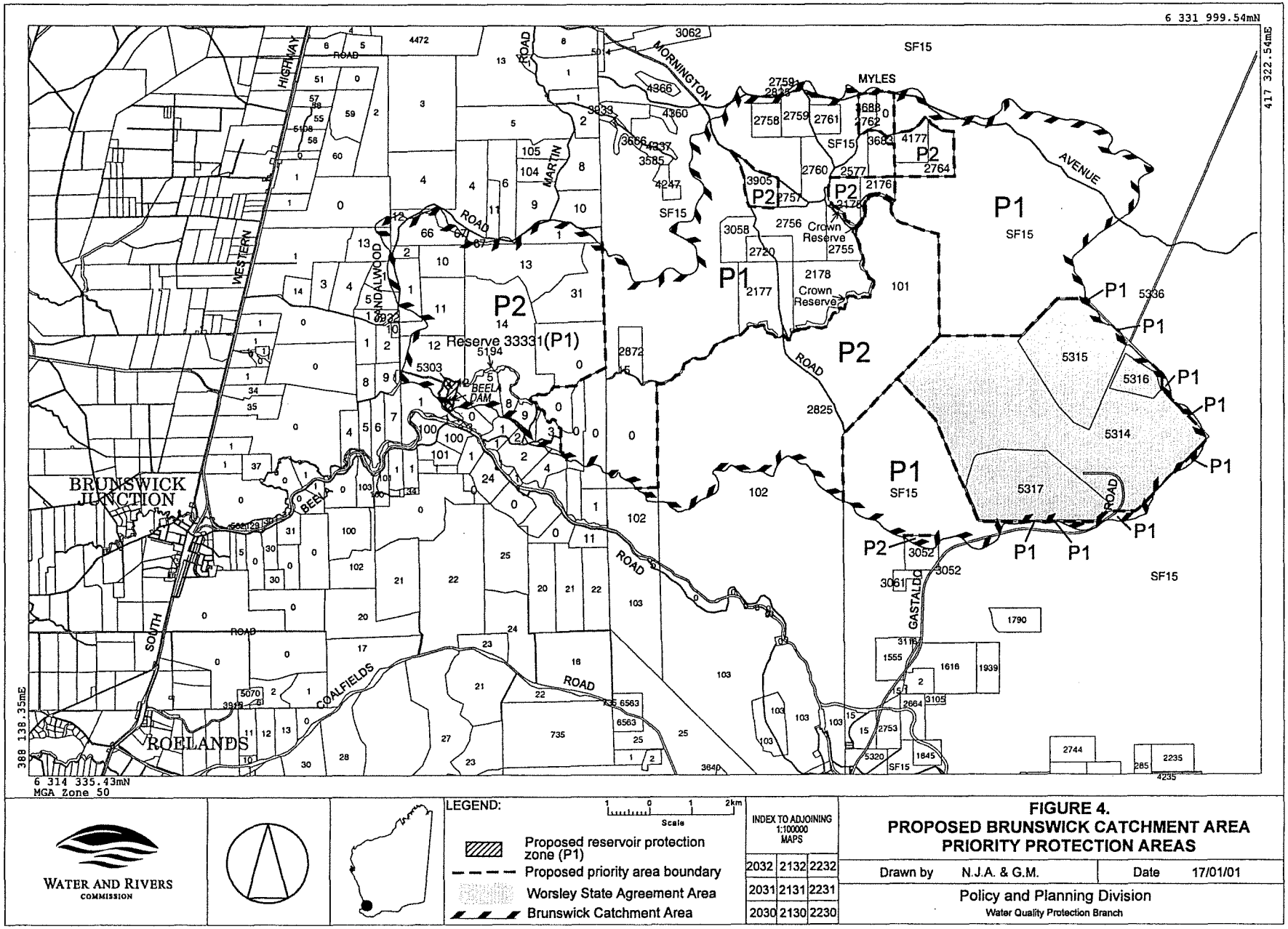

FIGURE 4.
PROPOSED BRUNSWICK CATCHMENT AREA
PRIORITY PROTECTION AREAS

Drawn by	N.J.A. & G.M.	Date	17/01/01

Policy and Planning Division
Water Quality Protection Branch

7. Management of potential water quality risks

7.1 Protection objectives

The objective of this plan is to protect this water source in the interest of providing safe drinking water to Brunswick Junction, Roelands and Burekup. However, the rights of existing approved land uses to continue in the Brunswick Catchment Area are recognised.

The Priority 1 and 2 classifications proposed for this catchment have the fundamental water quality objectives of risk avoidance and risk minimisation, respectively. The overall source protection objective for the catchment is to maintain existing water quality and initiate measures to improve water quality where possible.

Beela Dam reservoir is a strategic source for water supply to the towns of Brunswick Junction, Burekup and Roelands, supplying an estimated 1200 people. Consequently, potential risks posed to water quality have been carefully assessed.

This plan aims to balance water quality protection, economic and social needs and aspirations as much as possible.

Current freehold land uses are generally compatible with the Priority 2 classification. This plan recognises the right of existing approved land uses to continue to operate in the catchment. The Commission will not be placing new restrictions on existing practices. However, the adoption of best management practices is encouraged for water quality protection.

7.2 Predominant water quality risks in the Brunswick catchment

7.2.1 Turbidity

High turbidity levels commonly occur in the water sourced from Beela Dam. 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 source of suspended solids is soil erosion and another source is through disturbance of the streambed.

The following practices are examples of potential contributors to turbidity:

- allowing stock to access streams;
- excessive vegetation removal;
- road construction;
- harvesting of timber using heavy machinery;
- off-road driving; and
- overstocking.

Management practices, such as retaining vegetation buffers to watercourses and control of stock access to streams, can reduce the risk of soil erosion and therefore reduce turbidity levels in the water. These practices are recommended as best management practices.

7.2.2 Pathogens

There is a potential risk to water quality from pathogen contamination by human and 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, Escherichia coli* and *Cholera*), parasites (e.g. *Cryptosporidium* and *Giardia*) and viruses. These pathogens generally occur due to faecal contamination.

The percentage of humans from around the world who are pathogen carriers range 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, Radford and Brownridge, 1988).

Even if the lower limit was used, as may be expected in Australia, there is a significant potential risk of contamination by any of these pathogens if humans are present in or near the dam and feeder streams.

Pathogen 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 sources estimate viability for longer periods.

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

Based on the potential risk posed by human contact with the water and the number of people that could be potentially affected, activities that require full-body contact with the water (such as swimming and bathing) are considered unacceptable in this catchment.

Current activities that involve only minimal body contact with the water (such as fishing) pose a lesser risk to water quality. These activities are considered acceptable to continue in the catchment, with management conditions.

Activities that do not require human contact with the water pose less of a risk to water quality. Consequently, activities with no water contact are generally permitted with management conditions, to ensure they meet water quality objectives.

7.3 Best management practices

The adoption of best management practices for land use activities is encouraged to help protect water quality.

To assist the adoption of sound environmental practices, guidelines for specific industries are being progressively developed in conjunction with other agencies (e.g. Agriculture Western Australia and the Department of Environmental Protection) and the relevant peak industry body (e.g. WA Pork Producers' Association). Examples include recently released Dairy Guidelines and 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 protection of public drinking water sources through environmental management guidelines and other informative material. The Commission recommends the use of best 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. signage and informative material) is a key mechanism for water quality protection for those who visit the catchment and for landowners in the catchment.

7.4 Land use planning

Rural land uses currently in the Brunswick Catchment Area are compatible with the Priority 2 classification. The Commission recognises landowners' legitimate rights to continue to use and develop their land in accordance with the priority classification.

It is recognised under the *State Planning Strategy* (Western Australian Planning Commission, 1997) that the establishment of appropriate protection mechanisms in statutory land use planning processes is necessary to secure the long-term protection of water sources.

It is therefore appropriate that the Brunswick Catchment Area and proposed priority classifications be recognised by a Special Control Area in the Greater Bunbury Region Scheme and in the Shire of Harvey and Shire of Collie District/Town Planning Schemes.

The Shire of Harvey's DPS No. 1 Precinct 24 recommends that the area should generally be retained as a broad hectare winter refuge grazing area. The Shire of Collie's Town Planning Scheme currently has no zoning for the freehold land that is located in the Catchment Area. However, the Town Planning Scheme is being reviewed and this freehold land is proposed to be zoned Agriculture. The Shire of Collie

has indicated the TPS will also be recognising public water source protection.

Priority classifications are not statutory under the *Country Areas Water Supply Act 1947*. They define the level of catchment protection that guides the Commission's response on land development proposals.

This protection plan and subsequent recognition of the catchment and priority classifications in statutory planning strategies will provide certainty for long-term management requirements for the land. These statutory planning mechanisms will determine future development within the Brunswick Catchment Area.

The Water and Rivers Commission's input into the development approval process is through providing advice on the compatibility of land uses with the priority classification. Advice is on a case-by-case basis.

7.5 Surveillance and by-law enforcement

The quality of public drinking 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.

Signs are erected in water supply catchments to advise of the catchment area location, activities that are prohibited or regulated and water quality protection measures.

The responsibility for catchment surveillance for water quality protection has been delegated to the Water Corporation by the Water and Rivers Commission. The powers of by-law enforcement have been assigned to the Water Corporation as part of this delegation. The Water Corporation will report to the Commission on the surveillance program and associated issues.

7.6 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause contamination of water sources. The Shire of Collie and Shire of Harvey Local Emergency Management Advisory Committees (through the Bunbury Emergency Management District) should be familiar with the location and purpose of the Brunswick 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 Brunswick Catchment Area.

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

7.7 Land use, potential water quality risks and recommended strategies

Table 1 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 their land for lawful purposes.

Table 1. Land use, potential water quality risks and recommended strategies

The following table summarises the potential water quality risks associated with the land use activities in the catchment and recommends strategies for minimising the impact on the water quality from the Beela Dam reservoir. The responsible agencies and appropriate timeframes for implementation of the strategies recommended in this table are outlined in the Implementation Strategy section of this report.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Freehold Land			
Assorted rural land use activities, including: grazing (mostly cattle run-off blocks), blue gum and pine plantations, orchards, gravel extraction, residences and sheds. (a)	The potential water quality risks associated with these freehold land uses include: • pathogen contamination (household wastewater disposal systems, animal grazing and stock access to streams); • pesticide and nutrient contamination (plantations, orchards, pasture, animal grazing); • chemical and fuel contamination (inappropriate storage and use); • increased turbidity (establishment and harvesting of plantations, animal grazing and stock access to streams, gravel extraction). The potential for pathogen contamination and turbidity is increased where large numbers of stock have direct access to the river, particularly when in close proximity to the reservoir.	Rural activities are very close to the reservoir and feeder streams and pose a potential risk to water quality. Turbidity caused by erosion and stock access to streams is a significant water quality risk in the catchment. The existing land uses are considered 'low intensity' and therefore compatible with the proposed Priority 2 (P2) classification. P2 is in line with the existing Shire of Harvey Town Planning Scheme. To aid water quality protection, landowners should be encouraged to adopt best practice.	*Acceptable with Best Management Practices.* • Development proposals to be referred to WRC for advice and recommendation. Proposals to be assessed to ensure that water quality protection objectives are met. Advice is on a case-by-case basis. For example, approval of gravel extraction proposals should include the conditions stated in the Water Quality Protection Note: *Extractive industries within PDWSAs.* • Allow scope for land use developments to demonstrate they can be compatible with P2 source protection. • Encourage land management initiatives (e.g. fencing to control stock access to watercourses, which would include provision of stock water facilities; retention of vegetation; revegetation of streamlines; and appropriate pesticide use). WRC has a Rivercare project for Brunswick River, which provides technical and financial assistance for these initiatives. See WRC Water Notes: *Protecting riparian vegetation*; *Livestock management: Fence location and grazing control*; *Livestock management: Watering points and pumps*; and *Livestock management: Construction of livestock crossings* and Statewide Policy No 2: *Pesticide Use in PDWSAs.* • The creation and fencing of stream reserves at key streamlines to be a recommended condition on subdivisions. • Inform public and landowners on protection of drinking water quality with the use of signage, education programs and informative material. • Develop environmental guidelines for agricultural activities in drinking water catchments with industry groups and relevant agencies. Landowners will be encouraged to adopt the guidelines as best practice.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Worsley Joint Venturers owned land – future use. (b)	The land is currently forested. The potential for risks to water quality are minimal if the area is kept forested as a buffer to other freehold land. Potential risks to water quality may result from development of the land, due to turbidity (bauxite mining, freshwater lake construction) or fuel contamination (spillage from vehicles).	Proposed changes to activities would be subject to rigorous environmental management planning through the Worsley Alumina Environmental Management Liaison Group and conditions associated with the *Alumina Refinery (Worsley) Agreement Act 1973* and *Environmental Protection Act 1986*.	*Future land uses may be acceptable if operated in accordance with an environmental management program.* • Future land use activities should be compatible with Priority 2 water source protection. • The Worsley environmental management program should be extended to cover the Worsley Joint Venturers property, if the land use changes to include bauxite extraction or freshwater lake development.
Lot 5303 – owned by Water Corporation. (c)	The potential risk to water quality is from pesticide contamination from weed control or from unauthorised access to the reservoir.	Weed control is necessary to stop the spread of nuisance weeds. However, it must be conducted in a way that minimises risk to water quality.	*Actions need to be taken to minimise risk.* • Avoid the use of herbicides or soil-disruptive weed control measures. If herbicides are required, it must be in accordance with Health Department of WA PSC 88 and Statewide Policy No 2: *Pesticide Use in PDWSAs*. • Ensure fencing continues to prevent stock access and other unauthorised access to Lot 5303.
Roads			
Shires of Harvey and Collie roads (d)	Mornington Road, Myles Avenue, Big Tree Road, Gastaldo Road, Sandalwood Road, Hill Road, Flynn Road, Camford Road, Niger Road and Trees Road are managed by the Shires of Harvey and Collie. (Parts of some of the roads are managed by CALM.) The potential risks to water quality from these roads are from a spill of a contaminating substance such as oil, diesel or chemical, and turbidity from unsealed roads due to stormwater run-off carrying sediment.	These roads are necessary for regional transportation, so the best approach would be to minimise the impact of a spill or erosion through road maintenance and management measures.	*Roads acceptable with Best Management Practice.* • Review road maintenance practices to minimise risk to water quality. • Ensure emergency response process is in place and the local emergency management advisory committees are aware of the Brunswick Catchment Area.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
State Forest			
Hardwood timber harvesting (e)	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 vegetation buffers along watercourses and understorey vegetation left after harvesting) timber harvesting does not necessarily lead to increased turbidity in watercourses (Borg, Loh and Bell, 1988). Water quality protection is a requirement of the CALM 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.* • Review and revise if necessary the Code of Practice for Timber Harvesting and the Manual of Management Guidelines for Timber Harvesting to include provisions for water quality protection. Ensure requirements for road maintenance, fuel storage and handling, and buffer zones along watercourses to a standard appropriate for protection of water quality are implemented. • 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.
Brunswick Plantation (pines and blue gums) (f)	The potential risk to water quality from the plantation is from: • turbidity (establishment of trees, harvesting, unsealed roads and tracks); and • pesticide and nutrient contamination (tree establishment and plantation maintenance). Water quality in streams draining relatively undisturbed stands of plantation is comparable with streams draining native forests.	With regard to erosion, research and experience has shown that proper management, specifically retaining a vegetated buffer between the harvesting area and watercourses, can result in little effect on water quality from activities that may cause erosion (Borg *et al.*, 1988). Therefore, with appropriate management, the activity is acceptable.	*Acceptable activity with Best Management Practices.* • Review and revise the Code of Practice for Timber Plantations. Ensure requirements for road maintenance, fuel storage and handling, fertiliser use, pesticide use and buffer zones along watercourses to a standard appropriate for protection of water quality are implemented. • Ensure silviculture contract specifications recognise water protection objectives. • The logging plans for the catchment to be reviewed to ensure water quality protection objectives are met. • Inspect protection measures on the ground.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Roads and tracks in State Forest (g)	Potential risk to water quality from turbidity due to erosion of unsealed roads and tracks. Studies have shown that unsealed forest roads are a potential source of sediment, so management and maintenance are essential (Grayson *et al.*, 1993). There is also a potential risk if pesticides are used for maintenance.	It is recognised roads and tracks are necessary for proper forest management. It is essential they are well maintained. Road maintenance and construction program should incorporate water quality protection measures. Management of roads/tracks is covered by relevant codes of practice.	*Acceptable activity with Best Management Practices.* • Manage roads in the plantation and State Forest in accordance with the relevant Codes of Practice. • Pesticide use must follow the guidelines outlined in HDWA PSC 88 and Statewide Policy No. 2: *Pesticide Use in PDWSAs.*
Fire management (h)	Firebreaks may lead to turbidity, spread of dieback, and possibly pesticide contamination, depending on the method used for maintenance. However, a serious wildfire would strip the land of vegetation, potentially resulting in significant erosion and turbid run-off 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. HDWA PSC 88 controls the use of herbicides by government agencies in catchment areas.	*Accepted as a necessary activity in proper forest management.* • Establish specific criteria that ensures the fire management adheres to water quality objectives. For example, specific criteria would include where firebreaks can be placed, and the use and management of drainage sumps for sediment control. • Pesticide use must follow the guidelines outlined in HDWA PSC 88 and Statewide Policy No. 2: *Pesticide Use in PDWSAs.* • Establish specific points for accessing watercourses and the reservoir for fire-fighting purposes.
Apiarists/ wildflower picking/ seed collection/ firewood collection (i)	The potential risks from these activities are from pathogen contamination and litter disposal through the presence of people near streams and the reservoir, and the risk of rubbish dumping as a precursor to casual firewood collection.	Permits issued by CALM for apiary activities include water quality protection measures. The numbers of people involved are generally low and all these activities, except the collection of less than 1 tonne of firewood, are subject to conditional approval by CALM.	*Acceptable with controls such as CALM licence/permit conditions.* • Apply conditions for apiarists, wildflower picking and seed collection that meet water quality protection objectives. • Establish firewood collection areas taking account of water quality protection. • Inform public on protection of water quality through signage.
Other Crown Reserves			
Stream reserves (j)	The potential risks to water quality include: • pathogen and nutrient contamination (stock access to streams); • increased turbidity (stock access to streams); and • pesticide contamination (weed control).	Turbidity caused by stock access to streams is a significant water quality risk. Weed control is necessary to stop the spread of nuisance weeds. However, it must be conducted in a way that minimises risk to water quality.	*Actions need to be taken to minimise risk.* • Encourage initiatives to fence the stream reserves. • Consider appropriate vesting of the unvested Crown stream reserve on Ernest River. • Consider management of the vested and unvested stream reserves by the Water Corporation. • Avoid the use of soil-disruptive weed control measures. Herbicide use must follow HDWA PSC 88 and Statewide Policy No 2: *Pesticide Use in PDWSAs.*

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Feral animal control program (k)	Fox baiting: The potential risk posed by fox baiting is minimal as the poison used for fox baits 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 pathogen contamination. Feral pig control: Feral pigs pose potential risks to water quality due to pathogens from faecal matter and turbidity from foraging. Hunting reduces the number of feral pigs in the catchment, but may pose similar risks to recreational hunting (refer to w) if not carefully controlled and managed.	Fox baits are not considered to have an impact on water quality. However, if the carcasses of any dead animals are near watercourses, they can result in a risk to water quality. The Water Corporation has been involved with CALM's Operation Foxglove in public drinking water source areas. Feral pig control would help to reduce the risk to water quality posed by these animals. CALM has a feral pig control program, which utilises volunteers (with permits) and CALM employed hunters. However, in order to minimise the risk to water quality, the control program would need to be undertaken in a well-managed and organised manner.	*Fox baiting is an acceptable activity in the catchment, with conditions.* • Control fox numbers with 1080 through the CALM Operation Foxglove program. • Where feasible, rangers should remove any carcasses encountered near watercourses. *Organised control of feral pigs is an acceptable activity, with conditions.* • Work with CALM to develop guidelines for the managed control of feral pigs, which may include hunting under strict requirements. Guidelines should include water quality protection requirements. Controls could include, among other requirements, removal of carcasses from the catchment and control of the use of dogs in the Crown area of the catchment.
Special Mining Lease 1SA (bauxite mining) (l)	Through the Department of Minerals and Energy, Alcoa World Alumina Australia (Alcoa) holds a Special Mining Lease under the State Agreement Act. Alcoa has not conducted bauxite mining in the catchment to date. The potential risks to water quality from bauxite mining are: • turbidity due to site works (such as bauxite extraction and erosion from unsealed roads); and • chemical and fuel contamination from storage and use.	A multi-agency group, the Mining and Management Planning Liaison Group (MMPLG), oversees the implementation of the State Agreement Act, which includes review of management plans and enforcing environmental (including water quality protection) conditions where appropriate. The Commission has membership on the MMPLG.	*Acceptable if operated in compliance with conditions imposed by MMPLG.* • MMPLG conditions should address water quality protection measures.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Electricity and Gas Transmission Lines			
Western Power Muja Southern Terminal, Picton-Worsley, Worsley-Wagerup and Muja-Worsley lines. (m)	Potential risks to water quality from maintenance of easements are: • turbidity (from vegetation/weed clearing); • pesticide contamination (for vegetation control); and • fuel spillage from vehicles and machinery.	To maintain easements, Western Power control vegetation by slashing and rolling the vegetation. Vegetation clearing is generally completed in summer, to reduce the risk of erosion and the spread of dieback. No pesticides are used in the maintenance of terminal line easements, except for spot application of Roundup (which is approved under HDWA's PSC 88) to stump re-growth. Easement maintenance is necessary for operation of the terminal lines. However, maintenance practices need to minimise erosion, especially near streamlines.	*Acceptable with Best Management Practices.* • Ensure maintenance practices minimise erosion. • Avoid the use of pesticides where possible. Pesticide use must follow the guidelines outlined in HDWA PSC 88 and Statewide Policy No. 2: *Pesticide Use in PDWSAs.* • Ensure emergency response process is in place for fuel / chemical spillage. • Include this operation in routine surveillance program.
Epic Energy gas line corridor. (n)	Potential risks to water quality from maintenance of corridors are: • turbidity (from vegetation/weed clearing); • pesticide contamination (for vegetation control); and • fuel spillage from vehicles and machinery.	Epic Energy maintains the corridor in accordance with maintenance and environmental standards set by the Department of Minerals and Energy and the Department of Environmental Protection. The corridor is maintained by slashing and rolling vegetation in non-cropping areas. Pesticides are not used in the corridor. Easement maintenance is necessary for operation of gas lines. However, maintenance should continue to be carried out to minimise erosion, especially near streamlines.	*Acceptable with Best Management Practices.* • Ensure maintenance practices minimise erosion. • Avoid the use of pesticides where possible. Pesticide use must follow the guidelines outlined in HDWA PSC 88 and Statewide Policy No. 2: *Pesticide Use in PDWSAs.* • Ensure emergency response process is in place for fuel / chemical spillage. • Include this operation in routine surveillance program.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Worsley Alumina Refinery			
Worsley Alumina Pty Ltd refinery, conveyor belt and bauxite mining. (o)	The potential risks to water quality are: • turbidity due to site works (such as bauxite residue disposal area construction, bauxite extraction and erosion from unsealed roads); • chemical and fuel contamination from storage and use; and • chemical contamination from bauxite residue disposal areas.	Management of the refinery Crown lease area is in accordance with the Ministerial conditions of the *Alumina Refinery (Worsley) Agreement Act 1973*, the Worsley Alumina Project Environmental Review and Management Program 1979, the Worsley Alumina Project Consultative Environmental Review 1995, the *Environmental Protection Act 1986* and *Mining Act 1978*. The refinery is licensed and regulated under the *Environmental Protection Act 1986* and *Mining Act 1978*. Environmental performance is reviewed on behalf of the State through the Environmental Management Liaison Group (EMLG). The Commission provides input into the environmental management of the site, through the EMLG, which has representatives from various government agencies. The refinery lease is well managed and any risk posed by the activities has been minimised through implementing the environmental management program for the site. The refinery site and the bauxite residue disposal areas are located within contained catchment systems. Stormwater run-off from these sites does not enter the Worsley Freshwater Lake, unless monitoring indicates that the water is safe to discharge into the lake. One of the end land use objectives for decommissioning of the refinery lease is for water catchment protection and water production. Therefore, P1 objectives are to be met once the Agreement ceases to apply.	*Acceptable if operated in accordance with the environmental management program.* • Worsley Alumina to continue operating in compliance with the environmental management program. • Commission continue to be involved in environmental management through routine auditing of the site and participation on the Environmental Management Liaison Group.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Recreation on Crown Land			
Car rallies: • Rally Australia • Stirling Stages (CAMS) (p)	Potential risks associated with rallies include: • spillage of fuel from a vehicle accident or helicopters, especially near watercourses; • pathogen contamination from spectators; and • erosion from unsealed roads and tracks used on the route.	Rally Australia is an important international event and is important to the local area. It has specific requirements to not significantly alter course routes. Both events are pre-existing land uses, important to the area and well managed. Significant emergency response processes are in place. Rally Australia and CAMS provide funding for rehabilitation of roads following events. All existing events are approved based on an acceptable environmental management plan. This plan includes provisions for water quality protection (e.g. road maintenance, managed designated spectator areas that are fenced off and have portable toilets, and prohibition of mechanical servicing/refuelling in the catchment) and rehabilitation (e.g. rubbish collection) following events. Management measures are considered appropriate to minimise water quality risks.	*Existing rallies are acceptable with Best Management Practices (BMP).* • No additional rallies to be established in the catchment. • Each group develops an environmental management plan for their events. • Approval for each event will be subject to the review and implementation of the plan. The plan will be explicit in addressing water quality protection measures.
Trail bike enduro events (Motorcycling Australia WA) (q)	The potential risks associated with this activity are: • erosion associated with disturbance of soil and bikes crossing flowing streams, resulting in increased turbidity risk; • pathogen and litter risk associated with people staying for extended periods and possibly camping; and • fuel contamination from an accident or spill.	The Brunswick region, including the Brunswick catchment, is important for trail bike riding clubs. There are 2 events per year in the Brunswick catchment, in May and September. The events are currently approved through CALM. The risk posed by these events may be substantially reduced if events are held in low rainfall periods, spectators are kept out of the catchment and maintenance activities are also outside of the catchment. Risks from these events are considered acceptable, if BMP are adopted, given other risks in the catchment (e.g. stock access to streams and other agricultural pursuits) and the level of water treatment.	*Existing events are acceptable with Best Management Practices.* • No new events to be established in the catchment. • An environmental management plan is to be developed for each event. • Approval for each event will be subject to the review and implementation of the plan. The plan will be explicit in addressing water quality protection measures.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
4 Wheel Drive Association Events (r)	Potential risks include: • erosion from unsealed roads and tracks; • fuel contamination from an accident or spill; and • rubbish disposal.	Risks can be managed through conditional approval of events. The 4 Wheel Drive Association aims to minimise the impact of their activities to the environment and has been involved with CALM on environmental projects, such as Track Care WA. Events and routes during wet months will need to be carefully managed. Each event should be conducted in accordance with an approved environmental management plan.	*Existing events are acceptable with Best Management Practice.* • An environmental management plan is to be developed for each event. • Approval for each event will be subject to the review and implementation of the plan. The plan will be explicit in addressing water quality protection measures. • Driver education through information provision on water quality protection.
Camping (s)	There is a potential risk of pathogen contamination through human and animal faeces and urine, swimming, bathing, rubbish disposal and domestic animal contact with the water. There is also a potential risk of turbidity and pollution through vehicle usage and disturbance of streambeds.	Camping in the catchment is a common and well-established activity. There are no designated camping areas (and therefore no facilities such as toilets or rubbish disposal) within the Brunswick catchment. Measures undertaken in the past by CALM to prevent illegal camping have been unsuccessful. Camping within 300 yards of water bodies is prohibited under the by-laws of the CAWS Act. Camping without management and facilities poses a significant risk to water quality as: • No facilities such as toilets are provided. • There is little management of these sites (i.e. occasional rubbish removal). • Camping sites in most cases are close to the rivers. It is better to have managed camping rather than unmanaged, illegal camping. Therefore, it may be feasible for a designated campsite to be established with water quality protection measures. Activities at the site would need to be managed so that there is no contamination from toilet facilities and litter and no human or animal contact with the water. Given the other risks in the catchment (e.g. stock access to streams), it is not appropriate to preclude all recreation from the catchment, but management measures should be implemented to minimise water quality risks. In addition, the water is treated to a relatively high level before supply.	*Managed, designated camping may be acceptable, with conditions.* • Investigate the opportunity for designated camping in the catchment. • If an appropriate site/s is identified, a site development plan should be developed for that site/s. This would include the provision of facilities (e.g. toilets), locating the site an adequate distance from watercourses and adequate management and surveillance. • Implement surveillance to control existing camping in the catchment. Provide water quality protection information to campers in the catchment until the opportunity for a designated site/s has been investigated. • If a designated site/s is not identified, management measures would need to be developed for undesignated camping. • Use signage and education to ensure visitors understand they are in a catchment area and the need for water quality protection.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Picnicking (t)	The potential risks from this activity are pathogen contamination, from human and animal faeces and litter (if people are near the reservoir or feeder streams to the reservoir) and turbidity/spills due to vehicles. This risk is increased by the fact that proximity to water is often a desirable aspect of a picnic site.	Any human activity in the catchment poses some risk to water quality. However, risks are minimised where designated picnic sites, with facilities, are provided (i.e. toilets and rubbish collection) and where picnicking areas are sufficient distances from watercourses and the reservoir. Picnicking within 300 yards of water bodies is prohibited under the by-laws of the CAWS Act. Given the other risks in the catchment (e.g. stock access to streams), it is not appropriate to preclude all recreation from the catchment, but management measures should be implemented to minimise water quality risks. It is also better to have managed picnicking rather than unmanaged picnicking. In addition, the water is treated to a relatively high level before supply. Picnicking is an acceptable activity in the catchment with appropriate measures to reduce the risk to water quality.	*May be acceptable, with conditions.* • Investigate the opportunity for designated picnicking area/s in the catchment. • If an appropriate area/s is identified, a site development plan should be developed for that area/s. This would include the provision of facilities (e.g. toilets), locating the area an adequate distance from watercourses and adequate management and surveillance. • Implement surveillance to control existing picnicking in the catchment. Provide water quality protection information to picnickers in the catchment until the opportunity for a designated area/s has been investigated. • If a designated area/s is not identified, management measures would need to be developed for undesignated picnicking. • Use signage and education to ensure visitors understand they are in a catchment area and the need for water quality protection.
Swimming (u)	Swimming potentially poses a high risk of pathogen contamination through full-body contact with the water.	Swimming is a popular recreational activity in the catchment. Swimming in reservoirs and feeder streams is not permitted under the by-laws of the CAWS Act. The Health Department of WA recommends that swimming in water used for public supply does not occur. Water treatment does not adequately protect against risk from pathogens. Human contact with water poses a considerable threat to water quality and should be precluded from the catchment.	*Swimming is not acceptable in the reservoir and in streams that traverse Crown land in the catchment.* • Educate the public through signage that swimming in streams located in Crown land in the catchment is prohibited under the CAWS Act by-laws. • Undertake surveillance and by-law enforcement. • It is encouraged that swimming in streams located on freehold land should not occur.
Off-road driving (v)	The potential risks associated with this activity are: • erosion leading to turbidity; • dieback and weeds spread through extensive vehicle use; • pathogen and litter risk associated with people staying for extended periods and possibly illegally camping; and • fuel contamination from an accident or spill.	Off-road driving poses a significant risk of increasing turbidity in the reservoir. Therefore, it is an undesirable activity in the catchment. It is also a prohibited activity in State Forest. Vehicle access on public roads/tracks is acceptable.	*Off-road driving is not acceptable in the catchment.* • Use educational material to promote awareness of impact of off-road driving on water quality. • Undertake surveillance to control off-road driving in the catchment. • Encourage involvement with organised groups in appropriate areas.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Recreational hunting (w)	The presence of recreational hunters in the catchment increases the potential risk of pathogen contamination from pig carcasses, humans, dogs and litter, and increases risk of 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-managed feral animal control program.	*Uncontrolled hunting on Crown land is not an acceptable activity.* • Close catchment to uncontrolled hunting on Crown land through the CAWS Act by-laws. • Signs should be placed throughout the catchment indicating that uncontrolled hunting is illegal. • Undertake surveillance of the catchment and by-law enforcement. • Support CALM-managed feral animal control program.
Fishing (x)	The potential risks from fishing are: • pathogen contamination through human contact with the water body, absence of toilet facilities, use of meat bait and rubbish disposal; • turbidity through vehicle usage, fishing activity (i.e. erosion of riverbanks and disturbance of streambeds) and rubbish disposal.	Trout fishing is an important recreational activity on the Brunswick River, upstream of Beela Dam reservoir. Fisheries WA annually stock the Brunswick River with trout. The Commission considers that trout fishing poses some risk to water quality. However, given the other risks in the catchment (e.g. stock access to streams), it is not appropriate to preclude all recreation from the catchment, but management measures should be implemented to minimise water quality risks. In addition, the water is treated to a relatively high level before supply.	*Acceptable activity, with conditions.* • Allow lure and fly only fishing outside the Reservoir Protection Zone (RPZ) through the CAWS Act by-laws. • Provide information on measures that reduce risk to water quality (such as no fishing in the reservoir, avoid contact with the water, lure and fly only fishing, rubbish removal and no meat baits) when issuing Fisheries WA licences and through signage. • Establish surveillance to ensure compliance with protection measures.

Table 1 contd.

Activity	Potential Water Quality Risks	Considerations for Management	Recommended Protection Strategies
Marroning (y)	The potential risks from marroning are: • pathogen contamination through human contact with the water body, absence of toilet facilities, camping, use of meat bait and rubbish disposal; • turbidity through vehicle usage, marroning activity (i.e. erosion of riverbanks and disturbance of streambeds) and rubbish disposal.	Marroning is a popular and well-established activity in the catchment. Due to the nature of the watercourses in the catchment, drop-netting is the most common form of marroning. This form of marroning does not usually involve body contact with the water. Meat baits are infrequently used with drop-nets. Pellets are the most commonly used bait. Marroning can involve people staying for extended periods in the catchment and overnight camping is sometimes associated with the activity. Risks to water quality are increased when meat baits are used, rubbish is disposed, there is direct contact with the water and when people spend extended periods in the catchment. However, given the other risks in the catchment (e.g. stock access to streams), it is not appropriate to preclude all recreation from the catchment, but management measures should be implemented to minimise water quality risks. In addition, the water is treated to a relatively high level before supply.	*Acceptable activity, with conditions.* • Allow marroning without the use of meat baits outside the Reservoir Protection Zone (RPZ) through the CAWS Act by-laws. • Provide information on measures that reduce risk to water quality (e.g. no marroning in the reservoir, drop-nets, avoiding contact with the water, rubbish removal and no meat baits) when issuing Fisheries WA licences and through signage. • Establish surveillance to ensure compliance with protection measures.
Bushwalking / orienteering / rogaining (z)	There is a potential risk of pathogen contamination from human and animal waste if people walk in/near the reservoir or feeder streams.	Bushwalking is an activity that has low numbers using the catchment. Any human activity in direct contact with the water body poses some risk to water quality. However, if bushwalking trails are away from watercourses and the reservoir, the risk is negligible. Bushwalking through organised groups (e.g. orienteering) can be managed through education and approval conditions. Non-organised bushwalking can be managed through education. Bushwalking is an acceptable activity with appropriate measures to reduce any risk to water quality.	*Acceptable activity, with conditions.* • Ensure trails are outside the RPZ. Trails should cross streams at points where culverts and / or bridges are established. • Use signage to inform people they are in a catchment area and ways to protect water quality, such as promotion of rubbish removal. • Ensure organised orienteering/rogaining groups obtain approval for events. Ensure proper management of the group and water quality protection measures (e.g. adequate provision of chemical toilets) are conditions of approval.

Recommendations

1. Land planning strategies, including the Greater Bunbury Region Scheme and Shires of Harvey and Collie Town Planning Schemes, should incorporate the Brunswick Catchment Area and management principles outlined in this plan and reflect the Priority 1 and Priority 2 classifications given to the Catchment Area.

2. All development proposals in the Brunswick Catchment Area that are likely to impact on water quality should be referred to the Water and Rivers Commission for advice and recommendation.

3. Signs should be erected along the boundaries of the Catchment Area to define the area and promote public awareness of the need to protect water quality.

4. Incidents covered by WESTPLAN – HAZMAT in the Brunswick Catchment Area should be addressed through the following measures:

- The Shire of Harvey and Shire of Collie Local Emergency Management Advisory Committees (through the Bunbury Emergency Management District) being familiar with the location and purpose of the Brunswick Catchment Area.
- The locality plan for the Brunswick 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 Brunswick Catchment Area.
- Personnel dealing with WESTPLAN – HAZMAT incidents in the area given ready access to a locality map of the Brunswick Catchment Area and training to understand the potential impacts of spills on the surface water resource.

5. A surveillance program should be established to identify any incompatible land uses or potential contaminant threats within the Catchment Area.

6. The stream reserves should be managed in accordance with Priority 1 source protection. Consideration should be given to the appropriate vesting for the unvested Crown stream reserve on Ernest River. Consideration should be given to the Water Corporation managing the vested and unvested stream reserves.

7. Review the source water quality monitoring program to ensure key characteristic parameters are included. Routinely review water quality analysis results to detect any adverse trends and to compare with the national drinking water guidelines.

8. Adopt strategies detailed in Section 7.7 Land use, potential water quality risks and recommended strategies.

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

Implementation strategy

No.	Description	Implemented by	Recommended timing
1.	Incorporation into land planning strategies.	Shire of Collie, Shire of Harvey, Ministry for Planning and Western Australian Planning Commission.	Ongoing.
2.	Referral of development proposals.		
	(i) WRC to provide guidance on what land use activities constitute a potential water quality risk.	(i) Program Manager, Assessment and Advice (WRC).	(i) 2001 - 2002
	(ii) Referral of development proposals and events that are likely to impact on water quality.	(ii) Shire of Collie, Shire of Harvey, Ministry for Planning, Department of Conservation and Land Management, Department of Minerals and Energy, Department of Resources Development and Department of Environmental Protection.	(ii) Ongoing.
3.	Erection of signs along catchment boundary and at access points.		
	(i) Development of guidelines for signage.	(i) Water and Rivers Commission and Water Corporation.	(i) 2000 - 2001
	(ii) Determine number and location of signs required.	(ii) Regional Manager, South West Region (WRC), Regional Business Manager, South West Region (Water Corporation), Department of Conservation and Land Management, Shire of Collie and Shire of Harvey.	(ii) 2001 - 2002
	(iii) Erect and maintain signs.	(iii) Regional Manager, South West Region (WRC) / Regional Business Manager, South West Region (WC).	(iii) To be determined.

No.	Description	Implemented by	Recommended timing
4.	Incidents covered by WESTPLAN – HAZMAT in the Brunswick Catchment Area should be addressed through the following measures.		
	(i) The Shire of Harvey and Shire of Collie Local Emergency Management Advisory Committees (through the Bunbury Emergency Management District) being familiar with the location and purpose of the Brunswick Catchment Area.	(i) Shire of Harvey and Shire of Collie Local Emergency Management Advisory Committees (through the WRC South West Region).	(i) As soon as possible.
	(ii) The locality plan for the Brunswick Catchment Area being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.	(ii) Program Manager, Protection Planning (WRC).	(ii) As soon as possible.
	(iii) The HAZMAT Emergency Advisory Team must receive water quality protection advice during incidents in the Brunswick Catchment Area.	(iii) Regional Business Manager, South West Region (WC).	(iii) Ongoing.
	(iv) Personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Brunswick Catchment Area and training to understand the potential impacts of spills on the surface water source.	(iv) Shire of Harvey and Shire of Collie Local Emergency Management Advisory Committees.	(iv) As soon as possible.
5.	Catchment surveillance and by-law enforcement		
	(i) Develop guidelines for the surveillance of Catchment Areas.	(i) Program Manager, Protection Planning (WRC).	(i) 2000 - 2001
	(ii) Implement and undertake the surveillance and by-law enforcement program.	(ii) Regional Business Manager, South West Region (WC).	(ii) Ongoing from 2001.
6.	Stream reserves		
	(i) Stream reserves over Brunswick River and Ernest River to be managed in accordance with Priority 1 source protection.	(i) Water and Rivers Commission.	(i) Ongoing.
	(ii) Consider appropriate vesting of stream reserve over Ernest River.	(ii) Department of Land Administration and Water and Rivers Commission.	(ii) 2001 - 2002
	(iii) Consider management of stream reserves by Water Corporation.	(iii) Water and Rivers Commission and Water Corporation.	(iii) 2001 – 2002
	(iv) Herbicide use to be in accordance with PSC88 and Statewide Policy: *Pesticide Use in PDWSAs*.	(iv) Water and Rivers Commission and Water Corporation.	(iv) Ongoing.

No.	Description	Implemented by	Recommended timing
7.	Review the water quality monitoring program as per the recommendations.	Water Corporation.	Ongoing.
8 a.	Develop environmental guidelines and water quality protection notes for agricultural activities in drinking water catchments with industry groups and relevant agencies. The use of best practice will be encouraged.	Water and Rivers Commission, Agriculture WA, peak industry groups and landowner groups.	Ongoing.
8 a.	Encourage retention of vegetation and encourage and support fencing and revegetation of key streamlines (e.g. through WRC Rivercare programs).	Water and Rivers Commission and Water Corporation.	Ongoing.
8 c.	Management of Lot 5303: (i) Herbicide use to be in accordance with PSC 88 and Statewide Policy: *Pesticide Use in PDWSAs*. (ii) Ensure fencing maintained to prevent stock and unauthorised access.	(i) Water Corporation. (ii) Water Corporation.	(i) Ongoing. (ii) Ongoing.
8 d.	Assess risk to water quality from Shire roads and develop a road maintenance and management plan that minimises water quality risks.	Water and Rivers Commission, Shire of Harvey, Shire of Collie and Water Corporation.	2001 - 2002
8 e, f, g, h.	State 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. Consider provisions for accessing watercourses and Beela Dam reservoir for emergency fire-fighting operations. (iii) Regular review of proposed 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, WRC and Water Corporation. (ii) Department of Conservation and Land Management, Forest Products Commission, WRC and Water Corporation. (iii) WRC, Water Corporation, Department of Conservation and Land Management and Forest Products Commission. (iv) Department of Conservation and Land Management and Forest Products Commission. (v) WRC and Water Corporation (under delegation).	(i) Ongoing. (ii) 2001 – 2002 (iii) Ongoing. (iv) Ongoing. (v) Ongoing.

No.	Description	Implemented by	Recommended timing
8 i, r, z.	Ensure approval of transitory activities (i.e. organised bushwalking, rogaining, 4WD groups, apiarists, wildflower and seed collection) includes water quality protection measures.	Department of Conservation and Land Management, Water and Rivers Commission and Water Corporation (under delegation).	Ongoing.
8 k.	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 and Water Corporation.	2001 - 2002
8 m, n.	Liaise with Western Power and Epic Energy to ensure maintenance practices minimise impact on water quality.	Water and Rivers Commission, Western Power, Epic Energy and Water Corporation (under delegation).	2001 - 2002
8 p, q, r.	Motorsport in Brunswick Catchment Area (i) Rally Australia, Confederation of Australian Motorsport (CAMS), 4 Wheel Drive Association and Motorcycling Australia WA to develop environmental management plans for their existing events. (ii) Review and approval of the management plans, their implementation and event approval.	(i) Rally Australia, CAMS, 4 Wheel Drive Association and Motorcycling Australia WA. (ii) Water and Rivers Commission, Department of Conservation and Land Management and Water Corporation (under delegation).	(i) 3 months prior to each event. (ii) Ongoing.

No.	Description	Implemented by	Recommended timing
8 s, t.	Camping and picnicking		
	(i) Investigate the opportunity for designated camping and picnicking in the catchment.	(i) Department of Conservation and Land Management, Water and Rivers Commission and Water Corporation.	(i) 2001 – 2002
	(ii) Develop a site development plan for that site/s if an appropriate site/s is identified.	(ii) Department of Conservation and Land Management, Water and Rivers Commission and Water Corporation.	(ii) After determination of appropriate site/s.
	(iii) Implement surveillance to control existing camping and picnicking in the catchment. Provide water quality protection information to campers / picnickers in the catchment until the opportunity for a designated site/s has been investigated.	(iii) Department of Conservation and Land Management and Water Corporation (under delegation).	(iii) Ongoing from 2001.
	(iv) If necessary, develop management measures for undesignated camping and picnicking if a designated site/s is not identified.	(iv) Department of Conservation and Land Management, Water and Rivers Commission and Water Corporation.	(iv) After investigation has completed.
	(v) Advise of prohibited activities and water quality protection through signage and education.	(v) Department of Conservation and Land Management, Water Corporation and Water and Rivers Commission.	(v) Ongoing from 2001.

No.	Description	Implemented by	Recommended timing
8 s, t, u, v, w, x, y.	Recreation		
	(i) Develop and implement regulations under the CAWS Act by-laws to prohibit camping and picnicking at undesignated sites, swimming in the reservoir and in streams traversing Crown land, uncontrolled hunting, fishing and marroning in RPZ and the use of meat baits when fishing and marroning in the catchment.	(i) Water and Rivers Commission and Water Corporation (under delegation).	(i) 2001 – 2002, ongoing.
	(ii) Use educational material to promote awareness of impact of off-road driving on water quality.	(ii) Water and Rivers Commission, Water Corporation and Department of Conservation and Land Management.	(ii) Ongoing.
	(iii) Erect signs in the Brunswick 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.	(iii) Water Corporation, Water and Rivers Commission and Department of Conservation and Land Management.	(iii) 2001 - 2002
8 x, y.	Fishing and marroning		
	(i) Implement CAWS Act regulations to manage fishing and marroning.	(i) Water and Rivers Commission.	(i) 2001 - 2002
	(ii) Inform community of water quality protection measures (e.g. lure and fly fishing, the use of drop-nets for marroning, no meat baits and rubbish removal) through signage and information.	(ii) Water and Rivers Commission, Water Corporation, Fisheries Western Australia and RecFishWest.	(ii) Ongoing.
	(iii) Establish surveillance to ensure compliance with protection measures.	(iii) Water Corporation and Fisheries Western Australia.	(iii) Ongoing.
9.	Review		
	(i) Implementation strategy.	(i) Water and Rivers Commission.	(i) Annually.
	(ii) Plan.	(ii) Water and Rivers Commission.	(ii) After five years.

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Glossary

Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Diffuse Source Pollution	Pollution originating from a widespread area, e.g. urban stormwater run-off, agricultural run-off.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
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 run-off, change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.
Run-off	Water that flows over the surface from a catchment area, including streams.
Scheme Supply	Water diverted from a source (or sources) by a water authority 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.
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.

Appendices

Appendix 1. Water quality monitoring results 1998 - 2000

Appendix 2. Land Use Compatibility in Public Drinking Water Source Areas

Appendix 1

Water quality monitoring results 1998 - 2000

Following is a summary of the results of water quality monitoring of the untreated water from Beela Dam. Samples were taken between 1998 and 2000. Levels are compared with the national drinking water guidelines (NH&MRC and ARMCANZ, 1996). Please note that all guideline values are for aesthetic (e.g. taste) considerations. Health guideline values are either not set for these parameters, or are higher than aesthetic values. This monitoring program is continuing.

Parameter	Range of Monitored Values	Guideline Value
Turbidity	0.8-27 NTU	5 NTU for aesthetics, 1 NTU for disinfection
pH	6.75-7.16	6.5-8.5
Colour	<1-55 TCU	15 TCU
Iron	0.195-2.2 mg/L	0.3 mg/L
Manganese	0.002-0.07 mg/L	0.1 mg/L
Aluminium	0.025-1.5 mg/L	0.2 mg/L

Appendix 2

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 Environmental Protection Act.
Extensive	Where limited additional inputs are required to support the desired land use. eg supplementary animal feed only during seasonal dry periods.
Intensive	Where regular additional inputs are required to support the desired land use. eg 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 land -use 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 eg. 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
Dog kennels	Incompatible	Conditional	Conditional

Land use	Priority 1	Priority 2	Priority 3
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]
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]
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]

Land use	Priority 1	Priority 2	Priority 3
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 ie 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 ground water	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
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, the depth of excavation in relation to the water table 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, 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 are sourced from operator's vineyards within the P2 area.