



# EXMOUTH WATER RESERVE WATER SOURCE PROTECTION PLAN

## Exmouth Town Water Supply



WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 26  
2000



**WATER AND RIVERS**  
COMMISSION

---

WATER AND RIVERS COMMISSION

HYATT CENTRE

3 PLAIN STREET

EAST PERTH

WESTERN AUSTRALIA 6004

TELEPHONE (08) 9278 0300

FACSIMILE (08) 9278 0301

WEBSITE: <http://www.wrc.wa.gov.au>

***We welcome your feedback***

*A publication feedback form*

*can be found at the back of this publication,*

*or online at <http://www.wrc.wa.gov.au/public/feedback/>*

*Cover Photograph: Limestone (photo taken at the Department of Transport quarry site at Exmouth)*

*[Taken by Adrian Tomlinson]*



---

# EXMOUTH WATER RESERVE WATER SOURCE PROTECTION PLAN

Exmouth Town Water Supply

Water and Rivers Commission  
Policy and Planning Division

WATER AND RIVERS COMMISSION  
WATER RESOURCE PROTECTION SERIES  
REPORT NO WRP 26  
2000



---

# Acknowledgments

Contribution	Personnel	Title	Organisation
Program Direction	Tony Laws	Manager, Water Quality Protection	Water and Rivers Commission
	David Boyd	Previous Manager, Water Quality Protection	Water and Rivers Commission
Supervision	Ross Sheridan	Program Manager, Protection Planning	Water and Rivers Commission
Report Preparation	Adrian Tomlinson	Senior Water Resources Planner	Water and Rivers Commission
Drafting	Nigel Atkinson	Contract Mapping Consultant	McErry Digital Mapping Pty Ltd

For more information contact:

Program Manager, Protection Planning  
Water Quality Protection Branch  
Water and Rivers Commission  
3 Plain Street  
EAST PERTH WA 6004

Telephone: (08) 9278 0300

Facsimile: (08) 9278 0585

## Reference Details

The recommended reference for this publication is:  
Water and Rivers Commission 2000, *Exmouth Water Reserve Water Source Protection Plan: Exmouth Town Water Supply*, Water and Rivers Commission, Water Resource Protection Series No WRP 26.

ISBN 0-7309-7421-09

ISSN 1326-7442

*Printed on recycled stock  
December, 2000*



---

# Foreword

## Water Source Protection Plans

Water Source Protection Plans establish the level of protection required within Water Reserves. 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 and 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 proactively 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 development 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 Water Reserve at Exmouth 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, well-head protection zones are defined to protect the water source from contamination in the immediate vicinity of production bores. Well-head 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.



---

# Contents

Summary	1	References	19
1. Introduction	2	Glossary	20
2. Scheme description	4		
3. Hydrogeology	7	<b>Appendices</b>	
4. Existing and proposed land use	9	Appendix 1: Land use compatibility in Public Drinking Water Source Areas .....	21
4.1 Existing	9		
4.2 Proposed	9	<b>Plates</b>	
5. Potential for contamination	11	Plate 1. A typical bore arrangement at Exmouth	2
5.1 Within or adjacent to the Water Reserve	11	Plate 2. Industrial waste tip face - Qualing Scarp	13
5.2 Within the wellfield recharge area west of the existing Water Reserve	14		
5.3 East of the Water Reserve	14	<b>Figures</b>	
6. Proposed protection area	14	Figure 1. Exmouth locality map.....	3
6.1 Proposed Water Reserve	14	Figure 2. Exmouth wellfield .....	5
6.2 Priority classification	14	Figure 3. Current Exmouth Water Reserve .....	6
Recommendations	16	Figure 4. Hydrogeological cross section .....	8
Implementation strategy	17	Figure 5. Location of mining tenements .....	10
		Figure 6. Potential contamination threats.....	12
		Figure 7. Proposed Exmouth Water Reserve .....	15



---

# Summary

The Exmouth Town Water Supply is drawn from a large number of low yielding bores situated along the eastern margin of the Cape Range. The wellfield draws water from an unconfined limestone aquifer that is highly vulnerable to contamination.

It is essential to protect the water source from any groundwater pollution risks as Exmouth's water resources are limited and also support unique subterranean fauna.

A new Water Reserve boundary is proposed. The new boundary covers the entire recharge area for existing and proposed production bores. In defining the new boundary, care has been taken to exclude areas not directly recharging the scheme and its future extensions, as there is significant competition for land at Exmouth.

The Water Reserve will be managed for Priority 1 source protection and strict limitations on land use will apply. Retention of natural vegetation and ecosystem maintenance are the most compatible land uses in the Water Reserve. Any development proposals in the Water Reserve should be referred to the Water and Rivers Commission.

Outside the Water Reserve careful consideration of the impacts of land use decisions on groundwater quality is also required. Water resources in these areas also support significant environmental values and are used for private water supplies.





---

## 1. Introduction

Exmouth is located approximately 1260 km north of Perth on the eastern side of the Cape Range Peninsula (**Figure 1**). It was established to serve the nearby naval communications base and now also supports fishing and tourism industries.

The long term average rainfall is about 260 mm. The climate of the Cape Range Peninsula is semi-arid. The Cape Range is flanked by a narrow (1.5 km) coastal plain. The range is deeply incised by dendritic intermittent streams, which form a rugged topography.

Exmouth's public water supply system is operated by the Water Corporation. The water is sourced from a wellfield screened in an unconfined limestone aquifer. Near the coast the watertable is extremely flat and saline water underlies a thin layer of fresh groundwater.

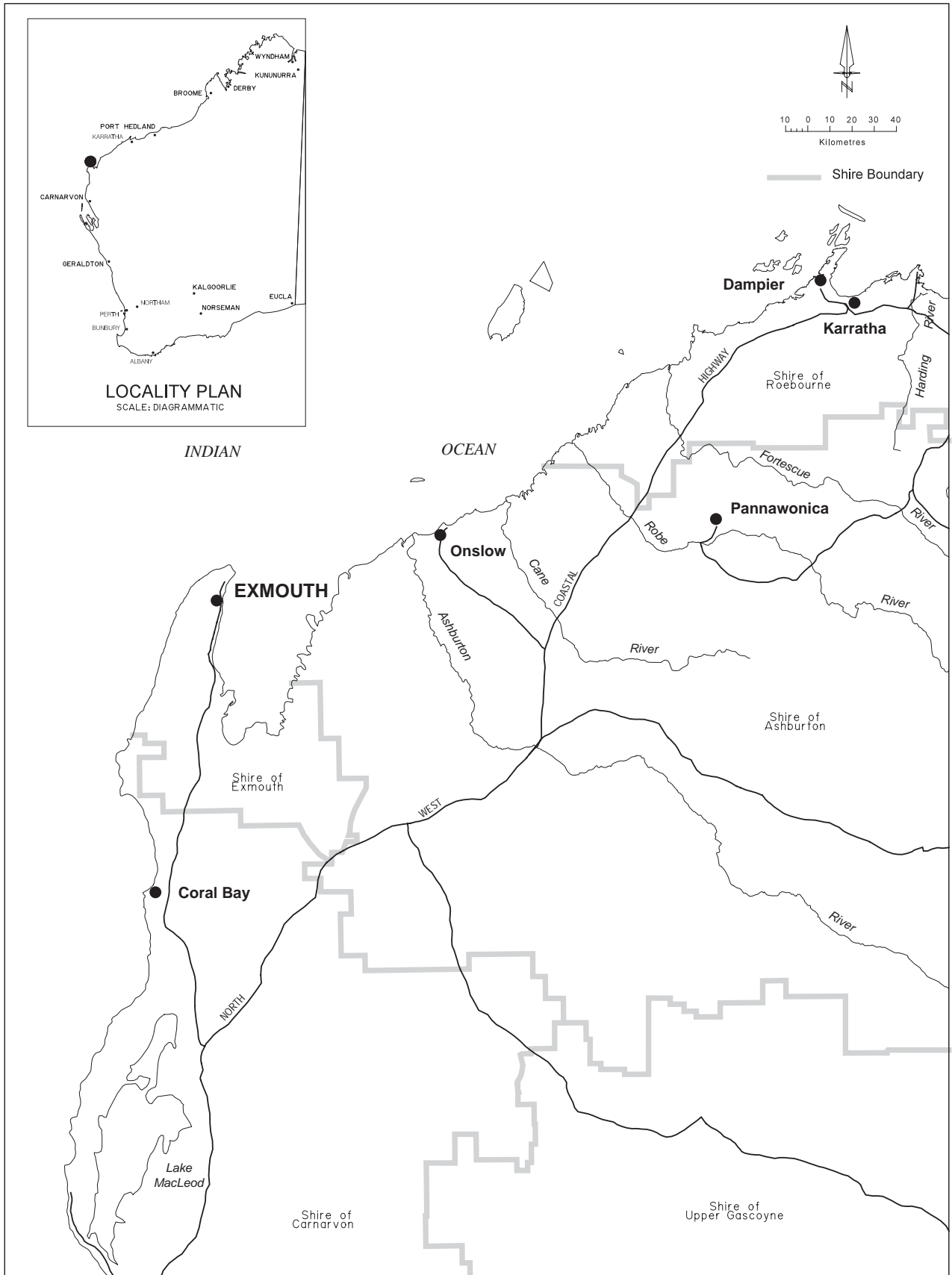
The limestone in the Cape Range contains karst features such as sink holes and solution cavities. The karst environment supports unique communities of troglobytic stygofauna. Karst features can also provide conduits for pollutants to move to the watertable.



**Plate 1. A typical bore arrangement at Exmouth. Bores are established in rugged terrain along the Cape Range. Exmouth can be seen in the background.**







**Figure 1. Exmouth locality map**



---

## 2 Scheme description

The Water Corporation wellfield is located to the south-west of Exmouth (**Figure 2**) along the eastern flank of Cape Range.

The wellfield consists of a large number of low yielding bores.

Due to increasing salinity, the wellfield has been rationalised and numerous bores in the north of the scheme have been decommissioned. Pumping rates from the remaining bores are low to minimise the potential for saline upconing.

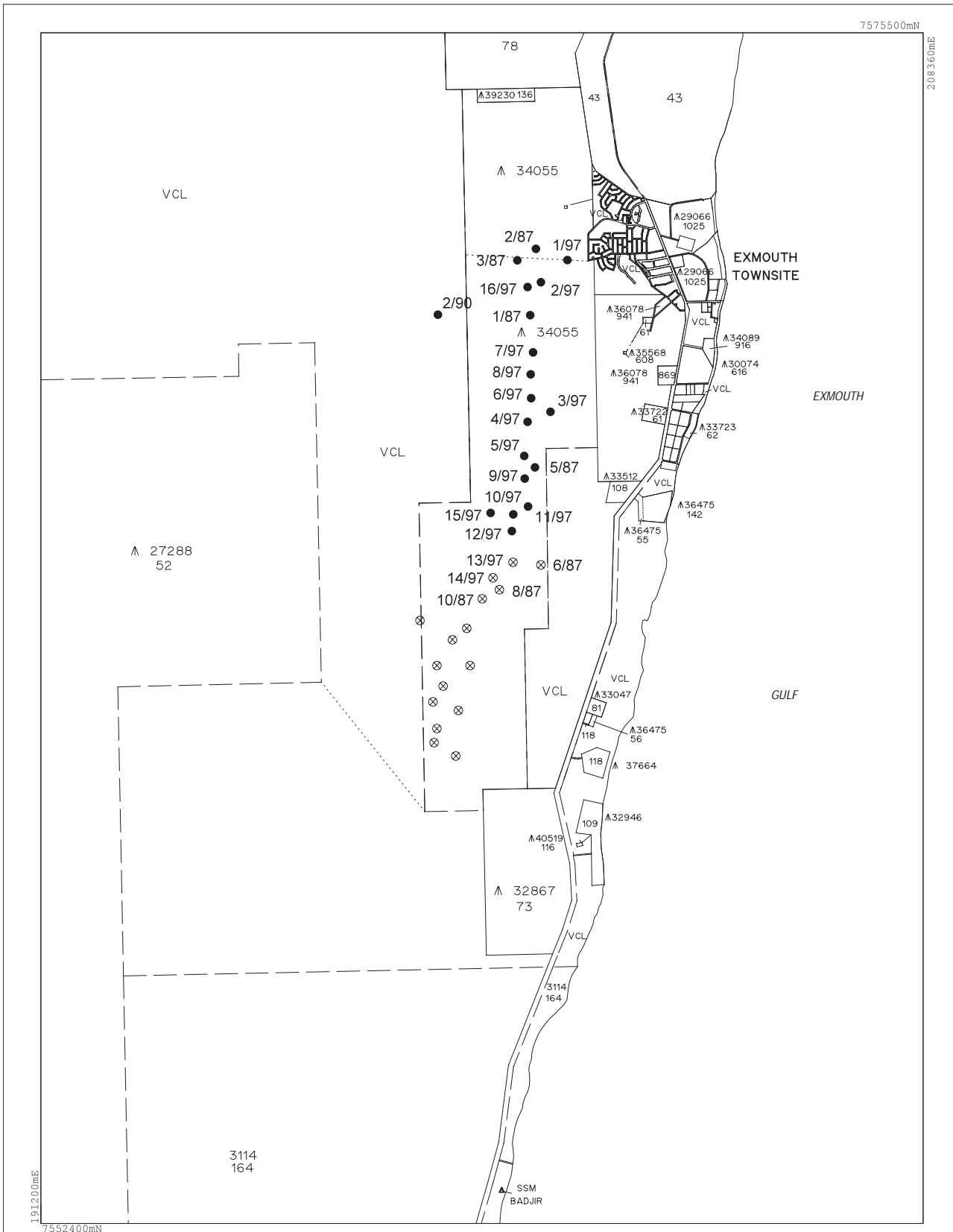
Groundwater salinity increases from west to east across the Water Corporation wellfield (Colman, 1994). This is attributed to the shallower depth to the mixing zone as the freshwater lens thins closer to the coast.


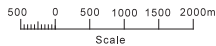

Groundwater salinity is also highest in the north of the wellfield. This is attributed to the northward thinning of the freshwater lens and the combined impact of abstraction from private bores, the naval base wellfield, and the public water supply scheme.

The Water Corporation plans to drill additional bores south west of the existing scheme.

The Exmouth Water Reserve has been declared under the *Country Areas Water Supply Act 1947* to protect the public water supply source from contamination. The Water Reserve extends south of the current wellfield to cover areas anticipated to be required for future wellfield extension (**Figure 3**).





 <p><b>WATER AND RIVERS COMMISSION</b></p>	<p>LEGEND:</p> <ul style="list-style-type: none"> <li>● Production bore</li> <li>⊗ Proposed production bore</li> </ul>	 <p>Scale</p>		INDEX TO ADJOINING 1:100000 MAPS	FIGURE 2. EXMOUTH WELLFIELD							
				<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">1654</td> <td style="width: 33%;">1754</td> <td style="width: 33%;">1854</td> </tr> <tr> <td>1653</td> <td>1753</td> <td>1853</td> </tr> <tr> <td>1652</td> <td>1752</td> <td>1852</td> </tr> </table>	1654	1754	1854	1653	1753	1853	1652	1752
1654	1754	1854										
1653	1753	1853										
1652	1752	1852										

**Figure 2. Exmouth wellfield**



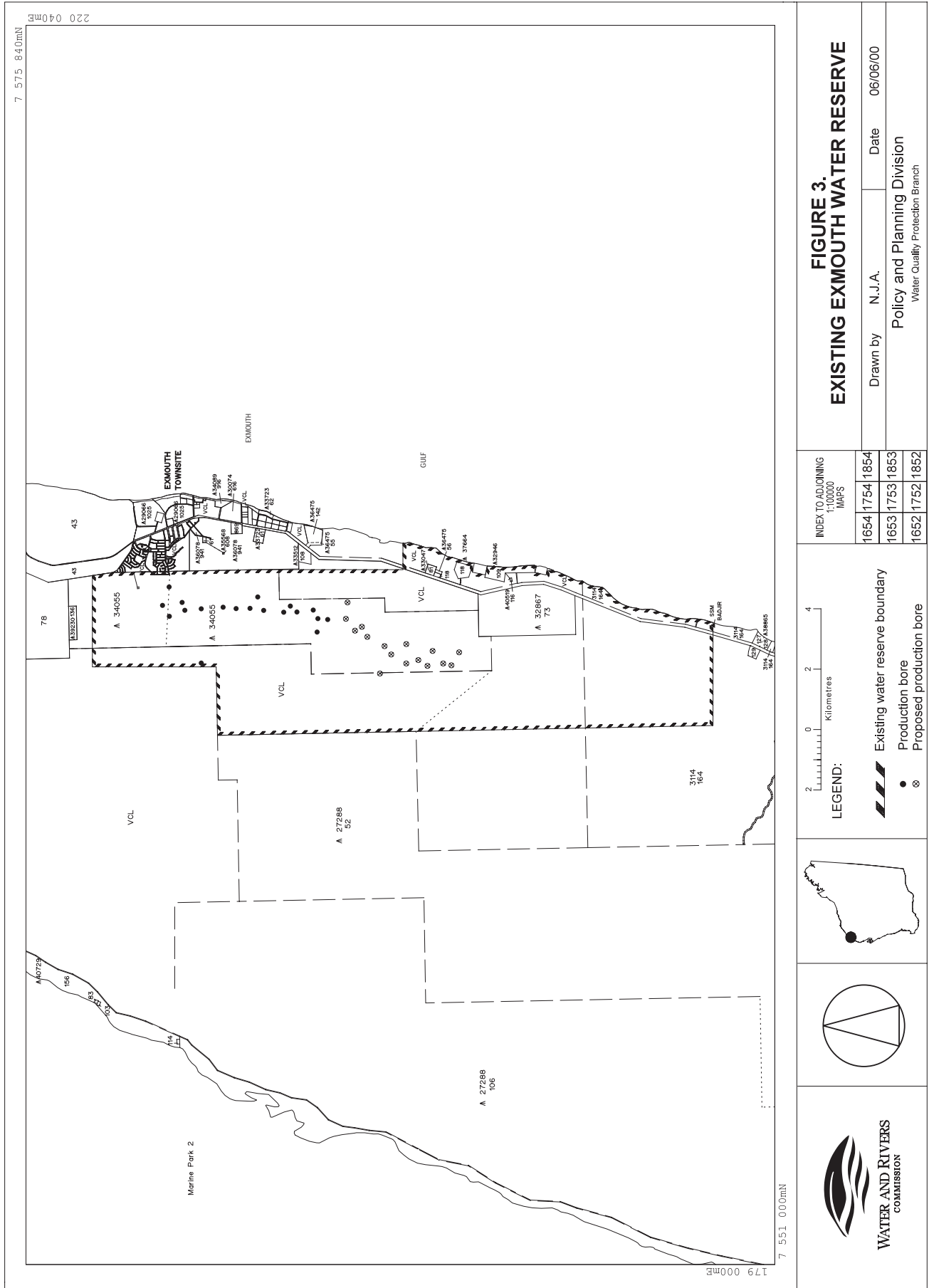


Figure 3. Current Exmouth Water Reserve



---

### 3. Hydrogeology

The Cape Range Peninsula is formed by calcareous sediments of Tertiary age with minor Quaternary deposits near the coast. At Exmouth, the Quaternary and Tertiary sediments probably extend to a depth of at least 600 m.

The three main formations intersected during water bore drilling are the Trealla, Tulki and Mandu Limestone Formations (**Figure 4**). They form a conformable sequence that dips to the west and the east from the axis of the Cape Range (Colman, 1994). The Exmouth Town Water Supply Scheme bores are usually screened in the Trealla Limestone and the upper Tulki Limestone. These main formations are described (as per Colman, 1994) in descending sequence below.

Trealla Limestone - consists of hard calcirudite and calcisilite with corallgal limestone, interbedded with calcareous sandstone of the Pilgramunna Formation. Many of the karst features such as sink holes, solution cavities and pipes are developed in this formation.

Tulki Limestone - consists of silty and sandy calcaronite, the top of which is recrystallised and similar in nature to the overlying Trealla Limestone. Karstic features are also strongly developed in the upper recrystallised part of the formation.

Mandu Limestone - in the Exmouth area this unit is either a grey fossiliferous calcaronite, or a white and brown marly calcaronite. It is generally finer grained than the Tulki Limestone as the formations form a downward fining sequence.

Groundwater flow in the vicinity of the Exmouth wellfield is in an easterly direction from the Cape Range toward the Exmouth Gulf. Groundwater is discharged from the aquifer to the ocean or springs near the coast, or by evapotranspiration and wellfield abstraction.

Aquifer recharge is from direct infiltration of rainfall or infiltration of stream runoff where channel beds are coarse gravel. Forth (1972) estimated recharge for the area west of the wellfield to be 25 mm/year. The recharge area for the Exmouth Town Water Supply is likely to consist of the area overlying the wellfield itself and the upgradient area to the west, extending to the groundwater divide, which roughly aligns with the axis of the Cape Range.

Hydraulic gradients are generally low and decrease toward the coast. Martin (1990) estimated the hydraulic gradient of the wellfield to be  $1.7 \times 10^{-4}$ . Local groundwater flow patterns are likely to be significantly affected by karstic features. This has implications for protecting groundwater quality as it means that groundwater pollutants may move rapidly through the aquifer and not necessarily in the direction of regional groundwater flow.

The groundwater aquifer is considered to be highly vulnerable to contamination from inappropriate land uses in its recharge area.

A saline interface is present beneath the wellfield and extends inland for about 5 km from the coast. The saltwater wedge coincides with and is controlled by the presence of highly transmissive karstic features (Colman, 1994). As a result, the wellfield is highly sensitive to overpumping and bores must be throttled to minimise saline upconing.

Groundwater from the aquifer also supplies numerous private users and the Harold E. Holt naval base.

Further fresh groundwater resources occur to the south and west of the wellfield. In both of these areas wellfield development must address the need to protect the troglobitic stygofauna. Also, despite the thickness of freshwater increasing to in excess of 150 m in the west, wellfield development in this area may be limited by the permeability of the aquifer.



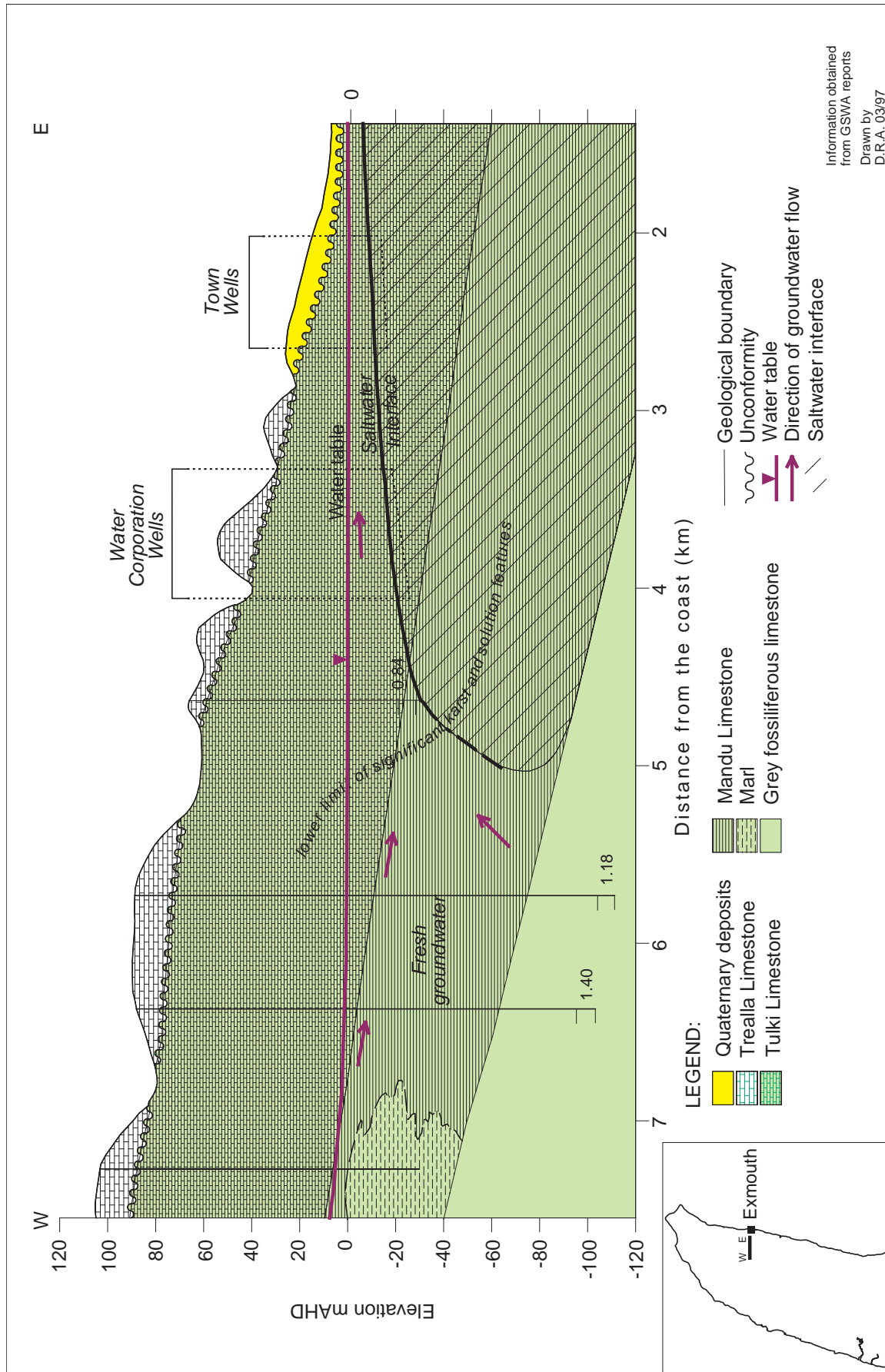


Figure 4. Hydrogeological cross section



---

## 4. Existing and proposed land use

### 4.1 Existing

A large area of the Water Reserve is vested with the Water Corporation for water supply (Reserve 34055) under the *Land Act 1933*. This has limited the townsite's encroachment into the wellfield.

Significant areas of vacant Crown land, private land holdings and pastoral leases also occur in the Exmouth Water Reserve to the east and the south of the wellfield. Significant land uses are outlined below.

#### **Airfield (Reserve 32867)**

The Shire of Exmouth maintains an airfield which originally served the offshore oil and gas industry but is now primarily used by chartered air services.

#### **Municipal landfill**

The Shire of Exmouth operates the Qualing Scarp landfill located north of the airfield.

The landfill is partitioned into five areas receiving domestic wastes, industrial wastes, liquid wastes, waste oils and car bodies.

It is licensed by the Department of Environmental Protection. As part of the licensing requirement, four groundwater monitoring bores have been established.

#### **Exmouth Gulf station**

The northern boundary of the Exmouth Gulf station overlaps the Water Reserve. The area is used for extensive livestock grazing. There is minimal infrastructure associated with the station within the Water Reserve.

#### **Limestone mining and quarrying**

There are extensive, high quality limestone resources in the Cape Range. Four mines are established or proposed near the Water Reserve. The mining tenements are shown on Figure 5.

#### *Department of Transport quarry*

This quarry was operated for the Department of Transport during the construction of the Exmouth Boat Harbour. Quarrying has now ceased.

#### *Whitecrest (E 08/885, M08/145, E08/885, L08/05)*

The Minister for the Environment conditionally approved a limestone mine on the lease.

The Water and Rivers Commission liaised closely with the proponent and Department of Environmental Protection during development of the proposal to establish conditions to minimise risks to water resources associated the operation.

#### *Alcoa (Finesky Holdings) - (M08/06)*

A Public Environmental Review was initiated by Finesky Holdings as part of the environmental impact assessment process for a mine proposal.

#### *Exmouth quarries and contracting - (M08/46, M08/62)*

These leases accommodate a small quarrying and screening operation providing construction materials for local users.

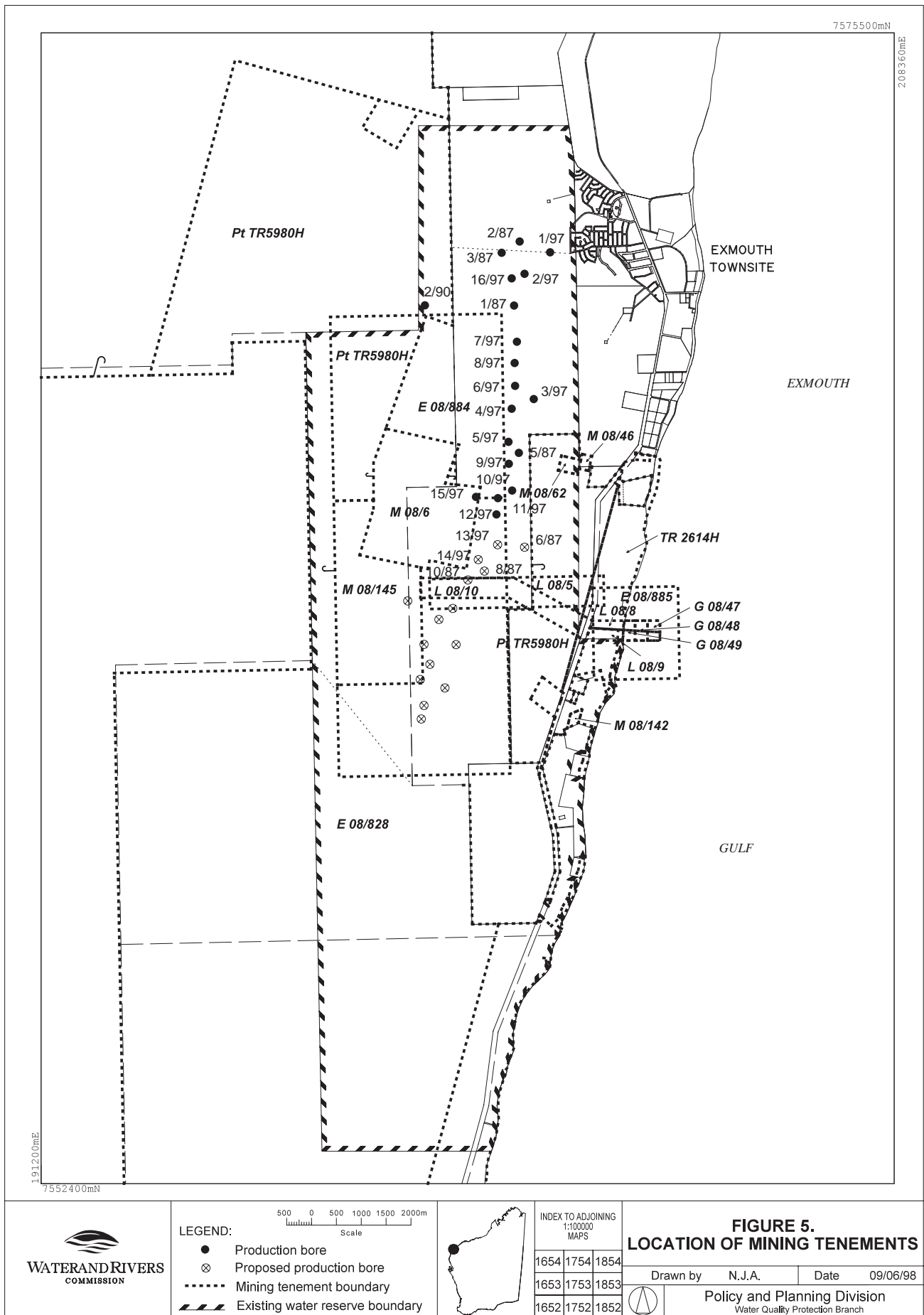
## 4.2 Proposed

### 4.2.1 The Exmouth Structure Plan

Due to increasing competition from different land uses and the need to coordinate development at Exmouth, the Exmouth - Learmonth Structure Plan was prepared by the Ministry for Planning. The structure plan builds on the *North West Cape and Adjacent Waters, Planning and Management Technical Working Paper No. 1* prepared by the Gascoyne Development Commission. The Structure Plan provides a framework for Exmouth's growth and balances the requirements of competing land uses.







**Figure 5. Location of mining tenements**



---

The structure plan identified demand for residential and rural living lots, industry, limestone mining with associated infrastructure, tourism, national defence and conservation estate management in proximity to the Exmouth Water Reserve.

Because of the significant demand for water and other land uses, the Exmouth Water Reserve must properly secure the recharge area for the public water supply wellfield without unnecessarily constraining other land.

The Structure Plan recognises and incorporates the requirements for water supply protection into the land use planning process. This is essential as sound land use planning provides the best mechanism to protect water resources from contamination by inappropriately sited land uses.

#### **4.2.2 Limestone mining**

A '5g' Reserve is proposed to be declared under the Conservation and Land Management Act over an area of high grade limestone south of the Exmouth Water Reserve. Within the 5g Reserve, land will be managed to accommodate limestone mining while protecting environmental values.

Limestone mining poses a significant risk to water resources, and water resources issues in the 5g Reserve are less sensitive than in the Water Reserve. Therefore, further mining leases are not appropriate in the Water Reserve and future mining leases should be concentrated in the 5g Reserve.

## **5. Potential for contamination**

The aquifer is highly vulnerable to contamination because of the karstic nature of the aquifer material. Karst features such as solution channels can provide conduits for the rapid transport of contaminants to the aquifer. The karst forms also make identification and prediction of the movement of contaminants extremely difficult.

Figure 6 shows potential point sources of contamination. These are discussed below.

## **5.1 Within or adjacent to the Water Reserve**

### **5.1.1 Wellfield infrastructure**

All bores are equipped with electric submersible pumps and do not pose a risk to groundwater quality.

Terrain in the wellfield area is rugged and access tracks are necessarily narrow with poor sight distances. To minimise potential for vehicle accidents, the Water Corporation regulates access to the Water Reserve. This strategy is supported. The accident risk can also be reduced by ongoing maintenance of access tracks.

### **5.1.2 Airfield**

The airfield is downgradient of the area proposed for wellfield extension. Fuel appears to be stored in an underground storage tank and in drums housed in the aircraft hangars. There are no provisions for containment of spillages during refuelling. Any spilt fuel could drain from the tarmac to the soil posing significant risks to water resources.

### **5.1.3 Qualing Scarp tip site**

The Qualing Scarp tip site is within the current Water Reserve but downgradient of proposed extensions to the wellfield. The site is used for disposal of domestic wastes and industrial wastes, septage and waste oils (Plate 2).

The WA Museum reached agreement with the Shire to stop disposal of waste oils to the site because of concerns regarding impacts of hydrocarbon contamination on stygofauna. At the time of field inspection, the practice was continuing, however the Shire advised alternative arrangements were being made. As hydrocarbon contamination poses a significant risk to the groundwater resources, it was important for these arrangements to be finalised.

The Shire indicated difficulties in preventing fires at the site. Combustion of tyres and other refuse has potential to release contaminants that could leach to the watertable. Therefore fire prevention should be considered an important component of the site's management strategy.





---

#### 5.1.4 Limestone quarries

Mining operations pose a risk to water resources as fuel, oils and solvents may be spilled to the ground during refuelling and servicing of vehicles, or from vehicle accidents. Additional risks arise from requirements for effluent disposal and increased access to the Water Reserve.

Lime processing could introduce additional contamination risks from the potential for leakage of lime to groundwater. Lime leakages may increase the pH of groundwater. This is probably of low significance for the quality of the public water supply but may pose a risk to stygofauna.

A number of mining tenements are established within the Water Reserve. It is recommended that any mining proposals on these should be formally assessed under the Environmental Protection Act. The Water and Rivers Commission should only support these proposals subject to preparation of detailed plans to

protect water resources. Lime processing is not supported within the Water Reserve. The environmental commitments for the Whitecrest mining proposal should be considered in assessing future mining proposals.

Future mining leases should be opposed within the Water Reserve as alternative limestone resources are available within the proposed '5g' Reserve. Water resources issues are less sensitive in this area.

#### 5.1.5 Emergencies

The Shire should be familiar with the WAHMEMS (Western Australian Hazardous Materials Emergency Management Scheme) procedures manual and have an understanding of the handling of hazardous materials that may be spilled. Shire personnel should have an understanding of the potential impacts of spills on the groundwater resource. Personnel required to respond to WAHMEMS situations should be adequately trained.



**Plate 2. Industrial waste tip face - Qualing Scarp**



---

## 5.2 Within the wellfield recharge area west of the existing Water Reserve

The groundwater capture zone of the wellfield extends west of the Water Reserve to a groundwater divide approximately coincident with the topographic divide of the Cape Range. Much of this area is in the Cape Range National Park or its proposed extensions. Development is limited to day visitor facilities at Shot Hole and Charles Knife canyons although small scale camping facilities may also be proposed in the area. The current development poses a low groundwater contamination risk with proper management.

## 5.3 East of the Water Reserve

As groundwater generally flows in an easterly direction from the Cape Range to Exmouth Gulf, groundwater contamination occurring east of the Water Reserve does not threaten the wellfield. It is still important to protect groundwater in this area because:

- stygofauna may be sensitive to contamination;
- groundwater is utilised for private abstraction;
- groundwater discharges to the Exmouth Gulf; and
- the karst features make the aquifer vulnerable to contamination and clean-up of contaminated groundwater, technically difficult and costly.

# 6. Proposed protection area

## 6.1 Proposed Water Reserve

There is significant competition for land in the Exmouth area. Therefore, it is essential to minimise the area reserved for water resources whilst ensuring the entire groundwater catchment for existing and proposed production bores is included.

The Water Corporation has rationalised the wellfield operating strategy including a wellfield extension. As a result, the Water Reserve can also be rationalised. The recommended Water Reserve is shown in **Figure 7**. Changes to the boundary are outlined below.

### *Western boundary*

The recharge area extends to the groundwater divide which roughly corresponds with the topographic divide for the Cape Range. This area should be included in the Reserve as the source is vulnerable to contamination and is predominantly National Park.

### *Southern boundary*

The Water Reserve already covers the proposed southern extension to the wellfield. Later extensions to the wellfield are also likely to be to the south. As this area is already inside the Water Reserve the current southern boundary is appropriate.

### *Eastern boundary*

As pumping rates from production bores are necessarily low, bore drawdowns are also low and there is limited potential for contaminants east of the wellfield impacting on production bores. Therefore, the eastern extent of the Water Reserve can be reduced in some areas. The recommended boundary maintains a buffer of about 1000 metres downgradient from production bores and is aligned to identifiable cadastre.

## 6.2 Priority classification

Water resources at Exmouth are vulnerable to contamination and the quantity of water available is limited. Therefore, the Water Reserve should be managed for Priority 1 source protection. The need to protect Exmouth's water supply should also be recognised by any planning strategies with the equivalent of a Water Catchments Reservation.

The Priority 1 classification means development in the Water Reserve will be limited. Compatible land uses in the Water Reserve include maintenance of native vegetation, continuation of the low intensity pastoral activities and national parks for conservation.





**FIGURE 7.**  
**PROPOSED EXMOUTH WATER RESERVE**

INDEX TO ADJOINING 1:100000 MAPS
1654 1754 1854
1653 1753 1853
1652 1752 1852

INDEX TO ADJOINING 1:100000 MAPS	Date
1654 1754 1854	06/06/00
1653 1753 1853	
1652 1752 1852	

Drawn by **N.J.A., D.R.A.**  
 Policy and Planning Division  
 Water Quality Protection Branch

Existing water reserve boundary  
 Proposed water reserve boundary  
 Priority source protection area  
 P1  
 Production bore  
 Proposed production bore

**WATER AND RIVERS  
 COMMISSION**

PP/WP/59015/0006/EX\_3-6-7-NEW

**Figure 7. Proposed Exmouth Water Reserve**



---

# Recommendations

1. The Water Reserve boundary should be amended as shown in **Figure 7**.
2. The Water Reserve should be managed for Priority 1 source protection.
3. Land planning strategies should recognise the Water Reserve with an equivalent zoning to a Water Catchments Reservation. The Exmouth Shire Council should incorporate the land use planning requirements for Priority 1 source protection areas into its Town Planning Scheme.
4. Any land use proposals in the Water Reserve should be referred to the Water and Rivers Commission for comment.
5. Disposal of oil to the Qualing Scarp tip site should cease.
6. The Exmouth Shire should consider how to limit fires at the Qualing Scarp tip site. A possible approach could be the installation of an enclosed incinerator for the burning of private papers.
7. Any future reviews of the Cape Range National Park Management Plan should consider groundwater protection objectives in the Exmouth Water Reserve.
8. Due to the rugged terrain in the wellfield all access tracks to the bores should be maintained in good condition to limit the potential for vehicle accidents.
9. The current arrangements for limiting vehicle access to the Exmouth Water Reserve should be maintained.
10. Signs should be erected in accordance with Water and Rivers Commission and Water Corporation standards to delineate the boundary of the Water Reserve.
11. Incidents covered by WESTPLAN – HAZMAT in the Exmouth Water Reserve should be addressed through the following measures:
  - The Local Emergency Management Advisory Committee (through the Karratha Emergency Management District) being familiar with the location and purpose of the Exmouth Water Reserve.
  - The locality plan for the Exmouth Water Reserve 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 Water Reserve.
  - 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 surface water resource.
12. Future mining leases should be opposed within the Water Reserve. The Water and Rivers Commission should support establishment of the proposed ‘5g’ Reserve and support granting of mining tenements within this area. Establishment of limestone mines on existing mining tenements should only be supported subject to detailed environmental impact assessment demonstrating best practice to protect water resources. Associated lime processing facilities should not be supported within the Water Reserve.
13. Implementation of the recommendations in this Water Source Protection Plan should be reviewed annually. The Water Source Protection Plan should be reviewed after 5 years.





# Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of the Water Reserve	Program Manager, Protection Planning (WRC)	2000-01
2.	Management for Priority 1 source protection	<ul style="list-style-type: none"> <li>• WRC</li> <li>• Water Corporation (as delegated)</li> <li>• Supported by Shire of Exmouth</li> </ul>	Ongoing
3.	Ensure Town Planning Scheme is compatible with water quality protection objectives for the Exmouth Water Reserve	Shire of Exmouth	At time of Town Planning Scheme review.
4.	Refer all rezoning, subdivision and development proposals within the Water Reserve to the WRC	<ul style="list-style-type: none"> <li>• Shire of Exmouth</li> <li>• Ministry for Planning</li> <li>• Water Corporation</li> <li>• Other statutory agencies</li> </ul>	Ongoing
5.	Ensure disposal of oil to Qualing scarp tip site has ceased	Shire of Exmouth	Immediately
6.	Investigate approaches to limit fires at the Qualing Scarp tip site	Shire of Exmouth	Immediately
7.	Consider recommendations of this report in management planning for the Cape Range National Park	CALM	At time of preparation of management plan
8.	Maintain access tracks in good condition	Water Corporation	Ongoing

## Implementation strategy continued

9.	Manage vehicle access to Water Reserve	Water Corporation under delegation from WRC and CALM	Ongoing
10.	Erect signs identifying the Water Reserve and water source protection requirements	<ul style="list-style-type: none"> <li>• WRC (Mid-West Gascoyne Region)</li> <li>• Water Corporation</li> </ul>	Immediately after standards for signs in Water Reserves are completed
11	<p>Incidents covered by WESTPLAN – HAZMAT in the Exmouth Water Reserve should be addressed through the following measures:</p> <p>(i) the Local Emergency Management Advisory Committee (through the Karratha Emergency Management District) being familiar with the location and purpose of the Exmouth Water Reserve</p> <p>(ii) the locality plan for the Exmouth Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team</p> <p>(iii) the Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the Exmouth Water Reserve</p> <p>(iv) personnel dealing with WESTPLAN – HAZMAT incidents in the area are given ready access to a locality map of the Exmouth Water Reserve and training to understand the potential impacts of spills on the surface water source</p>	<p>(i) Local Emergency Management Advisory Committee (through the Karratha Emergency Management District).</p> <p>(ii) WRC (Mid-West Gascoyne Region).</p> <p>(iii) Water Corporation</p> <p>(iv) Local Emergency Management Advisory Committee</p>	<p>(i) 2000-01</p> <p>(ii) 2000-01</p> <p>(iii) ongoing</p> <p>(iv) ongoing</p>
12	Support establishment of a '5g' Reserve for conservation and limestone mining in the area where water resources are least vulnerable and recommend mining proposals be consistent with the approach outlined in recommendation 12	WRC	Ongoing
13	<p>Review</p> <p>i) These recommendations</p> <p>ii) This plan</p>	<p>WRC</p> <p>WRC</p>	<p>Annually</p> <p>Review plan after 5 years</p>

---

# References

Colman, R. (1994) *Exmouth Scheme Review*, Colman Groundwater for the Water Authority of Western Australia.

Forth, J. R. (1972) *Exmouth Water Supply, Western Australia*, Geological Survey of Western Australia Annual Report, 1972.

Gascoyne Development Commission (1997) *North West Cape and Adjacent Waters, Planning and Management*, Technical Working Paper No. 1, March 1997.

Martin, M. W. (1990) *Exmouth Town Water Supply – Investigation Report and Recommendations for Future Work*. Geological Survey of Western Australia Hydrogeology Report No. 1991/28.

Shire of Exmouth (1994) *Management and Environmental Impact Plan for the Establishment and Operation of the Qualing Scarp Waste Disposal Facility*, June 1994.

Water Authority (1995) *Extensions to Exmouth Water Supply Wellfield- Consultative Environmental Review*, Report No WP 225, June 1995.

Western Australian Planning Commission (1998) *Exmouth – Learmonth (North West Cape) Structure Plan*, December 1998.



---

# Glossary

<b>Abstraction</b>	Pumping groundwater from an aquifer.
<b>Aquifer</b>	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
<b>Bore</b>	A narrow, lined hole drilled to monitor or withdraw groundwater.
<b>Catchment</b>	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
<b>Effluent</b>	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
<b>Groundwater</b>	Water which occupies the pores and crevices of rock or soil.
<b>Hydrogeology</b>	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
<b>Pollution</b>	Water pollution occurs when waste products or other substances, eg. effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical, biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.
<b>Recharge</b>	Water infiltrating to replenish an aquifer.
<b>Recharge Area</b>	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.
<b>Runoff</b>	Water that flows over the surface from a catchment area, including streams.
<b>Unconfined Aquifer</b>	An aquifer containing water, the upper surface of which is lower than the top of the aquifer. The upper surface of the groundwater within the aquifer is called the watertable.
<b>Underground Water Pollution Control Area (UWPCA)</b>	An area defined under the Metropolitan Water Supply, Sewerage and Drainage Act, in which restrictions are put on activities that may pollute the groundwater.
<b>Water Quality</b>	The physical, chemical and biological measures of water.
<b>Watertable</b>	The upper saturated level of the unconfined groundwater.
<b>Wellfield</b>	A group of bores to monitor or withdraw groundwater.



---

# Appendices

## Appendix 1: Land use compatibility in Public Drinking Water Source Areas



## Water Quality Protection Note

---

# LAND USE COMPATIBILITY IN PUBLIC DRINKING WATER SOURCE AREAS

### Purpose

To provide information on land use and activities that may impact on the quality of the State's water resources.

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

### Scope

These notes apply to proposed and existing 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*.

### Preamble

The following notes reflect the Commission's current position. They are recommendations only, and may be varied at the discretion of the Commission.

### Overview of 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 bores 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 objectives**

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](http://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 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.

*Incompatible*        The land use is incompatible 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.

*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 attached 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 <sup>14</sup>	Incompatible	Incompatible <sup>7</sup>	Conditional <sup>7</sup>
Apiaries on Crown land	Conditional	Conditional	Conditional
Aquaculture eg. crustaceans, fish, algae farms	Incompatible	Conditional	Conditional
Dairy sheds	Incompatible	Incompatible <sup>11,15</sup>	Conditional <sup>15</sup>
Feedlots	Incompatible	Incompatible	Conditional
Livestock grazing - pastoral leases	Conditional	Compatible	Compatible
Livestock grazing - broad acre (extensive)	Incompatible	Conditional <sup>11</sup>	Compatible
Livestock grazing (intensive)	Incompatible	Incompatible	Conditional <sup>11</sup>
Piggeries	Incompatible	Incompatible	Incompatible
Poultry farming (housed)	Incompatible	Conditional	Conditional
Stables	Incompatible	Conditional	Compatible

### AGRICULTURE - PLANTS

Land use	Priority 1	Priority 2	Priority 3
Broad acre cropping i.e. non-irrigated	Incompatible	Conditional <sup>1</sup>	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
Turf farms	Incompatible	Incompatible	Conditional
Viticulture (wine & table grapes)	Incompatible	Conditional	Compatible



---

**DEVELOPMENT - COMMERCIAL**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Aircraft servicing	Incompatible	Incompatible	Conditional <sup>6</sup>
Airports or landing grounds	Incompatible	Incompatible	Conditional <sup>6</sup>
Amusement centres	Incompatible	Incompatible	Compatible <sup>6</sup>
Automotive businesses	Incompatible	Incompatible	Conditional <sup>6</sup>
Boat servicing	Incompatible	Incompatible	Conditional <sup>6</sup>
Catteries	Incompatible	Compatible	Compatible
Caravan and trailer hire	Incompatible	Incompatible	Conditional <sup>6</sup>
Consulting rooms	Incompatible	Incompatible <sup>7</sup>	Compatible <sup>6</sup>
Concrete batching and cement products	Incompatible	Incompatible	Conditional
Cottage Industries	Conditional	Conditional	Compatible
Dog kennels	Incompatible	Conditional	Conditional
Drive-in / take-away food shops	Incompatible	Incompatible	Compatible <sup>6</sup>
Drive-in theatres	Incompatible	Incompatible	Compatible <sup>6</sup>
Dry cleaning premises	Incompatible	Incompatible	Conditional <sup>6</sup>
Farm supply centres	Incompatible	Incompatible <sup>7</sup>	Conditional
Fuel depots	Incompatible	Incompatible	Conditional
Garden centres	Incompatible	Incompatible	Compatible
Laboratories (analytical , photographic)	Incompatible	Incompatible	Conditional <sup>6</sup>
Markets	Incompatible	Incompatible	Compatible <sup>6</sup>
Mechanical servicing	Incompatible	Incompatible	Conditional <sup>6</sup>
Metal production / finishing	Incompatible	Incompatible	Incompatible
Milk transfer depots	Incompatible	Incompatible	Conditional
Pesticide operator depots	Incompatible	Incompatible	Incompatible
Restaurants and taverns	Incompatible	Incompatible	Compatible <sup>6</sup>
Service stations	Incompatible	Incompatible	Conditional <sup>6</sup>
Shops and shopping centres	Incompatible	Incompatible <sup>7</sup>	Compatible <sup>6</sup>
Transport depots	Incompatible	Incompatible	Conditional
Vehicle parking (commercial)	Incompatible	Incompatible	Compatible
Vehicle wrecking and machinery	Incompatible	Incompatible	Conditional
Veterinary clinics / hospitals	Incompatible	Incompatible <sup>7</sup>	Conditional <sup>6</sup>

**DEVELOPMENT - INDUSTRIAL**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Heavy industry	Incompatible	Incompatible	Incompatible
Light or general industry	Incompatible	Incompatible	Conditional <sup>6</sup>
Power stations	Incompatible	Incompatible	Incompatible



---

**DEVELOPMENT - URBAN**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Aged and dependent persons group dwellings	Incompatible	Incompatible	Compatible <sup>6</sup>
Cemeteries	Incompatible	Incompatible	Conditional
Civic buildings	Incompatible	Conditional <sup>7</sup>	Compatible <sup>6</sup>
Clubs -sporting or recreation	Incompatible	Conditional	Compatible <sup>6</sup>
Community halls	Incompatible	Conditional <sup>7</sup>	Compatible
Family day care centres	Incompatible	Incompatible <sup>7</sup>	Compatible <sup>6</sup>
Funeral parlours	Incompatible	Incompatible	Compatible <sup>6</sup>
Health centres	Incompatible	Incompatible	Compatible <sup>6</sup>
Hospitals	Incompatible	Incompatible	Conditional <sup>6</sup>
Medical centres	Incompatible	Incompatible	Compatible <sup>6</sup>
Toilet blocks and change rooms	Incompatible <sup>7</sup>	Conditional	Compatible

**EDUCATION / RESEARCH**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Community education centres	Conditional <sup>7</sup>	Conditional <sup>7</sup>	Compatible <sup>6</sup>
Primary / secondary schools	Incompatible	Incompatible	Compatible <sup>6</sup>
Scientific research	Conditional	Conditional	Compatible
Tertiary education facilities	Incompatible	Incompatible	Conditional <sup>6</sup>

**MINING AND MINERAL PROCESSING**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Extractive industries (sand mining, quarries)	Conditional <sup>2</sup>	Conditional <sup>2</sup>	Conditional <sup>2</sup>
Mineral exploration	Conditional <sup>4</sup>	Conditional <sup>4</sup>	Conditional <sup>4</sup>
Mining	Conditional <sup>4</sup>	Conditional <sup>4</sup>	Conditional <sup>4</sup>
Mineral processing	Incompatible	Incompatible	Conditional <sup>4</sup>
Tailings dams	Incompatible	Incompatible	Conditional <sup>4</sup>

**PROCESSING OF ANIMALS / ANIMAL PRODUCTS**

<b>Land use</b>	<b>Priority 1</b>	<b>Priority 2</b>	<b>Priority 3</b>
Animal product rendering works	Incompatible	Incompatible	Incompatible
Abattoirs	Incompatible	Incompatible	Incompatible
Dairy product factories	Incompatible	Incompatible	Conditional <sup>6</sup>
Food processing	Incompatible	Incompatible	Conditional <sup>6</sup>
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 <sup>6</sup>
Composting / soil blending (commercial)	Incompatible	Incompatible	Conditional
Vegetable / food processing	Incompatible	Incompatible	Conditional <sup>6</sup>
Wineries	Incompatible	Incompatible	Conditional

**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 <sup>8,9</sup>	Conditional <sup>8</sup>
Special rural subdivision to a lot size between 1 and 2 ha	Incompatible	Incompatible	Conditional <sup>8,9</sup>
Special rural subdivision to a lot size less than 1 ha	Incompatible	Incompatible	Incompatible
Urban subdivision	Incompatible	Incompatible	Compatible <sup>6</sup>
Industrial subdivision	Incompatible	Incompatible	Conditional <sup>6</sup>

**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 <sup>1</sup>
Motor sports ie permanent racing facilities	Incompatible	Incompatible	Conditional
Public swimming pools	Incompatible	Incompatible	Conditional
Recreational parks -irrigated	Incompatible	Incompatible	Conditional <sup>1</sup>
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 <sup>16</sup>	Compatible
Caravan parks	Incompatible	Incompatible	Conditional <sup>6</sup>
Farm stay accommodation	Incompatible	Conditional <sup>16</sup>	Compatible
Motels, hotels, lodging houses, hostels	Incompatible	Incompatible	Compatible <sup>6</sup>

**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 <sup>17</sup>	Conditional

### **OTHER DEVELOPMENTS**

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

#### **Table reference notes:**

1. Conditions may limit fertiliser and pesticide application.
2. Conditions cover the storage of fuels and chemicals and the depth of mining in relation to the watertable with strict guidelines for rehabilitation.
3. Conditions cover the storage and use of fuel and other chemicals.
4. Conditions placed via the mining lease and / or environmental 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. Only permitted if this use is incidental to the overall land use in the area and consistent with 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 capability 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 larger 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.



---

# Publication feedback form

The Water and Rivers Commission welcomes feedback to help us to improve the quality and effectiveness of our publications. Your assistance in completing this form would be greatly appreciated.

Please consider each question carefully and rate them on a 1 to 5 scale, where 1 is poor and 5 is excellent (*please circle the appropriate number*).

**Publication title** .....

*How did you rate the quality of information?*

1            2            3            4            5

*How did you rate the design and presentation of this publication?*

1            2            3            4            5

*How can it be improved?*

.....  
.....  
.....

*How effective did you find the tables and figures in communicating the data?*

1            2            3            4            5

*How can they be improved?*

.....  
.....  
.....

*How did you rate this publication overall?*

1            2            3            4            5

*If you would like to see this publication in other formats, please specify. (Eg. CD)*

.....

*Please cut along the dotted line on the left and return your completed response to:*

**Publications Coordinator  
Water and Rivers Commission  
Level 2, Hyatt Centre  
3 Plain Street  
East Perth WA 6004  
Fax: (08) 9278 0704**

