GOVERNMENT OF WESTERN AUSTRALIA

CUE WATER RESERVE
WATER SOURCE PROTECTION PLAN

Cue Town Water Supply

WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 35

2001

WATER AND RIVERS COMMISSION

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Water and Rivers Commission
Policy and Planning Division

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Foreword

Water Source Protection Plans

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

The plans identify sources of contamination that should be investigated and set out programs for management of the resource. Water Source Protection Plans are developed in consultation with affected landowners, industry groups and relevant government agencies.

Proclaiming Water Reserves 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, 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 use compatible with Water Source Protection Plans.

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

Water quality protection framework

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

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

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

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

In addition to priority classifications, Wellhead Protection Zones are defined to protect the water source from contamination in the immediate vicinity of production bores. Wellhead Protection Zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside Water Reserves. Special conditions apply within these zones.

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Summary

The town of Cue is a gold mining and pastoral support centre for the surrounding region. It is located approximately 650 kilometres north east of Perth in the Shire of Cue. The Water Corporation supplies water to the town from seven bores in the North East wellfield and two bores in the Brackish wellfield.

The existing wellfields have reached the limit of supply capacity. Future wellfield expansion will be in the Yarraquin catchment to the south east of the townsite.

The water supply bores abstract water from unconfined alluvial formations that are vulnerable to contamination.

The North East and Yarraquin areas are relatively undisturbed. However, the water source has the potential to be contaminated from activities within the recharge area. Historical mining activity poses a water quality risk to the Brackish wellfield.

The existing Water Reserve should be modified to reflect the recharge area of the existing North East and Brackish wellfields and the new Yarraquin wellfield.

The main area of the Water Reserve, encompassing the North East and proposed Yarraquin wellfields, should be managed for Priority 1 source protection.

The Brackish wellfield part of the Water Reserve should be managed for Priority 3 source protection.

Any development proposals that may affect the quality of the water supply should be referred to the Water and Rivers Commission for comment.

A draft plan was released for stakeholder comment and submissions received were considered in the preparation of the final plan.

1. Introduction

Cue township services the gold mining and pastoral industry and a growing tourism industry. It is located 650 kilometres north east of Perth and is within the administrative boundary of the Shire of Cue (see Figure 1). The Water Corporation supplies water to the town from two wellfields, licensed for a total abstraction of 200 000 kilolitres per annum.

The North East wellfield consists of seven production bores (2/81, 5/81, 6/81, 7/81, 5/85, 6/85 and 6/87) located approximately 9 kilometres to the north east of town (see Plate 1).

The Brackish wellfield consists of two production bores (1/75 and 4/75) located approximately 8 kilometres to the north of town. This wellfield is used for peak supply.

The proposed Yarraquin wellfield consists of three test bores (1/97, 4/97 and 5/97) located 4 kilometres south east of town.

The North East and Brackish wellfields are covered by an existing Water Reserve proclaimed under the *Country Areas Water Supply Act 1947* in January 1990. See Figure 2 for the location of the wellfields and existing Water Reserve.

The bores are screened between 44 and 74 metres below ground level, in an alluvial aquifer. The groundwater is chlorinated before reticulation.

2. Physiography

The climate at Cue is semi-arid with high summer temperatures. The rainfall is highly erratic with long term average of 250 millimetres per annum. The average annual potential evaporation is more than 10 times the annual rainfall.

About 80% of rainfall occurs in the winter months between April and September. The remainder falls during summer, and is normally associated with local thunderstorms or southward movement of a tropical cyclone.

The Cue area is characterised by rocky hills that are dissected by watercourses with wide alluvial valleys. The area drains to the west and south-west by wide ephemeral creeks that are only active after heavy or prolonged rainfall.

Plate 1. North East production bore 6/85 and surrounding mallee vegetation.

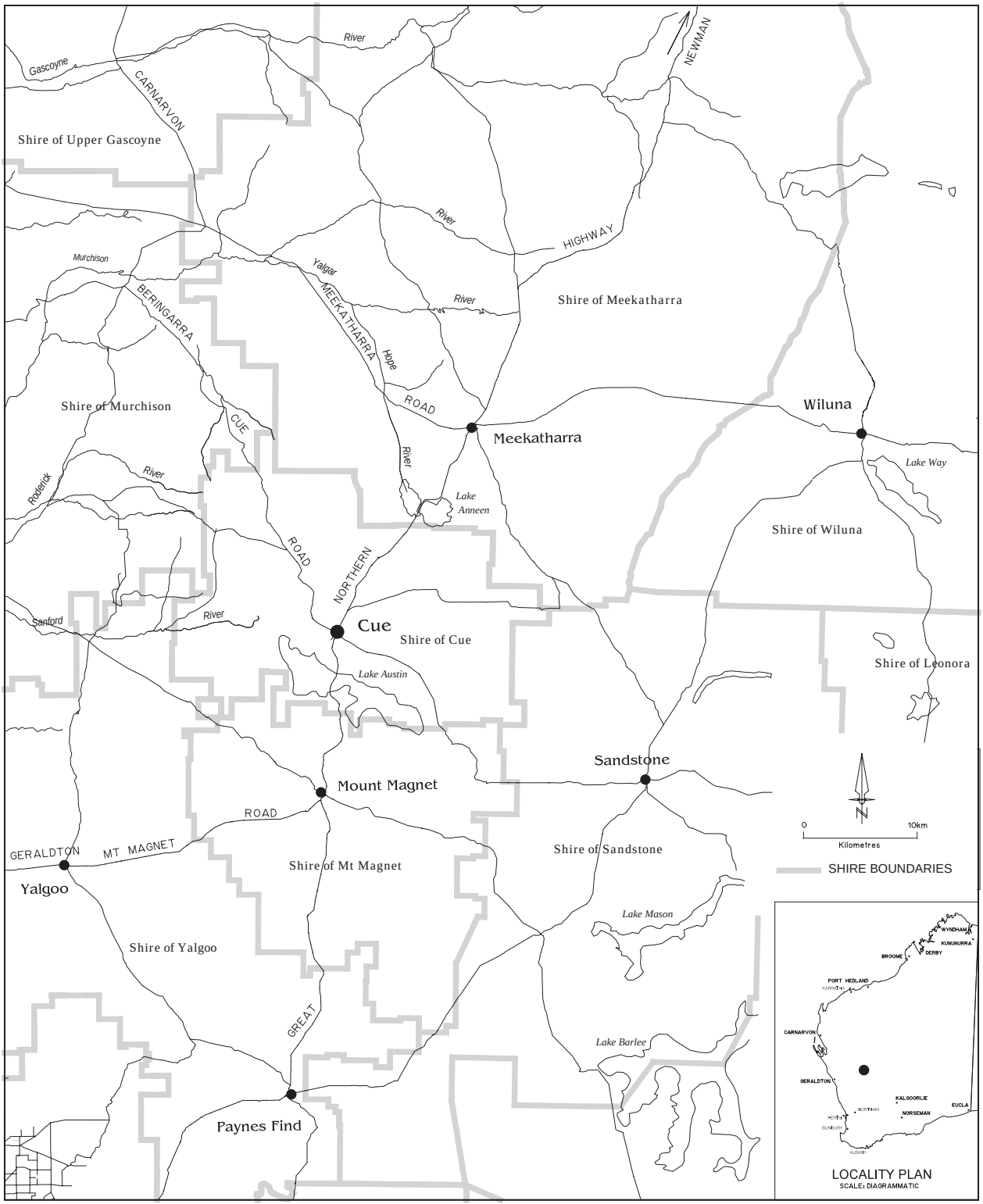

Figure 1. Cue locality map.

3. Hydrogeology

The Cue area is located on the northern extent of the Yilgarn Craton within the Meekatharra - Mt Magnet greenstone belt. The basement rocks are overlain with large areas of laterite, however in some areas this laterite has been eroded along current and historical drainage lines. In these areas the basal rock has been overlain by colluvial and alluvial deposits of sand and clay up to 50 metres thick.

The main groundwater storage is within these thin deposits of alluvial and colluvial material, which are occasionally underlain by fractured rock aquifers. The wellfields draw groundwater from this unconfined alluvial aquifer. The aquifer is considered vulnerable to contamination from overlying land uses.

Most rainfall is lost by evaporation or surface runoff. Only a small portion infiltrates the soil and recharges the groundwater. The majority of recharge for the Cue source occurs during rainfall events that result in sustained surface flow events. This sustained flow gives the opportunity for downward percolation of water into the alluvial deposits.

The limit of supply from the North East and Brackish wellfields is currently being reached.

The Water Corporation has investigated and established three production bores in the Yarraquin catchment to the south east of the townsite (see Plate 2). These are proposed to supplement the Cue scheme in the long term. The yield of the Yarraquin aquifer is estimated to be 120 000 kilolitres per annum.

Plate 2. Site of the proposed Yarraquin wellfield.

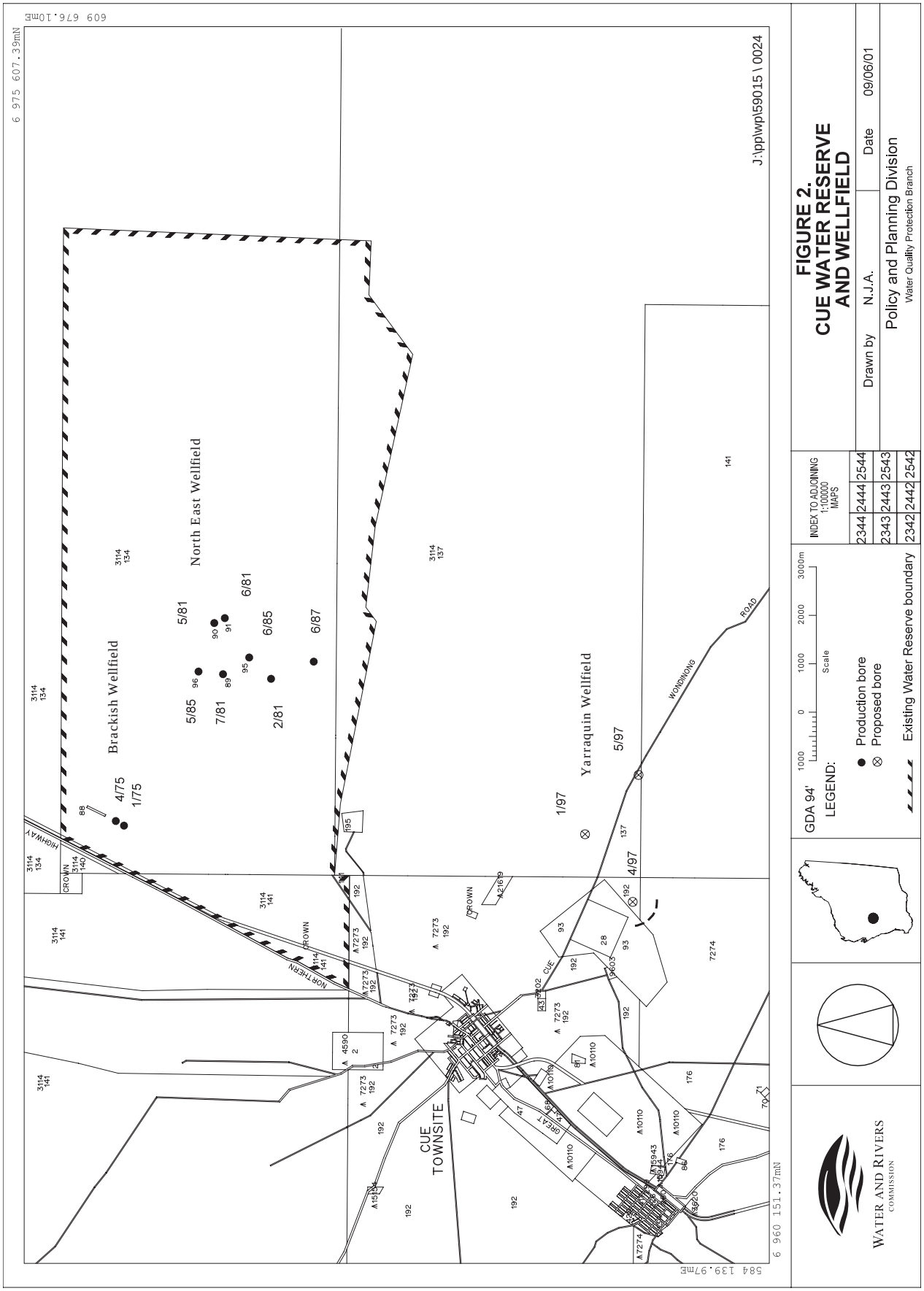

Figure 2. Existing Cue Water Reserve and wellfield.

3.1 Water quality

The groundwater quality within the Cue area is generally brackish or saline. However some bores yield potable or marginal quality water. Bores with potable or marginal quality water are mainly found in the alluvial deposits near the recharge areas.

Salinity in the Brackish wellfield ranges from 1400 to 2000 mg/L total dissolved salts (TDS). The North East wellfield has salinity ranging from 600 to 1000 mg/L TDS. These sources are blended to supply water with salinity between 800 and 900 mg/L TDS.

Salinity at the proposed Yarraquin wellfield is 530 mg/L TDS for test bores 1/97 and 5/97 and 1400 mg/L for test bore 4/97.

The level of nitrate (as NO_3) in raw water from production bores ranges from 44 mg/L to 84 mg/L. The NHMRC 1996 Australian Drinking Water Guidelines set a guideline value of 50 mg/L (as NO_3). Nitrate levels exceed the guideline value.

The nitrate levels are naturally occurring in the raw water and are outside the influence of the water source protection planning process. Use of this water for public supply is subject to requirements set by other agencies (Health Department of WA and Office of Water Regulation).

Hardness as $CaCO_3$ ranges between 140 and 500 mg/L. The NHMRC guidelines indicate that $CaCO_3$ between 200 and 500 mg/L could increase scaling problems in piping and heating appliances.

4. Existing and proposed land use

The major land use within the Water Reserve is stock grazing on pastoral leases. The areas around the wellfields are predominantly vegetated with mallee scrub.

Other land uses within the wellfield recharge areas include prospecting and mining explorations. Currently no major mining activity is being undertaken in the Water Reserve. However, due to the transitory nature of mining activities it is possible that future mining will take place.

5. Proposed proclaimed area

The existing Cue Water Reserve, proclaimed in January 1990, does not protect the Yarraquin area and covers an extensive area, which is unlikely to be used for future wellfield development. The Reserve should be modified to protect the catchment area of the existing North East and proposed Yarraquin wellfield. The proposed boundary has been defined using topographical information (see Figure 3).

The main area of the Water Reserve, encompassing the North East and proposed Yarraquin wellfields, should be managed for Priority 1 source protection as the water source is of strategic importance for supply to Cue. Current land uses are of low risk and are considered compatible with this classification. Future development should be carefully assessed in line with the principle of risk avoidance.

A Water Reserve, joining two 300 metre radii, should be declared around production bores 1/75 and 4/75 in the Brackish wellfield. This area should be managed for Priority 3 source protection and as a Wellhead Protection Zone. The priority classification is based on the following criteria:

- The Brackish wellfield does not yield high quality drinking water and is used only for peak supply;
- Land use activities and development are managed within the Wellhead Protection Zone to avoid immediate contamination risks;
- An alternative water source is available at the Yarraquin wellfield; and
- The wellfield will be decommissioned when production begins in the Yarraquin wellfield.

The detail of general land use compatibility under each priority classification is outlined in the guidance document titled *Land Use Compatibility in Public Drinking Water Source Areas* (see Appendix 1). This document provides general guidance on the compatibility of future land use development. The term "conditional" is used where the land use can usually be compatible with the objectives of source protection, with the adoption of best management practices. Generally, these are practical steps to protect water resources from potential contaminants and cover issues such as fuel and chemical storage and waste disposal.

5.1 Wellhead Protection Zones

Wellhead Protection Zones are defined over the area around production bores to manage immediate risks to the water source. Each production bore within the P1 source protection area should have a 500 metre radius Wellhead Protection Zone. Each production bore within the P3 source protection area should have a 300 metre radius Wellhead Protection Zone. Development within these areas will be carefully assessed to address immediate water quality risks.

The Commission would have concerns with activities such as tailings dams and fuel and chemical storage being sited in a Wellhead Protection Zone.

6. The impact of water source protection planning

The Commission's water source protection planning recognises existing approvals and does not prohibit currently approved land use activities. The Commission will not place new restrictions on existing land use practices. However, best management practices are encouraged for water quality protection.

It is only when a landowner or leaseholder applies to the local government authority, Department of Environmental Protection or Department of Minerals and Energy to expand an existing operation or develop the land for a new land use type that the Commission will provide advice into the approval process. Advice will be based on the compatibility of the activity with the priority classification.

7. Potential for contamination

Table 1 identifies potential contaminant risks in the proposed Water Reserve and suggests specific protection measures. "Potential Impact" indicates the extent of impact the issue poses if it does contaminate the water source and "Likelihood" indicates the chance of the issue contaminating the water source. Figure 4 identifies the location of potential contaminant threats.

8. Management of potential water quality risks

8.1 Protection objectives

The objective of this plan is to protect drinking water in the interest of public health, however the right of existing approved land uses to continue in this Water Reserve is recognised.

The main area of the Cue Water Reserve, encompassing the North East and proposed Yarraquin wellfields, is proposed for Priority 1 source protection. The Priority 1 classification has the fundamental water quality objective of risk avoidance.

The Brackish wellfield is proposed for Priority 3 source protection. The proposed Priority 3 classification has the fundamental water quality objective of risk management. This plan generally recommends strategies to implement best management practices in Priority 3 areas to manage risks rather than restricting land use options.

Table 1 outlines suggested risk management measures.

8.2 Best management practices

Best management practices for land use activities are encouraged to help protect water quality. These are often in the form of an industry code of practice or environmental guideline. They are usually developed in consultation with industry groups, producers and State government agencies.

For example, water quality protection *Guidelines for Mining and Mineral Processing* have recently been released by the Water and Rivers Commission. They have been produced in consultation with the Department of Environmental Protection, Department of Minerals and Energy and key industry representatives.

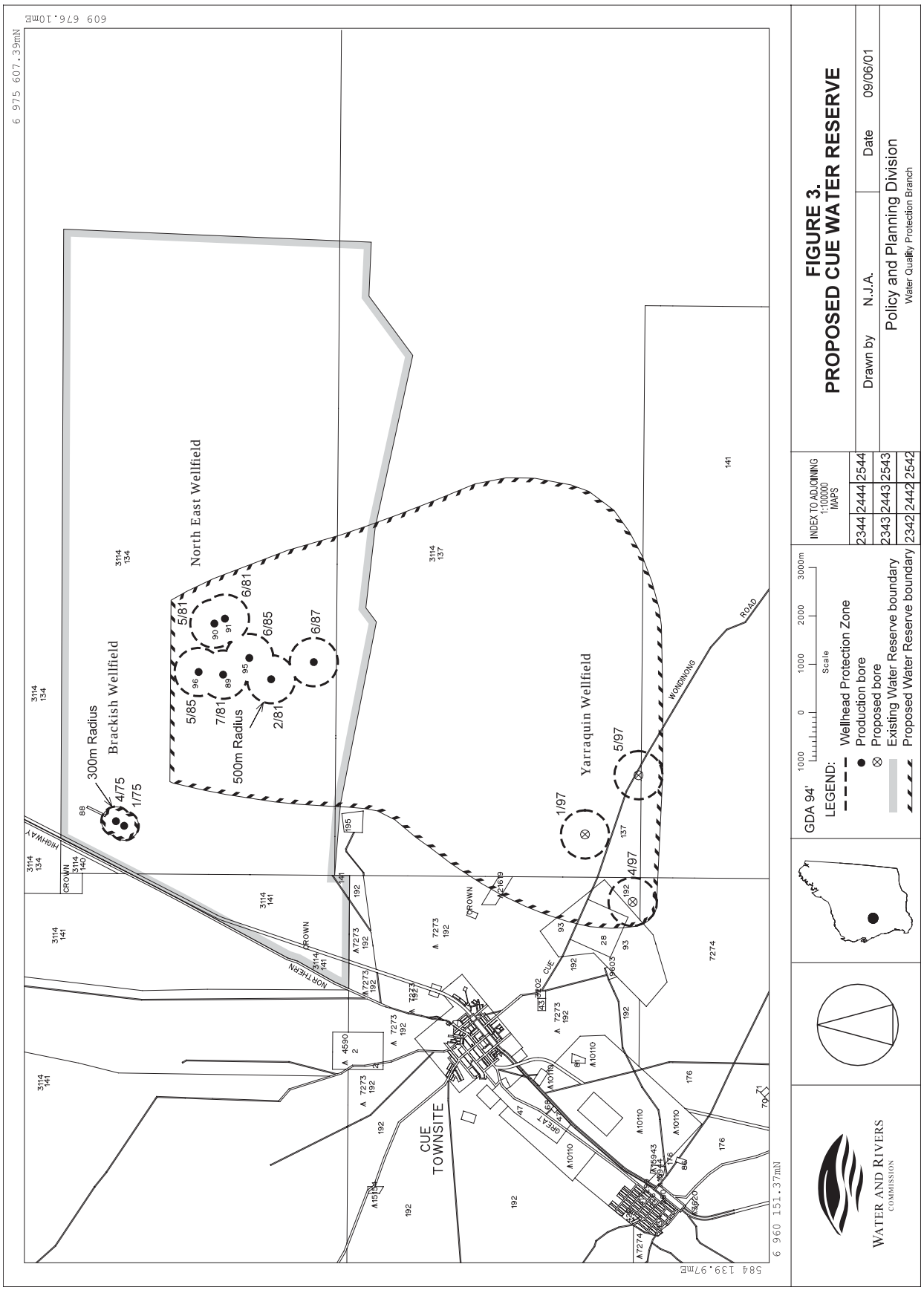

Figure 3. Proposed Cue Water Reserve.

8.3 Water Quality Protection Notes

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

They can be found on the internet via the Commission homepage (http://www.wrc.wa.gov.au/protect/policy).

8.4 Land use planning

It is recognised under the State Planning Strategy 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 Water Reserve and priority classifications be recognised in land planning strategies, such as the Shire of Cue Town Planning Scheme.

8.5 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 Reserves, as an important water quality protection mechanism. Surveillance is also important in raising the general level of awareness of the need to protect water quality.

Signs are erected in Water Reserves to advise of the Water Reserve location, activities that are prohibited or regulated and water quality protection measures.

8.6 Emergency response

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause groundwater contamination. The Shire of Cue Local Emergency Management Advisory Committee (LEMAC), through the Meekatharra Emergency Management District, should be familiar with the location and purpose of the Cue Water Reserve. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT (Hazardous Material) Emergency Advisory Team. The Regional Manager (Mid-West), Water Corporation, should provide local advice to the HAZMAT Emergency Advisory Team during incidents in the Cue Water Reserve. The Regional Manager (Mid-West Gascoyne), Water and Rivers Commission, should have a broader advisory role to any HAZMAT Emergency Advisory Team.

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

Table 1. Potential sources of contamination within the Cue Water Reserve.

See Figure 4 for location of potential sources of contamination.

Map ref.	Issue	Threats	Risks	Potential Impact	Likelihood	Current Preventative Measures	Suggested Protection Measures
1.	Transport along Cue – Wondinong Road. The road is within the Wellhead Protection Zone of proposed Yarraquin production bore 5/97.	• Acute events such as accidents and spills. • Cumulative impacts from stormwater runoff.	Groundwater contamination by hydrocarbons and other chemicals.	High - small quantities may contaminate the source.	Low - a minor transport route.	WESTPLAN HAZMAT response plan for major spill events is in place.	• Maintain emergency response plan. Ensure awareness of the Water Reserve and keep relevant personnel informed. • Install signs to define the Water Reserve boundary. Signs should include an emergency contact number. • Review monitoring program for production bores.
2.	Cue airfield (see Plate 3).	• Aircraft refuelling from 250 litre drums.	Groundwater contamination by hydrocarbons.	High - small quantities may contaminate the source.	Low	Fuel is transported to the site only as required. No fuel is stored on site.	• Fuel transfer should meet Water and Rivers Commission standards for fuel transfer in Public Drinking Water Source Areas. • Review monitoring program for production bores.
		• Septic system.	Groundwater contamination from nutrients and bacteria.	Low	Low		Nil

Map ref.	Issue	Threats	Risks	Potential Impact	Likelihood	Current Preventative Measures	Suggested Protection Measures
N/A	Various minor exploration, prospecting and mining leases.	Temporary fuel handling and storage.	Groundwater contamination by hydrocarbons.	Moderate	Low	DEP licence conditions and DME mining, prospecting and exploration lease approvals.	• DEP licence conditions and DME approvals should be reviewed according to Water and Rivers Commission standards for PDWSAs upon renewal. New DEP Works Approvals should also meet Commission standards for PDWSAs. • Review monitoring program for production bores.
N/A	Nallan, Yarraquin and Austin Downs pastoral stations.	Stock grazing in the Water Reserve.	Groundwater contamination from nutrients and bacteria.	Very low	Very low	Grazing is extensive with low stocking rates.	Nil

Plate 3. Cue airfield.

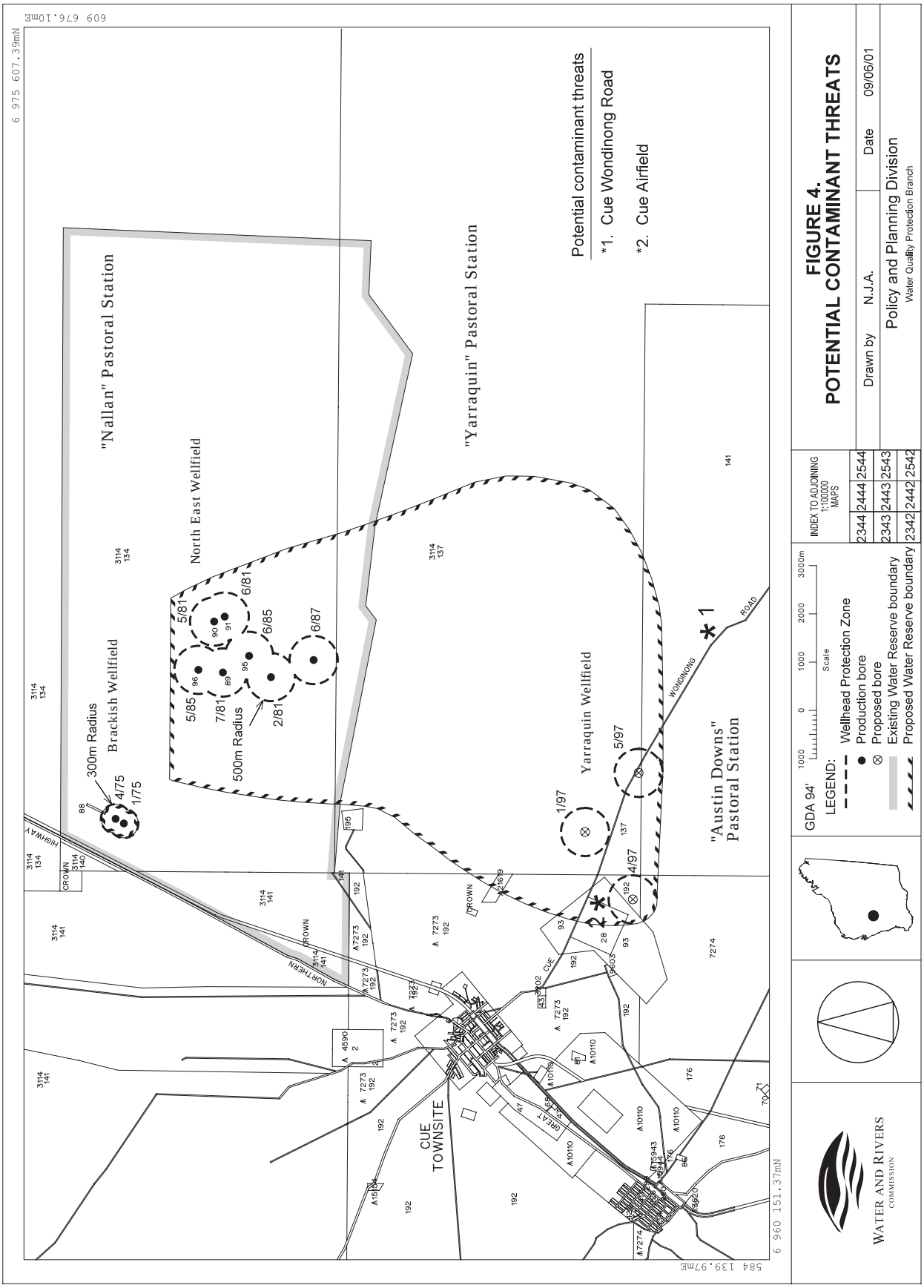

Figure 4. Potential contaminant threats.

Recommendations

1. The modified Cue Water Reserve should be gazetted under the *Country Areas Water Supply Act 1947*.

2. Land planning strategies, such as the Shire of Cue Town Planning Scheme, should incorporate the management principles outlined in the Water and Rivers Commission's *Land Use Compatibility in Public Drinking Water Source Areas* (see Appendix 1) and reflect the Priority 1 and Priority 3 classifications given to the Water Reserve.

3. All land use development proposals in the proposed Cue Water Reserve which are likely to impact on water quality should be referred to the Water and Rivers Commission for comment. This includes Department of Environmental Protection licence renewal and works approval applications and Notices of Intent for Department of Minerals and Energy mining, prospecting and exploration lease approvals. A locality plan of the proposed Cue Water Reserve should be provided to the Department of Environmental Protection and the Department of Minerals and Energy.

4. Signs should be erected around the boundary of the Water Reserve to define the location and promote public awareness of the need to protect water quality. Signs should include an emergency contact phone number.

5. Incidents covered by WESTPLAN – HAZMAT in the proposed Cue Water Reserve should be addressed through the following measures:

    (i) The Cue Local Emergency Management Advisory Committee (through the Meekatharra Emergency Management District) being familiar with the location and purpose of the Water Reserve.

    (ii) The locality plan for the Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.

    (iii) The Water Corporation providing local advice to the HAZMAT Emergency Advisory Team during incidents in the Water Reserve.

    (iv) The Regional Manager, Water and Rivers Commission, to have a broader advisory role to any HAZMAT Emergency Advisory Team.

    (v) Personnel dealing with WESTPLAN - HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource

6. A surveillance program should be implemented to identify any incompatible land uses or potential contaminant threats within the proposed Water Reserve. Implementation of the surveillance should be delegated to the Water Corporation.

7. Monitoring program reviews should address the risks identified in this plan. Water quality data should continue to be reviewed regularly to identify any adverse trends.

8. Implementation of these recommendations should be reviewed annually. A full review of this Water Source Protection Plan should be undertaken after five years.

Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of the Water Reserve.	Program Manager, Protection Planning (WRC).	2001-02
2.	Incorporation of Cue Water Reserve into land planning strategies.	Shire of Cue, Ministry for Planning.	Ongoing
3.	Referral of development proposals:		
	(i) All development proposals in the Cue Water Reserve which are likely to impact on water quality should be referred to the Water and Rivers Commission.	(i) Shire of Cue, Ministry for Planning, Department of Minerals and Energy, Department of Environmental Protection and Mid-West Development Commission.	(i) Ongoing
	(ii) The locality plan for the proposed Cue Water Reserve being provided to the Department of Environmental Protection and the Department of Minerals and Energy.	(ii) Program Manager, Protection Planning (WRC)	(ii) As soon as possible.
4.	Erection of signs:		
	(i) Development of guidelines for signage.	(i) Program Manager, Protection Planning (WRC).	(i) 2001-02
	(ii) Determine number and location of signs required around the boundary of the Water Reserve.	(ii) Regional Manager, Mid-West Gascoyne Region (WRC)/ Regional Business Manager, Mid-West Region (WC).	(ii) 2001-02
	(iii) Erect signs.	(iii) Regional Manager, Mid-West Gascoyne Region (WRC)/ Regional Business Manager, Mid-West Region (WC).	(iii) To be determined

No	Description	Implemented by	Timing
5.	Incidents covered by WESTPLAN – HAZMAT in the Cue Water Reserve should be addressed through the following measures:		
	(i) The Cue Local Emergency Management Advisory Committee (through the Meekatharra Emergency Management District) being familiar with the location and purpose of the Water Reserve.	(i) Cue Local Emergency Management Advisory Committee through WRC (Mid-West Gascoyne Region).	(i) As soon as possible.
	(ii) The locality plan for the Water Reserve 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 Water Corporation to provide local advice to the HAZMAT Emergency Advisory Team during incidents in the Water Reserve.	(iii) Water Corporation.	(iii) Ongoing.
	(iv) The Regional Manager, Water and Rivers Commission, should have a broader advisory role to the HAZMAT Emergency Advisory Team.	(iv) Regional Manager, Mid-West Gascoyne (WRC).	(iv) Ongoing.
	(v) Personnel dealing with WESTPLAN – HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.	(v) Cue Local Emergency Management Advisory Committee.	(v) As soon as possible.

No	Description	Implemented by	Timing
6.	Surveillance program: (i) Develop guidelines for the surveillance of Water Reserves. (ii) Consider delegation of surveillance and by-law enforcement to Water Corporation. (iii) Implement the surveillance program.	(i) Program Manager, Protection Planning (WRC). (ii) Program Manager, Protection Planning (WRC); and Manager, Infrastructure Planning Branch (WC). (iii) Regional Business Manager, Mid-West (WC).	(i) 2001-02. (ii) 2001-02. (iii) On completion of surveillance guidelines.
7.	Monitoring program: (i) Review monitoring program for production bores in light of contamination risks. (ii) Continue to regularly review water quality data for adverse trends.	(i) Water Corporation (ii) Water Corporation	i) As soon as possible. ii) Ongoing.
8.	Review of this plan, recommendations and implementation strategy.	Water Quality Protection Branch (WRC).	(i) Implementation strategy – annually. (ii) Full review- 5 years.

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Glossary

Abstraction	Pumping groundwater from an aquifer.
Allocation	The quantity of groundwater permitted to be abstracted by a well licence, usually specified in kilolitres/year (kL/a).
Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
Bore	A narrow, lined hole drilled to monitor or withdraw groundwater.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Confined aquifer	An aquifer that is confined between shale and siltstone beds and therefore contains water under pressure.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Groundwater	Water which occupies the pores and crevices of rock or soil.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
Leaching / Leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater; the material washed out is known as leachate. Leachate can pollute groundwater and waterways.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
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.
Pollution	Water pollution occurs when waste products or other substances (e.g. effluent, litter, refuse, sewage or contaminated runoff) change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.

Public Drinking Water Source Area	The collective term given to existing and future drinking water sources, identified by proclaiming Underground Water Pollution Control Areas, Water Reserves or Catchment Areas under the *Country Areas Water Supply Act 1947*, or the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*.
Recharge	Water infiltrating to replenish an aquifer.
Recharge area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
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.
Stormwater	Rainwater which has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Unconfined aquifer	An aquifer with no upper non-porous material to limit its volume or to exert pressure. The upper surface of the groundwater within the aquifer is called the watertable.
Water Reserve	An area proclaimed under the Metropolitan Water Supply Sewerage and Drainage Act or Country Areas Water Supply Act to allow the protection and use of water on or under the land for public water supplies.
Wastewater	Water that has been used for some purpose and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water quality	The physical, chemical and biological measures of water.
Watertable	The upper saturated level of the unconfined groundwater.
Wellfield	A group of bores to monitor or withdraw groundwater.

Appendix 1

Land Uses Compatiblity 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 apply to 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, **Wellhead Protection Zones** and **Reservoir Protection Zones** are defined to protect the water source from contamination in the immediate vicinity of production wells and reservoirs. Wellhead 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 requirements in the form of 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.

The Commission recognises that many activities were established before the introduction of these tables. The Commission will negotiate with the operators of such activities to develop appropriate management practices to minimise the impact on water resources.

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

Definitions used in the following tables

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

More information

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

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

Tables showing 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 e.g. crustaceans, fish, algae	Incompatible	Conditional	Conditional
Dairy sheds	Incompatible	Incompatible[11,15]	Conditional[15]
Feedlots	Incompatible	Incompatible	Conditional
Livestock grazing - pastoral leases	Conditional	Compatible	Compatible
Livestock grazing - broad acre (extensive)	Incompatible	Conditional[11]	Compatible
Livestock grazing (intensive)	Incompatible	Incompatible	Conditional[11]
Piggeries	Incompatible	Incompatible	Incompatible
Poultry farming (housed)	Incompatible	Conditional	Conditional
Stables	Incompatible	Conditional	Compatible

AGRICULTURE - PLANTS

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

DEVELOPMENT - COMMERCIAL

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

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

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

SPORT AND RECREATION

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

STORAGE/ PROCESSING OF TOXIC AND HAZARDOUS SUBSTANCES (THS)

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

TOURISM ACCOMMODATION.

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

WASTE TREATMENT AND MANAGEMENT

Land use	Priority 1	Priority 2	Priority 3
Injection of liquid wastes into groundwater	Incompatible	Incompatible	Incompatible
Landfills -Class I, II or III	Incompatible	Incompatible	Conditional
Landfills -Class IV and V	Incompatible	Incompatible	Incompatible
Recycling depots	Incompatible	Incompatible	Conditional
Refuse transfer stations	Incompatible	Incompatible	Conditional
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 /mining camps,	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
National and Regional Parks[13]	Compatible	Compatible	Compatible
Nature Reserves	Compatible	Compatible	Compatible
Prisons	Incompatible	Incompatible	Conditional[6]

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, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Health Department, may be accepted with maintenance requirements.

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

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

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

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

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

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

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

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

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

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

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