



Government of **Western Australia**
Department of **Water**

Murray

groundwater allocation plan



Looking after all our water needs

Water resource allocation
planning series
Report no 22
April 2012



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Message from the Minister



The Peel region is the fastest growing regional area in Western Australia. *The Murray groundwater allocation plan* delivers certainty about groundwater availability for this rapid growth – it clearly identifies there is water available, where it is available from and how to access it through licensing.

Mining, construction, agriculture, and residential development already utilise groundwater to contribute to the economy of the region. The internationally important Peel Inlet - Harvey Estuary system and associated wetlands are also groundwater-dependent.

There are considerable water management challenges to overcome for development in this low lying land. I see this plan as an important tool to integrate land and water planning. It complements the recently released *Murray drainage and water management plan* and opens opportunities for fit-for-purpose reuse of drainage water.

I am satisfied this plan provides an important balance between the water use needs for regional growth and the needs of the environment and existing groundwater users.

A handwritten signature in black ink that reads "Bill Marmion". The signature is written in a cursive, flowing style.

Hon Bill Marmion MLA, BEng, MBA
Minister for Environment; Water



Contents

Message from the Minister	iii
Summary	vii
1 Plan context and scope	1
1.1 Purpose of the plan	1
1.2 The plan area	1
1.3 Groundwater resources covered	2
1.4 Plan timeframe	4
1.5 Scope of the plan	4
1.6 Main stakeholder interests	4
2 What the plan will achieve	10
2.1 Outcomes	10
2.2 Objectives	11
2.3 How the plan will meet the objectives	11
3 Water allocation limits	12
3.1 Components of the allocation limit	13
3.2 Water that is left in the system	13
3.3 Allocation limits	14
4 Water allocation and licensing approach	15
4.1 Legislative requirements	15
4.2 Approach to water licensing	16
4.3 Licensing policy for the Murray groundwater area	18
5 Groundwater monitoring	22
5.1 Current program	22
5.2 Review of the monitoring program	25
6 Implementing and evaluating the plan	26
6.1 Actions	26
6.2 Evaluating the plan	28
Appendices	31
Appendix A — Salinity maps and hydrogeological cross-sections	32
Appendix B — Map information and disclaimer	38
Glossary	39
Volumes of Water	40
List of shortened forms	40
References	41

Contents

Figures

Figure 1	The Murray groundwater area and subarea boundaries	3
Figure 2	Unconfined shallow aquifers in the plan area	5
Figure 3	Deeper aquifers in the plan area	6
Figure 4	Planning boundaries for the Murray groundwater allocation plan and the Murray drainage and water management plan	9
Figure 5	State reference network bores actively monitored as at 2009 in the Murray groundwater area	24

Tables

Table 1	Allocation limits and components in the Murray groundwater area	14
Table 2	Local policies specific to the Murray groundwater area	18
Table 3	Department of Water state-wide strategic and operational policies that apply in the Murray groundwater area	20
Table 4	Department of Water monitoring bores in the Murray groundwater area 2009	22
Table 5	Additional actions to implement the Murray groundwater allocation plan	26
Table 6	Performance indicators for measuring against the plan objectives	28



Summary

Murray groundwater allocation plan

The Department of Water is responsible for allocating and licensing abstraction of Western Australia's water resources on behalf of the Minister for Water. The department use water allocation plans to manage how water is abstracted from surface and groundwater systems.

Purpose of the Murray groundwater allocation plan

This allocation plan is the first to be completed for the Murray groundwater resources. The department prepared this plan to:

- replace allocation limits set in 1998 using up-to-date information
- integrate land and water planning
- maximise the volume of fit-for-purpose water available to support water use development.

The department developed the plan in response to land-use planning information predicting population growth and urban development in the north of the plan area. This plan is one of a state-wide series of water allocation plans setting out the department's approach to managing renewable water resources in areas where the level of water use is increasing.

This plan sets out allocation limits, how water for the environment is accounted for, our approach to water allocation and licensing policy for the Murray groundwater area.

Water availability

As at April 2012 approximately 40 GL of water is available for licensing in 13 out of the 15 resources in the Murray groundwater area.

Most of the available water is from the superficial aquifer. However, bore yields are generally low and suited to small scale distributed abstraction from this aquifer. Groundwater quality ranges from brackish to saline in all aquifers. The Leederville aquifer is close to fully allocated in the Nambeelup and Coolup subareas. Water is available from all aquifers in the Pinjarra and Waroona subareas. Current entitlements and the percentage of the total volume licensed is for; mining and industry 48%; agriculture 26%; parks and conservation 10%; commercial, including public water supply 11%; backyard bores (self-supply) 5%.

Additional water-use development in fully-allocated areas may be accommodated through water-use efficiency measures and/or trading. Refer to the water register on our website at <www.water.wa.gov.au> for up-to-date information on water availability.

Allocation and licensing approach

In Western Australia water licences are the regulatory instrument issued under the *Rights in Water and Irrigation Act 1914* to manage individual abstraction.

Summary continues

The *Murray groundwater allocation plan* guides allocation and licensing in the Murray groundwater area. Licence entitlements will be issued up to the allocation limits set for each groundwater resource using the licensing policies outlined in Section 4. After seven years from when it was released for public comment the plan will be reviewed and may be replaced.

Allocation planning and drainage

Residential and economic development in the Murray groundwater area faces the dual challenges of extensive areas of seasonally inundated land and limited availability of good quality groundwater. Innovative water management and alternative water sources will need to be established to overcome these difficulties in parallel with growth.

The *Murray drainage and water management plan* is a guide for reducing the risk of flooding and inundation in urban development. It promotes fit-for-purpose use of drainage and stormwater by incorporating it into the urban water cycle via storage in winter for use in summer. The drainage plan applies to the superficial aquifer only and technical studies refer to drainage and flood management in the Nambeelup subarea, in the north of the Murray groundwater area.

Together this allocation plan and the drainage plan support the integration of water and land-use planning at a district and regional scale.

Updating the plan using the public submissions

The department received twelve submissions on the *Murray groundwater allocation plan: for public comment*. Our response to these submissions and an explanation of how we used the comments to update the plan is described in *Statement of response – Murray groundwater allocation plan*.

Chapter One

Plan context and scope

The Department of Water has developed the *Murray groundwater allocation plan* to specify how abstraction and use of groundwater will be managed and to guide how water licensing decisions will be made in the Murray groundwater area. The plan sets updated allocation limits from those originally set in 1998.

Current entitlements and the percentage of the total volume licensed is for; mining and industry 48%; agriculture 26%; parks and conservation 10%; commercial, including public water supply 11%; backyard bores (self supply) 5%.

1.1 Purpose of the plan

The purpose of the plan is to maximise the volume of water available to support regional growth, without reducing reliability to existing users or damaging groundwater-dependent ecosystems. The plan will be an important reference tool for land-use planning given the proposed regional growth.

The development of this allocation plan and the review of the 1998 allocation limits was triggered by:

- the observed drying climate trend in the south-west of Western Australia
- the limited availability of water from some aquifers in the plan area
- the potential for increased risk to groundwater quality (salinity

and acidity) and groundwater-dependent ecosystems from increased abstraction

- the proposed development in the Peel region.

There are two supporting documents to provide further information on the plan area and explain the method used to set the allocation limits:

- *Murray groundwater allocation limits method report* (DoW 2012a)
- *Murray groundwater area: subarea reference sheets* (DoW 2012b).

They can be accessed on our website at www.water.wa.gov.au.

1.2 The plan area

Location

The Murray groundwater area is located approximately 50 km south of Perth and covers approximately 1050 km². Most of the plan area is in the Shire of Murray, but the southern portion is in the Shire of Waroona (Figure 1).

Proclamation

Because the Murray groundwater area is proclaimed, commercial water users require a licence to lawfully abstract groundwater under Section 5C of the *Rights in Water and Irrigation Act 1914*.

The Mandurah groundwater area was proclaimed on 19 March 1976 under Part III, Division 3, Section 26B of the *Rights in Water and Irrigation Act 1914*. The groundwater area name was changed to the Murray groundwater area by a variation of the proclamation on 15 October 1976. The groundwater area boundary was modified by a subsequent variation on 29 June 1988 with the addition of further land to the north and south of the original boundary.

1.3 Groundwater resources covered

The Murray groundwater area is divided into four subareas for allocation planning and licensing purposes:

- Nambeelup
- Coolup
- Pinjarra
- Waroona.

The subarea boundaries are based on hydrological features including the Serpentine River, Murray River, Harvey River, Peel Inlet and Harvey Estuary as well as cadastral boundaries (Figure 1).

In the plan area there are four sedimentary aquifers and a fractured rock aquifer system along the Darling Scarp. The four sedimentary aquifers, in order of increasing depth, are the superficial, Rockingham Sand, Leederville and Yarragadee aquifers. The aquifer boundaries used to define the groundwater resources for this plan are shown in Figure 2 and Figure 3.

The department defines a 'groundwater resource' as being a particular aquifer in a particular subarea and sets an allocation limit for each groundwater resource.

The superficial and Rockingham Sand aquifers are hydraulically connected and are managed as a single groundwater resource called the Perth-Superficial Swan.

The Leederville aquifer is divided into the upper and lower Leederville units based on the green clay marker and is managed as two separate groundwater resources.

The Yarragadee aquifer is a multilayered aquifer system. The Cattamarra Coal Measures is the main Yarragadee aquifer unit in the Murray groundwater area. Where bore logs indicate the Cattamarra Coal Measures unit, licences are assigned to the Cattamarra Coal Measures North groundwater resource.

In the superficial and Leederville aquifers a saltwater interface exists along the western boundary of the plan area. Water quality varies considerably between resources and subareas, ranging from brackish to saline. High nutrient levels are encountered in the superficial aquifer, a legacy of past agricultural practices in the area.

The *Murray groundwater area: subarea reference sheets* (DoW 2012b) contain more information about the hydrogeology in the plan area.

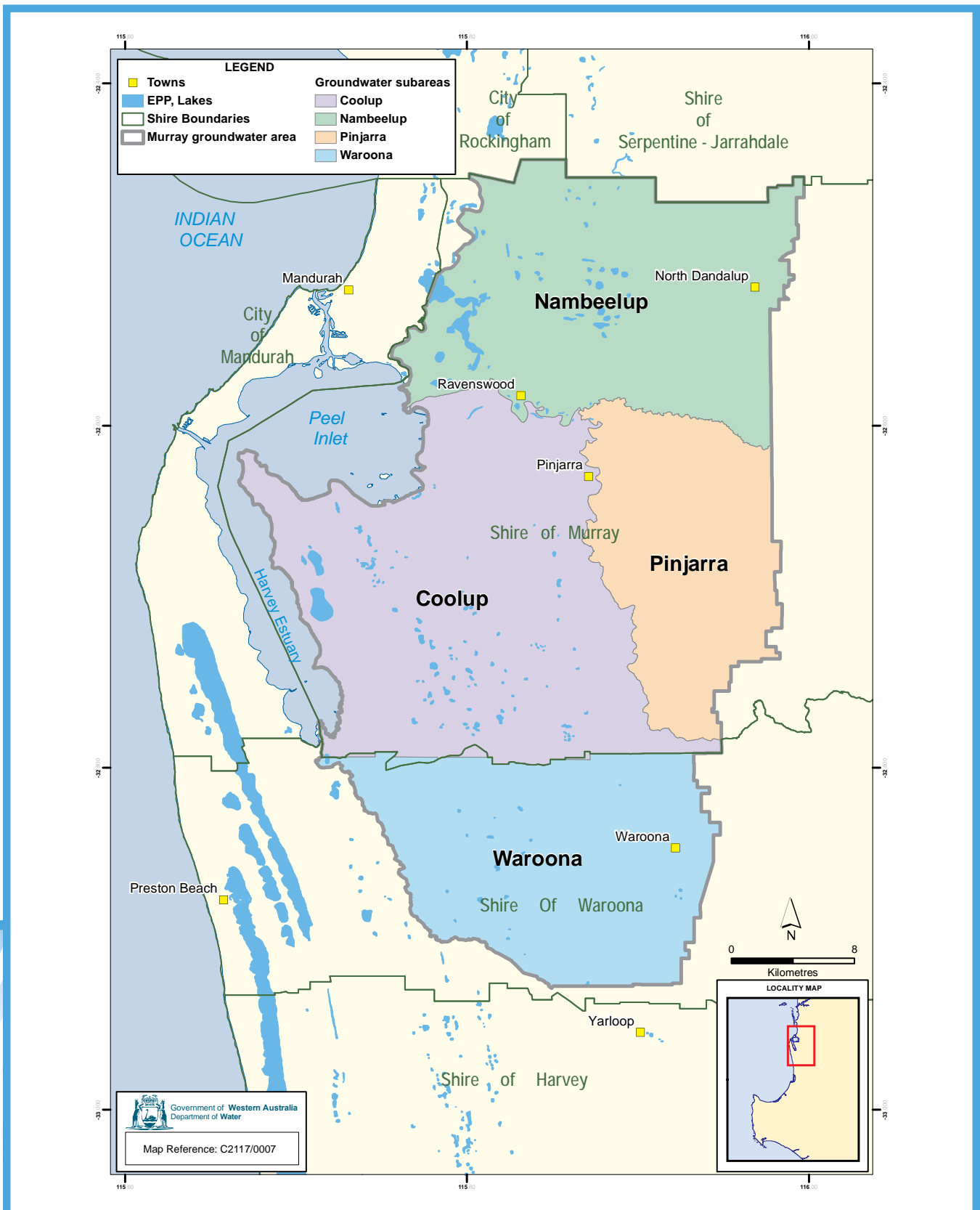


Figure 1
The Murray groundwater area and subarea boundaries
Murray groundwater allocation plan

1.4 Plan timeframe

The *Murray groundwater allocation plan* is implemented from the day it is endorsed by the Minister for Water. The allocation limits came into effect on 18 April 2010 when the plan was released for public comment.

It will remain in effect for seven years after which it will be reviewed and may be replaced. It may be amended or revoked by the Minister for Water or replaced sooner if it is identified as necessary through the annual evaluation process.

1.5 Scope of the plan

Current water demand in the plan area is mostly less than 70% of the licensable allocation limit for each resource. This standard water allocation plan is the Department of Water's response to this level of demand. For a standard plan the allocation limits are set using existing information and the department use these limits as the main tool to manage existing water use, future demand and groundwater-dependent ecosystems.

The *Murray groundwater allocation plan* is non-statutory. It guides licensing under the *Rights in Water and Irrigation Act 1914* by setting out:

- the allocation planning boundaries
- allocation limits to replace those set in 1998
- broad outcomes and specific objectives for the plan area

- approach to managing groundwater through local and state-wide policies
- how we will implement, evaluate and review the plan.

The plan does not:

- address the protection of drinking water sources, flooding, drainage or land planning issues¹
- address water quality management. This is addressed in *Water quality improvement plan for the rivers and estuary of the Peel-Harvey system – phosphorus management* (EPA 2008).

1.6 Main stakeholder interests

Groundwater-dependent ecosystems

The Peel Inlet and Harvey Estuary forms the western boundary of the Murray groundwater area. The estuary system, rivers and wetlands in the area are of regional, state and international importance. They are managed and protected by state, federal and international legislation as well as by state environmental policies, including:

- Environmental Protection Authority System 6 report (EPA 1983)
- Swan Coastal Plain lakes environmental protection policy (EPA 1992b)

¹ These issues are addressed through other plans developed by the Department of Water and can be accessed via our website www.water.wa.gov.au or by contacting the Kwinana Peel regional office in Mandurah.

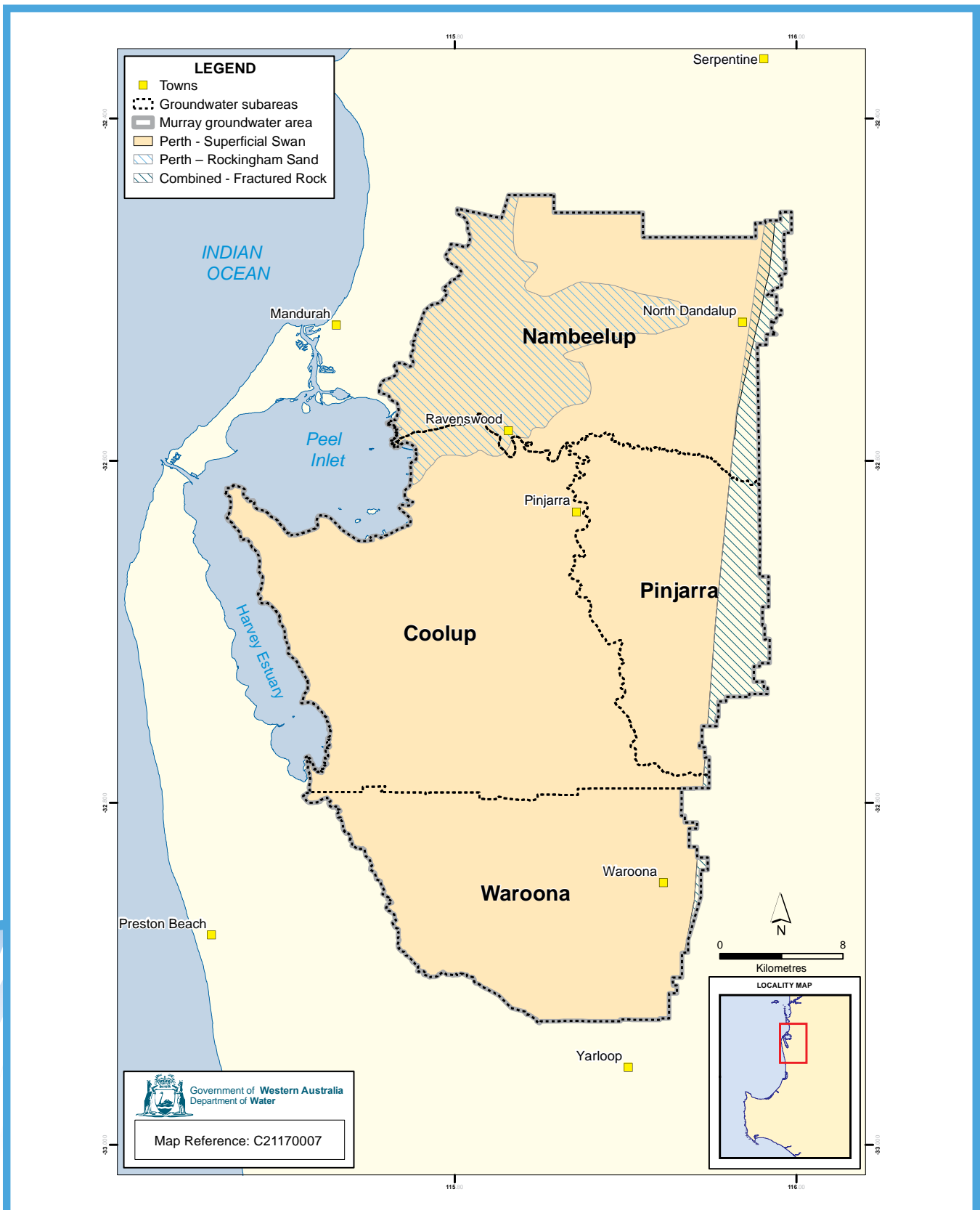


Figure 2
Unconfined shallow aquifers in the plan area
Murray groundwater allocation plan

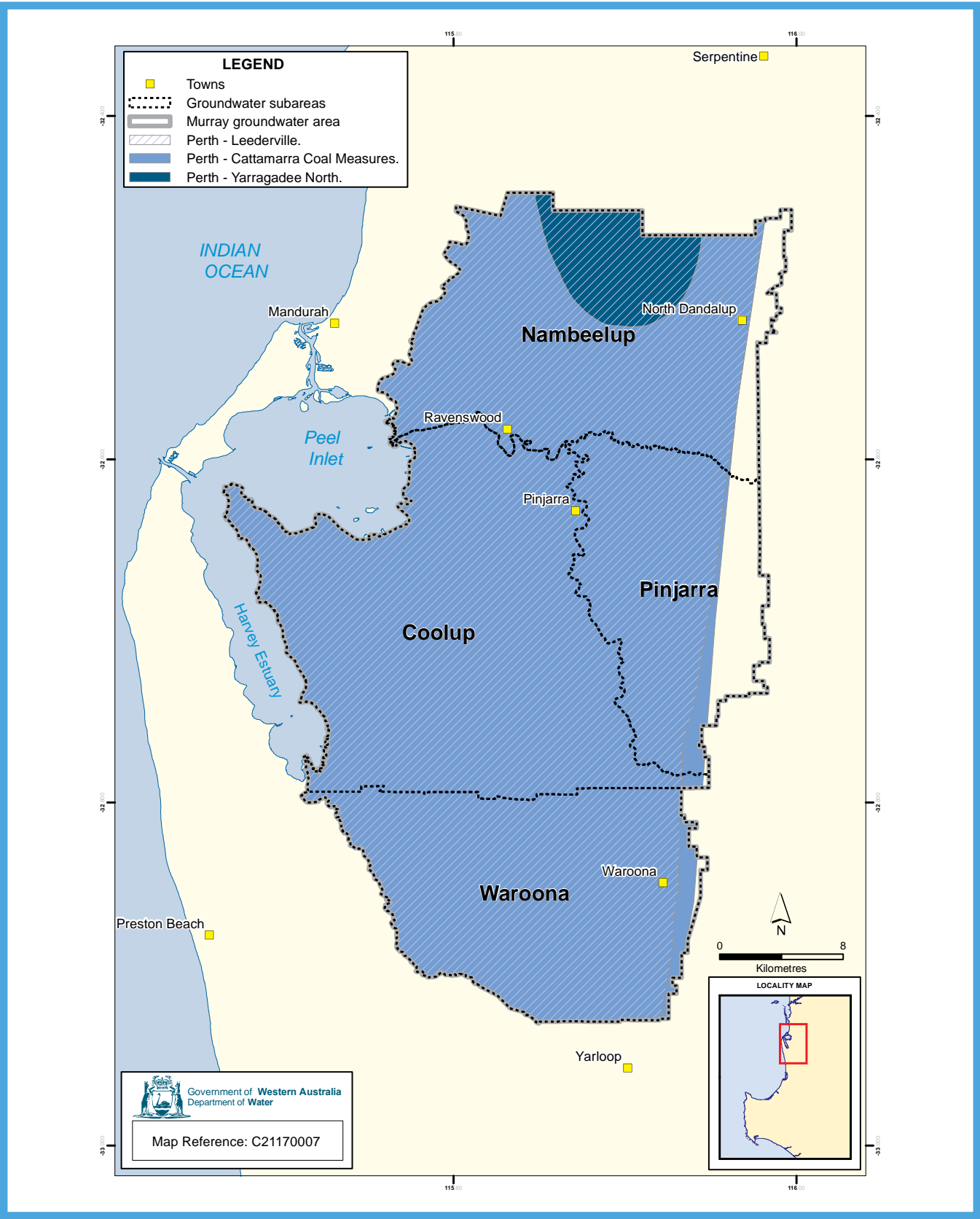


Figure 3
Deeper aquifers in the plan area
Murray groundwater allocation plan

- Peel-Harvey estuarine system environmental protection policy (EPA 1992a)
- *Wetlands of the Swan Coastal Plain* (geomorphic database for wetlands of the Swan Coastal Plain) (Hill et al 1996).
- Convention on wetlands of international importance especially as waterfowl habitat (Ramsar convention of wetlands) (UNESCO 1971).

In the Murray groundwater area the water needs of groundwater-dependent ecosystems is managed by licensing water abstraction up to the allocation limits (Chapter 3). Abstraction is managed at a local scale through licences. The licence assessment process is guided by strategic and operational policies, guidelines and local licensing rules (Chapter 4).

For information on the method used to set the allocation limits and how water for the environment was met see the allocation limits method report.

Integrated land and water planning

The Murray groundwater area is characterised by naturally occurring shallow groundwater in the superficial aquifer and extensive areas of seasonally inundated land in winter. In summer, water levels decline and the inundated land dries out. Generally, bore yields from the superficial aquifer are low and water quality is poor. The aquifer is suited to small scale distributed abstraction for agricultural and industrial purposes.

These water management problems mean the plan area has previously been bypassed for urban development. However, continued population growth in the Peel region has increased the pressure for urban development in the Murray groundwater area. Strategic planning for development in the region is outlined in the *Southern metropolitan and Peel subregional structure plan* (WAPC 2009) which is consistent with *Directions 2031 spatial framework*. (WAPC 2010).

State planning policy 2.9: Water resources (WAPC 2006) and *Better urban water management* (WAPC 2008) identify the process by which land and water planning are integrated. They illustrate what information proponents are required to include in water management strategies and plans at each stage of the land planning process.

The *Murray groundwater allocation plan* is a regional scale water management plan and informs land use planning at the regional scheme level. It supports water use development by providing information on:

- the groundwater resources and water availability
- how the abstraction of groundwater will be licensed and regulated
- how development in fully-allocated areas can be accommodated through options such as increased water use efficiency and trading.

1

Plan context and scope

The *Murray drainage and water management plan* (DoW 2011) is a guide to managing shallow groundwater. It will assist proponents to prepare water management strategies and plans at each stage of the statutory land planning process and in accordance with *Better urban water management* (WAPC 2008).

The principles and strategies in the drainage plan relate to management of flooding, stormwater, water-dependent ecosystems, nutrient and pollutant export and the interaction between surface water and groundwater. Technical studies for the drainage plan were undertaken in the Nambeelup subarea of the Murray groundwater area, where development is proposed.

Drainage will be necessary to allow development in the plan area to proceed and reduce the risk of flooding and inundation after development is complete. Reuse options developed for drainage and stormwater could provide fit-for-purpose water to meet demand in summer if the groundwater resources, managed through this allocation plan, become fully allocated.

The Department of Water recognises the need for further policy on assessment and potential licensing of drainage water reuse options. It is a new area of water management in the state which is progressing and is discussed in relation to the Murray groundwater area in sections 4.2 and 6.1 of this plan.

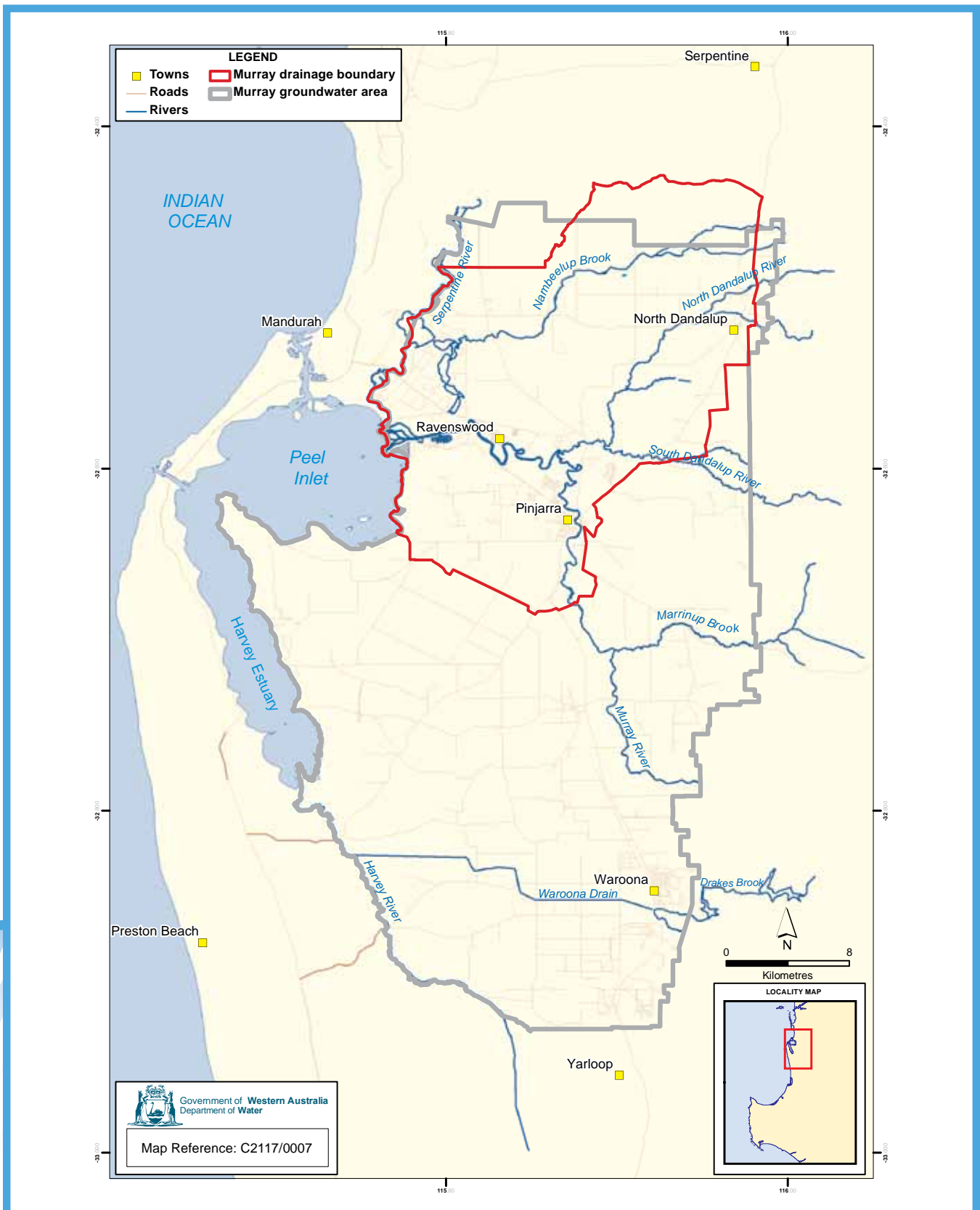


Figure 4
Planning boundaries for the *Murray groundwater allocation plan* and the *Murray drainage and water management plan*

Chapter Two

What the plan will achieve

The purpose of the *Murray groundwater allocation plan* is to support water use development in the plan area, without reducing reliability to existing users or damaging in situ values and groundwater-dependent ecosystems.

In this report, the outcomes are the broad scale and long-term results of implementing this plan. The objectives are the shorter term goals that will contribute to achieving the outcomes. The allocation limit decision made for each resource was guided by the outcomes and objectives below.

The outcomes and objectives for this plan were developed by considering:

- the strategic land-use planning for the Peel region
- the volume of current licence entitlements and how water is used
- the predicted future demand and changes in water use.

2.1 Outcomes

The desired outcomes of this plan are to:

- a maximise the volume of fit-for-purpose groundwater to support water use development
- b protect in situ values and groundwater-dependent ecosystems
- c integrate land and water planning in the Murray groundwater area.

2.2 Objectives

The objectives of this plan are to:

- a maintain groundwater throughflow within each aquifer
- b maintain the groundwater level in the superficial aquifer at a height sufficient to minimise risk to groundwater-dependent ecosystems
- c restrict inland movement of the saltwater interface in the superficial aquifer
- d prevent the exposure of acid sulfate soils from dewatering and draw down in the superficial aquifer
- e increase the efficient use of groundwater.

2.3 How the plan will meet the objectives

The following sections explain how we will implement the plan and manage water allocation in the Murray groundwater area. To meet the objectives of the plan we will:

- allocate water up to the allocation limits in Table 1
- follow the approach for allocating and licensing water set out in Chapter 4
- licence the abstraction of water according to the licensing policies in Section 4.3
- monitor the groundwater resources through the program explained in Chapter 5
- carry out the actions in Section 6.1
- evaluate our performance in achieving the objectives as described in Section 6.2.

Chapter Three

Water allocation limits

An allocation limit is the annual volume of water set aside for consumptive use from a water resource. This includes water available for licensing and water for uses exempt from licensing.

At April 2012 approximately 40 GL is available for licensing from 13 out of the 15 resources in the plan area. Self-supply water users in the Murray groundwater area mainly get their water from the superficial and Leederville resources, however availability and quality varies with depth and between subareas.

Water is available from the superficial resource across the plan area but generally yield is low and quality is poor. Availability is limited in the Nambeelup subarea from the upper and lower Leederville resources. In the Coolup subarea the upper Leederville has water available, but the lower Leederville is fully allocated. Water is available from the Leederville resources in the Pinjarra and Waroona subareas. The Cattamarra Coal Measures and fractured rock resources generally require further investigation by applicants who seek to obtain a licence from these resources.

The actual volume of water available for licensing is subject to change as licence entitlements are issued or amended. For up-to-date information proponents are encouraged to contact the department's Kwinana Peel regional office in Mandurah or check the online water register on our website at www.water.wa.gov.au.

Public water supply

The Water Corporation's Integrated Water Supply Scheme provides public drinking water to most localities in the Murray groundwater area. Water for the scheme is obtained outside the plan area. A one gigalitre public water supply licence is current in the plan area but is not utilised due to poor quality. There are no drinking water source protection areas in the Murray groundwater area because these groundwater resources are not suitable for public water supply. Water quality ranges from brackish to saline in all resources and the hydrogeology of the superficial aquifer is such that bores are low yielding.

3.1 Components of the allocation limit

In the Murray groundwater area the allocation limits are split into two components:

- licensable (general licensing, public water supply)
- unlicensable (exempt use including stock and domestic).

The volume of water set aside for licensing is the allocation limit minus the volume of water estimated and set aside for the unlicensed component (Table 1).

The fractured rock resource allocation limits were set for management purposes only and do not represent

expected yield. Fractured rock has not been included in the allocation limits table because the aquifer is very hydrogeologically variable and abstraction reliability cannot be accurately predicted.

3.2 Water that is left in the system

For the Murray groundwater area 25% of calculated recharge was set aside to remain in the superficial and Leederville resources to protect aquifer integrity, in situ values and groundwater-dependent ecosystems. The allocation limits are based on the remaining 75% of recharge. For more information see *Murray groundwater allocation limits method report* (DoW 2012a).

3.3 Allocation limits

Table 1

Allocation limits and components in the Murray groundwater area

Subarea	Resource	Allocation limit GL/yr	Allocation limit components GL/yr			Is water available for licensing? ² (as at April 2012)
			Unlicensable	Licensable		
			exempt use	general licensing	public water supply ¹	
Coolup	Superficial Swan	17.00	1.90	15.10		Yes
	Upper Leederville	4.50	0.00	4.50		Yes
	Lower Leederville	1.15 ³	0.00	1.15		No
	Cattamarra	0.10	0.00	0.10		Restricted
	Total	22.75	1.90	20.85	0.00	
Nambeelup	Superficial Swan	13.50	1.40	12.10		Yes
	Upper Leederville	3.00 ³	0.00	3.00		Limited
	Lower Leederville	3.00	0.00	2.00	1.00	Limited
	Cattamarra	0.60	0.00	0.60		Restricted
	Total	20.10	1.40	17.70	1.00	
Pinjarra	Superficial Swan	1.70	0.45	1.25		Yes
	Lower Leederville	1.80	0.00	1.80		Yes
	Cattamarra	2.60	0.00	2.60		No
	Total	6.10	0.45	5.65	0.00	
Waroona	Superficial Swan	8.00	1.20	6.80		Yes
	Upper Leederville	2.20	0.00	2.20		Yes
	Lower Leederville	1.50	0.00	1.50		Yes
	Cattamarra	0.10	0.00	0.10		Restricted
	Total	11.80	1.20	10.60	0.00	
Total for the plan area		60.75	4.95	54.80	1.00	

- 1 There are no drinking water source protection areas in the Murray groundwater area. The 1 GL is licensed for public water supply but is not utilised due to poor quality.
- 2 Available water applies to the general licensing component only. 'Yes' means the component is less than 70% licensed, 'Limited' means more than 70% of the component is licensed, 'No' means 100% of the component is licensed and alternative sources such as trading or managed aquifer recharge should be investigated. Cattamarra is restricted by depth, availability and quality.
- 3 These allocation limits have been reviewed and reduced from the plan for public comment. See *Murray groundwater allocation limits method report*, section 2.3 for details.

Chapter Four

Water allocation and licensing approach

Water licences are the regulatory instrument the Department of Water uses under the *Rights in Water and Irrigation Act 1914* to manage the individual take of groundwater and surface water.

The department uses policies to guide the assessment of licence applications and the setting of licence conditions. The *Murray groundwater allocation plan* includes local licensing policies to manage groundwater allocation and licensing in the plan area.

4.1 Legislative requirements

Water licences

The *Rights in Water and Irrigation Act 1914* establishes the legislative framework for managing and allocating water in Western Australia.

Before people in the Murray groundwater area can access groundwater, they need a licence issued under the provisions of section 26D of the *Rights in Water and Irrigation Act 1914* to construct or alter wells.

Water users in the Murray groundwater area require a water licence to lawfully take groundwater under section 5C of the *Rights in Water and Irrigation Act 1914*.

The granting of a water licence is through the department's assessment of individual applications to take water. As well as the allocation plan, we consider clause 7 (2) of Schedule 1 of the *Rights in Water and Irrigation Act 1914* for this assessment. Where water is available, it is allocated on a first-in first-served basis up to the allocation limit.

To manage water use when granting a licence we may apply terms, conditions and restrictions to licences under clause 15 of Schedule 1 of the *Rights in Water and Irrigation Act 1914*. Conditions may refer to attachments or other documents that the licensee must abide by, for example an operating strategy.

The department may alter any licence condition as specified under clause 24 (1) of Schedule 1 of the *Rights in Water and Irrigation Act 1914*. The rights of licensees are covered under clause 26.

Water resource management

The Department of Water is responsible for managing water resources in Western Australia consistent with the objects of Part III of the *Rights in Water and Irrigation Act 1914*. Allocation plans define how the department manages in accord with object (a) of the Act:

- a To provide for the management of water resources, and in particular –
 - i. for their sustainable use and development to meet the needs of current and future users; and
 - ii. for the protection of their ecosystems and the environment in which water resources are situated, including by the regulation of activities detrimental to them.

Domestic exemption

Private, domestic water supply from the watertable aquifer in a proclaimed groundwater area is managed through the *Rights in Water and Irrigation Act Exemption and Repeal* (section 26C) Order 2010. Taking groundwater from the watertable aquifer in the plan area is exempt from licensing where it is used solely for:

- fire fighting purposes
- watering of stock, other than those raised under intensive conditions
- domestic garden and lawn irrigation (not exceeding 0.2 hectares).

Compliance and enforcement

The *Rights in Water and Irrigation Act 1914* requires that water users have appropriate authorisation to take surface water or groundwater. If authorisations are not demonstrated or the conditions of an authorisation are breached the department will take appropriate enforcement action.

4.2 Approach to water licensing

A water licence provides a legal and secure entitlement to water. The Department of Water uses water licences to manage abstraction and use at an individual scale to:

- protect the entitlements of other users
- protect water-dependent ecosystems
- support development.

The department undertakes the licensing process in accordance with the requirements of:

- the *Rights in Water and Irrigation Act 1914*
- the state-wide strategic and operational policies
- this allocation plan.

Managing abstraction near groundwater-dependent ecosystems

For the Murray groundwater area 25% of calculated recharge was set aside to remain in the superficial and Leederville resources to protect aquifer integrity, in situ values and groundwater-dependent ecosystems. The allocation limits are based on the remaining 75% of recharge.

Applicants seeking to obtain a licence near a groundwater-dependant ecosystem may be required to provide additional information. This will inform our assessment and protect the ecosystem from abstraction at a local scale.

Licensing from the Cattamarra Coal Measures resource

In accordance with *Operational policy no. 5.12 – Hydrogeological reporting associated with a groundwater well licence* (DoW 2009c), applicants who seek to obtain a licence from the Cattamarra Coal Measures resource may be required to complete a hydrogeological investigation in support of their application.

Assessing drainage of shallow groundwater (including subsoil drainage)

Drainage will be an important consideration of urban development in the Murray groundwater area due to extensive areas of seasonally inundated land. Drainage will be designed to control groundwater levels with the purpose of protecting infrastructure. This design option has the potential to affect

groundwater levels in the superficial aquifer beyond the boundary of the development and affect other users, including groundwater-dependent ecosystems.

The Department of Water's Urban Water Management Branch assess urban developments and their proposed drainage in accordance with *Better urban water management* (WAPC 2008). The assessment of water management strategies and plans forms the basis of the department's advice to external land planning agencies. Proponents should identify early in the process their requirements for drainage of shallow groundwater and use the principles, strategies and best practise guidelines in the *Murray drainage and water management plan* (DoW 2011) to design drainage to mitigate any water management issues.

Installation of subsoil drainage is not a licensable activity under the *Rights in Water and Irrigation Act 1914*. A licence assessment process will be triggered when drainage water is not returned to the environment but reused by the proponent or a third party, for example by managed aquifer recharge or use on public open space.

The *Murray drainage and water management plan* (DoW 2011) contains more information on potential reuse options. Managed aquifer recharge proposals will be managed according to *Operational policy 1.01 – Managed aquifer recharge in Western Australia* (DoW 2011).

The Department of Water recognises the need for further policy on this issue. It is a new area of water management in the state which the department is progressing (see Section 6.1).

4

Water allocation and licensing approach

Water use efficiency

As licensing progresses and less water is available for allocation the establishment of water use efficiency measures and programs will increase. To optimise the use of water in fully allocated resources, licensees can sell or lease water efficiency gains to other water users. The department manages these activities through state-wide operational and strategic policies.

As part of water efficiency measures, the government has introduced three-day water restrictions for domestic garden bore use in the Perth-Peel region in addition to a state-wide daytime sprinkler ban.

The department works with licensees to align with the domestic garden bore restrictions by applying conditions to licences where the use is for non-

commercial crops such as golf courses, public open spaces and recreational ovals.

The department may also implemented additional efficiency measures, such as winter sprinkler bans when they are declared.

4.3 Licensing policy for the Murray groundwater area

Local policy

These local policies provide additional guidance to manage water related issues specific to the Murray groundwater area. They apply because either the local issues are not addressed in state-wide policy or an alternative approach is needed to better manage the local issue.

Table 2
Local policies specific to the Murray groundwater area

Policy group	Policy detail
1. Licence assessment	
1.1. 26D licence conditions on bore construction	<p>1.1.1. Licensees drilling bores into the Leederville or Cattamarra Coal Measures resource are required to submit:</p> <ul style="list-style-type: none"> • a description of the lithology • the survey level of the bore • a geophysical log. <p>Palynology analysis may be requested for bores drilled into the Cattamarra Coal Measures resource.</p> <p>1.1.2. To distribute the draw from an aquifer, the department may request that the location of a proposed new bore is changed prior to drilling.</p>

Table 2 (continued)
Local policies specific to the Murray groundwater area

Policy group	Policy detail
2. Licence conditions	
2.1. Operating strategies	In addition to <i>Operational policy no. 5.08 – Use of operating strategies in the water licensing process</i> (DoW 2010) the department may request an operating strategy where groundwater is requested: <ul style="list-style-type: none"> • from the Cattamarra Coal Measures resource • for the irrigation of parks, gardens, public open space and maintenance of artificial wetlands or lakes • as part of a licensable dewatering activity
2.2. Dewatering	2.2.1. Dewatering is a licensable activity. Exemptions do apply for small scale, short term dewatering projects under the <i>Rights in Water and Irrigation dewatering exemption order 2010 (Section 26C)</i> .
	2.2.2. Operating strategies for dewatering may require contingency plans for emergency situations where the dewatering may: <ul style="list-style-type: none"> • directly affect groundwater-dependent ecosystems • directly affect environmentally sensitive areas • directly affect other users • expose acid sulfate soils.
2.3. Metering	In addition to <i>Strategic policy no. 5.03 – Metering the taking of water</i> , (DoW 2009e) meters will be required where: <ul style="list-style-type: none"> • a community bore is supplying water for the irrigation of domestic gardens • the bore is abstracting from the Cattamarra Coal Measures resource • the bore is for the irrigation of public open space, parks and gardens or maintenance of artificial lakes and wetlands.
3. Managing impacts	
3.1. Saltwater interface	The department may restrict groundwater abstraction from the superficial or Leederville aquifers adjacent to the Peel Inlet and Harvey Estuary to minimise the risk of the saltwater interface moving inland. The department may require licensees to construct and monitor bores if their abstraction increases the risk of saline intrusion.
3.1. Ground/surface water interaction	Where a new licence application is submitted that has the potential to decrease the groundwater contribution to river baseflow during low flow periods (generally summer months) the department may: <ul style="list-style-type: none"> • request a hydrogeological investigation • require production bores to be located away from the river • restrict abstraction (e.g. timing and rate of abstraction).

Table 2 (continued)

Local policies specific to the Murray groundwater area

Policy group	Policy detail
3.3. Water level criteria	For sites where water level criteria or trigger levels are set the department may: <ul style="list-style-type: none"> • restrict abstraction (e.g. timing and rate of abstraction) • require production bores to be located away from these sites • request an operating strategy or additional monitoring
4. Stock and domestic	
4.1. Stock and domestic use	<p>4.1.1. A licence is required to take water for domestic purposes from a confined aquifer.</p> <p>4.1.2. Aquaculture is considered as stock raised under intensive conditions and is not exempt from licensing.</p>

State-wide policy

The Department of Water manages groundwater abstraction according to state-wide operational and strategic policies. The main policies that apply to licensing in the Murray groundwater area are outlined below. These policies can be accessed on our website at www.water.wa.gov.au.

Table 3

Department of Water state-wide strategic and operational policies that apply in the Murray groundwater area

Policy Title	Application
1. Licence assessment	
<i>Operational policy no. 5.12 – Hydrogeological reporting associated with a groundwater well licence (DoW 2009c)</i>	The department may request further information from applicants to complete a licence assessment, such as: <ul style="list-style-type: none"> • hydrogeological information, the level of assessment is outlined in this policy • monitoring reports, the approved structure is outlined in this policy Dewatering is also covered by this policy.
<i>Operational policy no. 5.11 – Timely submission of required further information (DoW 2009b)</i>	The department's approach to managing timelines when a licensee is requested to submit additional information in support of their licence application.

Table 3 (continued)

Department of Water state-wide strategic and operational policies that apply in the Murray groundwater area

Policy Title	Application
2. Licence conditions	
<i>Strategic policy no. 5.03 – Metering the taking of water (DoW 2009e)</i>	The department's approach to metering the take of water, and circumstances where metering conditions may be applied on individual licences.
<i>Operational policy no. 1.02 – Policy on water conservation and efficiency plans: achieving water use efficiency gains through water licensing (DoW 2009a)</i>	Direction on preparing water conservation and efficiency plans when they are required as a licence condition.
<i>Operational policy no. 5.08 – Use of operating strategies in the water licensing process (DoW 2010a)</i>	Guidance on when an operating strategy is required and what it should contain, including: <ul style="list-style-type: none"> • the water licence applicants who are likely to require an operating strategy • how operating strategies form part of the conditions of a water licence • how licence applicants should develop an operating strategy • the licensee's responsibilities in complying with an operating strategy.
3. Managing licenses to optimise water use	
<i>Statewide policy no. 11 – Management of unused licensed water entitlements (WRC 2003)</i>	The circumstances when whole or portions of licensed entitlements may be recouped by the department to maximise development opportunities, including: <ul style="list-style-type: none"> • if it is proved that the entitlements are consistently unused • extenuating circumstances cannot be provided.
<i>Operational policy no. 5.13 – Water entitlement transactions for Western Australia (DoW 2009d)</i>	The rules for a trade, transfer or lease of all, or part of, a licensed water entitlement.
<i>Operational policy no. 1.01 – Managed aquifer recharge in Western Australia (DoW 2011)</i>	Is applied when managed aquifer recharge is an option for fit-for-purpose reuse of water that is obtained from dewater, drainage or storm water for example.

Chapter Five

Groundwater monitoring

5.1 Current program

The current monitoring bore network consists of around 100 bores that the Department of Water uses to monitor water level and hydraulic head in the aquifers and formations across the Murray groundwater area (Before 2007, water levels were measured once at the end of summer and once at the end of winter. Since 2007, to better define minimum and maximum water levels in an aquifer, the monitoring bores have been measured in April, May, June and again in September, October and November. and Figure 5). Monitoring data is used to measure the performance indicators (Section 6.2) which identify whether our management approach is meeting the objectives of this plan.

Monitoring in the superficial aquifer is sufficient to identify long-term trends and changes in water level across the Murray groundwater area. Monitoring in the Leederville and Yarragadee aquifers, including the Cattamarra Coal Measures unit, is limited and long-term changes in hydraulic head in these aquifers are less easy to confirm.

Table 4
Department of Water monitoring bores in the Murray groundwater area 2009

Monitoring bore line and bore series code	Superficial	Leederville	Yarragadee	Cattamarra	Total
Lake Thompson (T)	8	0	0	0	8
Harvey shallow (HS)	75	0	0	0	75
Artesian monitoring (AM)	0	4	3	2	9
Harvey borehole line (HL)	0	2	0	1	3
Mandurah borehole line (MH)	0	3	1	2	6
Total	83	9	4	5	101

Before 2007, water levels were measured once at the end of summer and once at the end of winter. Since 2007, to better define minimum and maximum water levels in an aquifer, the monitoring bores have been measured in April, May, June and again in September, October and November.

The department will continue to monitor aquifers trends through the monitoring bore network. This assessment will help us:

- update licence conditions
- investigate regional and local changes in the aquifers
- evaluate performance of the plan against the objectives.

The department may set licence conditions that direct licensees to install private monitoring bores where abstraction has the potential to affect groundwater-dependent ecosystems and/or other groundwater users. We use information gained through private monitoring bores to manage individual abstraction and potential impacts on a local scale.



Figure 5
State reference network bores actively monitored as at 2009 in the
Murray groundwater area

use information gained through private monitoring bores to manage individual abstraction and potential impacts on a local scale.

5.2 Review of the monitoring program

The current monitoring program in the Murray groundwater area will be reviewed as an action of this plan. The review will recommend changes to the monitoring program so that the information it provides is sufficient to measure the performance indicators and evaluate this plan. The review will decide on:

- the required frequency of water level measurements
- monitoring criteria for the Leederville aquifer

- where water quality monitoring is most needed
- the optimum distribution of the monitoring network.

As part of the review, we will also consider incorporating into the state reference network:

- bores drilled as part of the *Murray drainage and water management plan* (DoW 2011)
- Nambeelup monitoring bores (NB series)

The monitoring program review will check if further monitoring is required as a result of technical studies completed for the *Murray drainage and water management plan* (DoW 2011), including:

- *Ecological water requirements for selected wetlands in the Murray drainage and water management plan area*

Chapter Six

Implementing and evaluating the plan

The previous sections describe how the Department of Water will implement the *Murray groundwater allocation plan* by licensing in accordance with the allocation limits, using the allocation and local licensing policies and monitoring the aquifers.

This section sets out additional actions that need to be carried out and explains how we will evaluate and check whether the objectives of the plan are being met.

6.1 Actions

This planning process identified actions that need to be carried out to improve management of the groundwater resources in the plan area. These actions are additional to the standard implementation tools explained in this plan. The actions were developed by:

- recognising gaps in our current knowledge and information
- reviewing current management arrangements
- assessing what information is needed for future planning.

Table 5

Additional actions to implement the Murray groundwater allocation plan

Action		Responsibility ¹	Timelines
Monitoring program			
1	Review and recommend changes to the current groundwater monitoring program, incorporate recommendations from the <i>Murray drainage and water management plan</i> , see Section 5.2.	Kwinana Peel region Water Allocation Planning Water Resource Assessment	2012
2	Implement changes to the monitoring program.	Kwinana Peel region	2013
Licensing			
3	Review and correct licences that have been incorrectly assigned to the Leederville or Cattamarra Coal Measures resources.	Kwinana Peel region	Ongoing

Table 5 (continued)

Additional actions to implement the Murray groundwater allocation plan

Action		Responsibility ¹	Timelines
4	Map the green clay marker in the Leederville aquifer.	Water Resource Assessment	2012
Allocation limits			
5	<p>Evaluate new information on the groundwater resources that is expected to become available over the life of this plan, including:</p> <ul style="list-style-type: none"> technical studies and modelling completed as part of the <i>Murray drainage and water management plan</i> project the future climate scenario adopted for the <i>South West Coastal groundwater allocation plan</i> (in preparation) groundwater and surface water interaction modelling new information from the State Groundwater Investigation Program on the geology and hydrogeology of the Leederville and Cattamarra aquifers in the Murray groundwater area. <p>This information will be used in the annual evaluation of the plan.</p>	<p>Urban Water Management</p> <p>Kwinana Peel region</p> <p>Water Resource Assessment</p> <p>Water Allocation Planning</p>	Annually
Policy			
6	Develop state-wide policy on assessment of drainage and the options for re use.	Strategic Policy Urban Water Management	2012

¹ Department of Water branch responsible for the action

6

Implementing and evaluating the plan

6.2 Evaluating the plan

Performance indicators

The department's performance in meeting the plan objectives will be measured using the performance indicators in Table 6.

Table 6
Performance indicators for measuring against the plan objectives

Performance indicator	Objective	How it will be evaluated
Stability of minimum groundwater levels	a-d	Superficial aquifer Minimum summer groundwater levels in superficial aquifer monitoring bores do not decline by more than 0.1 m/yr over three years. Information obtained from: <ul style="list-style-type: none"> • licensee monitoring reports • the department's state monitoring network and annual resource review report
Movement of the saltwater interface	c	Salinity level does not increase by more than 10% between reporting periods. Information obtained from: <ul style="list-style-type: none"> • licensee monitoring reports • the department's state monitoring network (salinity is not currently monitored. It will be recommended as part of the monitoring program review).
Stability of pH of groundwater in the superficial aquifer ¹	d	pH of groundwater in the superficial aquifer is not less than 4. Information obtained from: <ul style="list-style-type: none"> • Licensee monitoring reports

- 1 This performance indicator is designed to identify any changes in pH as a result of the exposure of acid sulfate soils or the addition of nutrients or fertilisers which can generate acidic groundwater.

Evaluation statement

An annual evaluation statement will be released that describes the response of the groundwater resources to our management according to the plan objectives.

The evaluation statement will include:

- the allocation status for each resource, including any changes in licensed entitlements since the last year
- the status of plan actions due in the evaluation period
- the status and trends of groundwater quantity and quality
- the department's performance against the plan objectives
- the need, if any, to amend or replace the plan.





Appendices

Murray groundwater allocation plan

A

Appendix A
Salinity maps and hydrogeological
cross-sections

Figures A1–A5 provide additional information on the Murray groundwater resources. Figures A1 and A2 show the range of salinity likely to be encountered in the superficial and Leederville aquifers. Figures A3, A4 and A5 are hydrogeological cross-sections showing depth of the various aquifers across the groundwater area.

A saltwater interface exists along the western boundary of the Murray groundwater area in the superficial and Leederville aquifers. Water quality is variable across the groundwater area. In the superficial aquifer water quality ranges from fresh, less than 1000 mg/L total dissolved solids (TDS) along the Darling Scarp to saline over 14 000 mg/L along the Peel Inlet and Harvey Estuary (Figure A1).

Groundwater is generally fresh in the semi confined/confined upper and lower Leederville aquifers except along the Darling Scarp south of Pinjarra and along the Peel Inlet and Harvey Estuary (Figure A2).

In the Yarragadee aquifer groundwater is fresh along the Darling Scarp north of the Murray River. Elsewhere groundwater is generally brackish, more than 1000 mg/L TDS.

High nutrient levels may be encountered in the superficial aquifer in areas that are, or were, heavily fertilised.

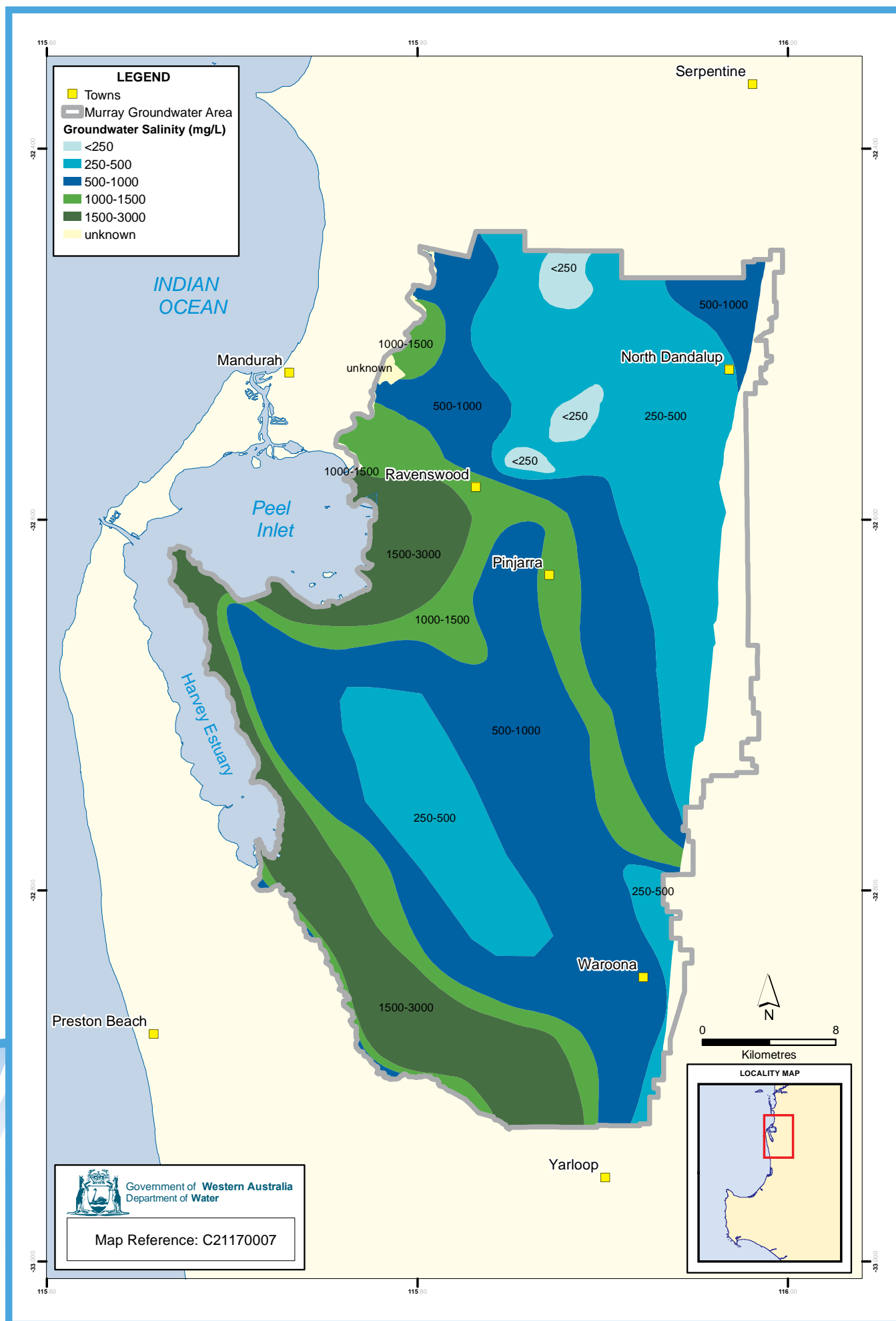


Figure A1
Groundwater salinity contours in the superficial aquifer (2001) (mg/L TDS)
Murray groundwater allocation plan

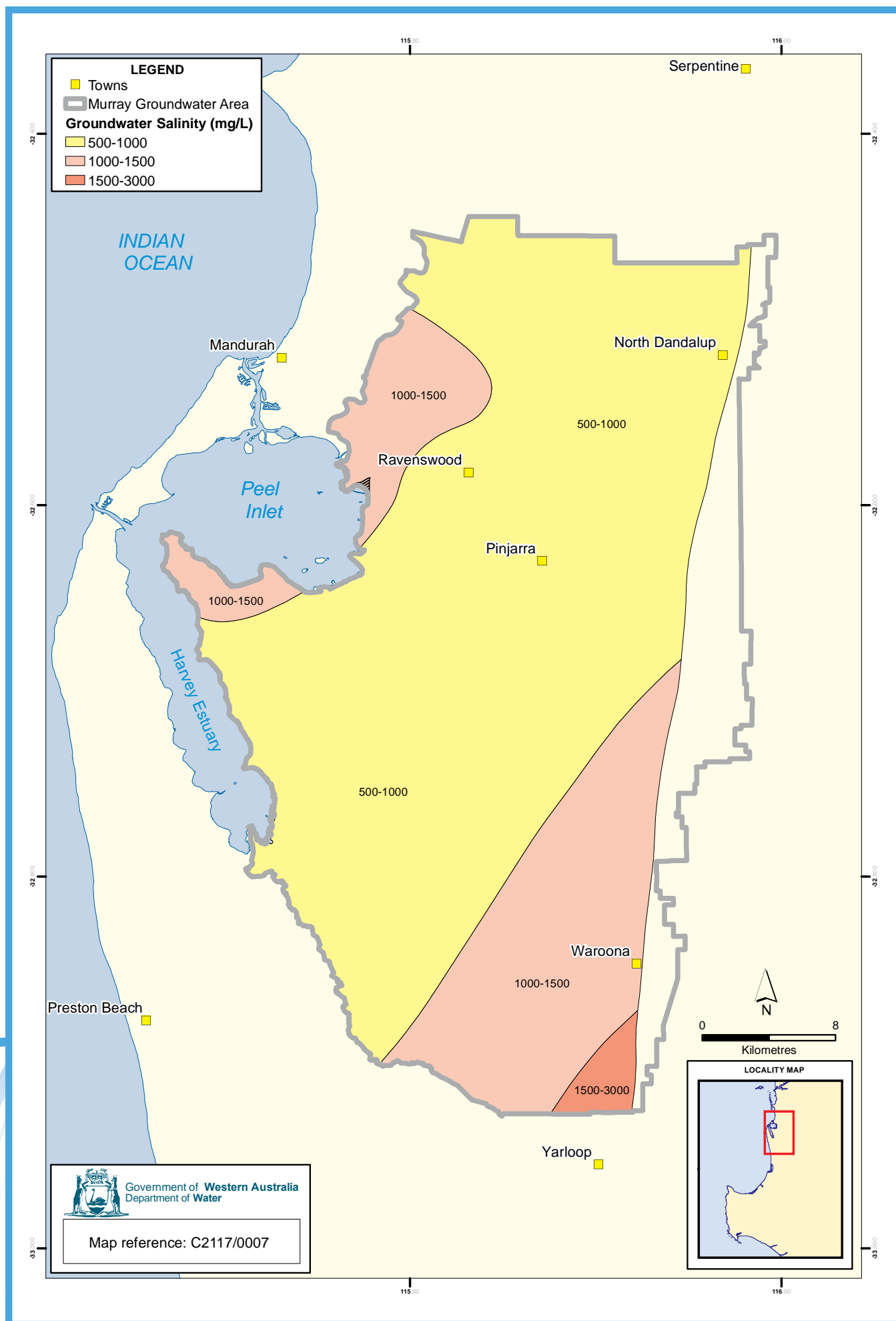


Figure A2
Groundwater salinity contours for the Leederville aquifer (2001) (mg/L TDS)
Murray groundwater allocation plan

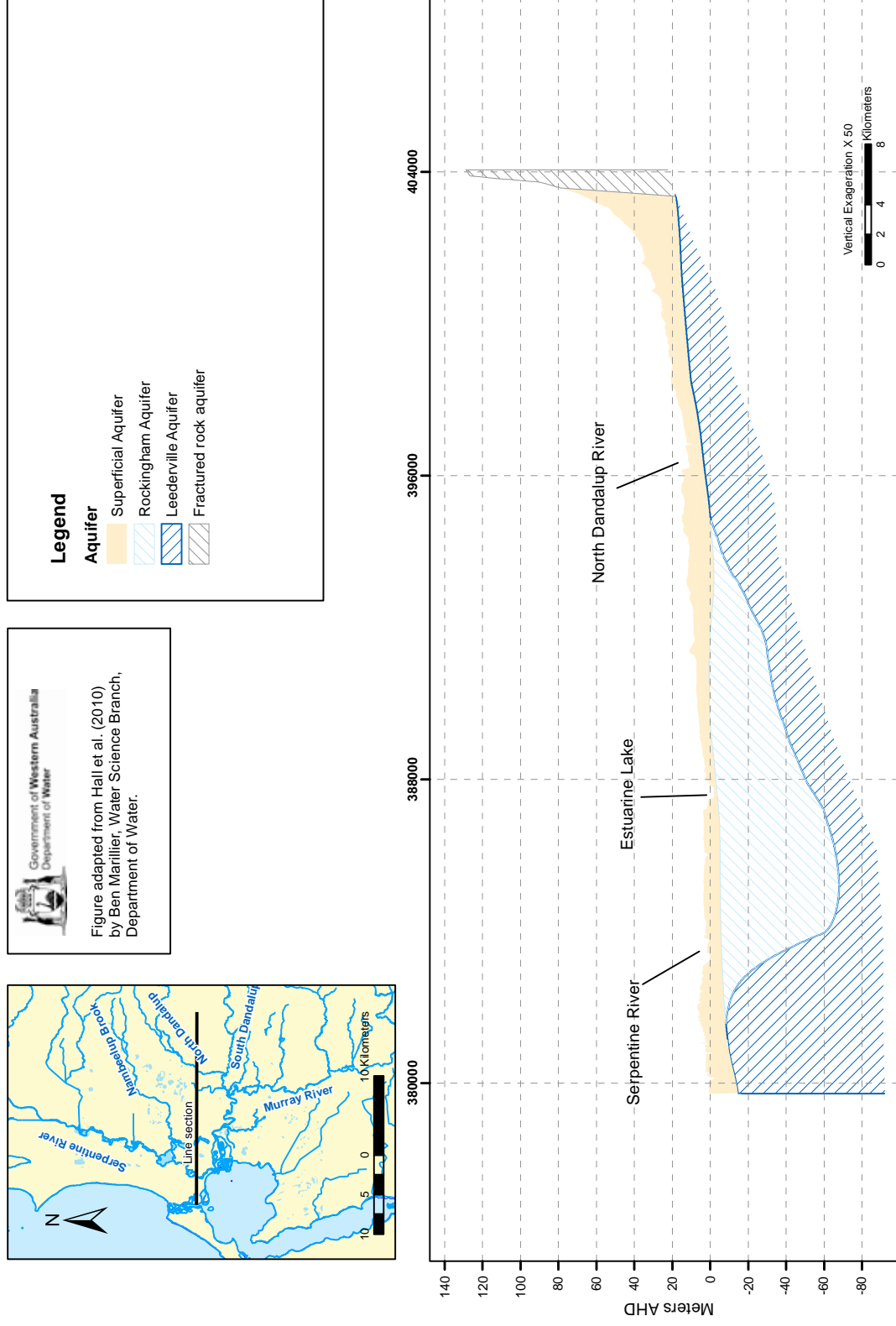


Figure A3
Hydrogeological cross-section for the Nambeelup subarea – unconfined formations
Murray groundwater allocation plan

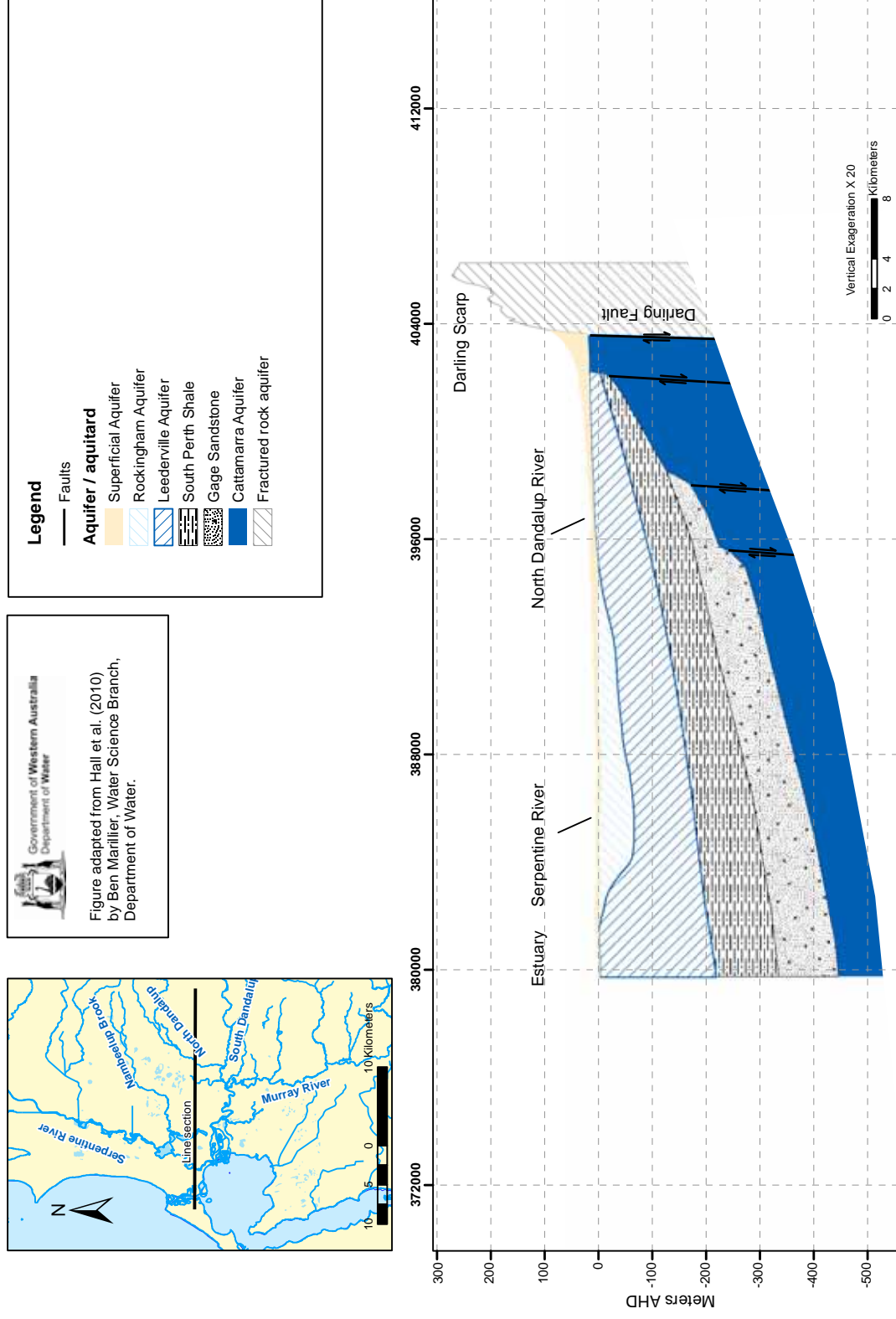


Figure A4
Hydrogeological cross-section for the Nambeelup subarea – confined formations
Murray groundwater allocation plan

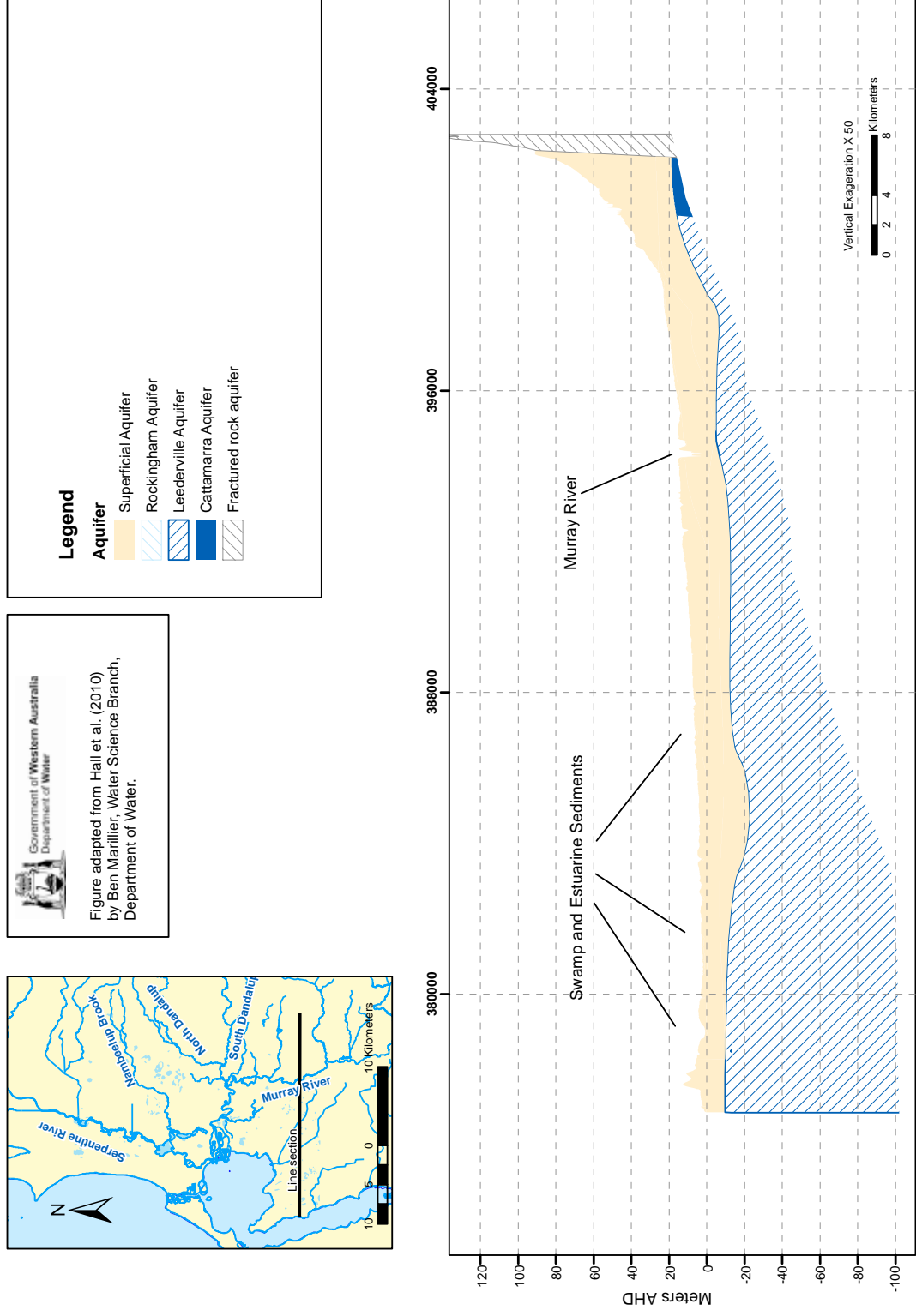


Figure A5
Hydrogeological cross-section for the Coolup and Pinjarra subareas – unconfined formations
Murray groundwater allocation plan

Datum and projection information

Vertical datum: Australian Height Datum (AHD)
Horizontal datum: Geocentric Datum of Australia 94
Projection: MGA 94 Zone 50
Spheroid: Australian National Spheroid

Project information

Client: Christie Silva
Map author: Gary Floyd and Shona Shah
File path: J:\gisprojects\Project\C_series\C2117...For all maps
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Compilation date: 09 March 2012

Disclaimer

These maps are a product of the Department of Water, Water Assessment and Allocation Division and were printed as shown.

These maps were produced with the intent that they be used for information purposes at the scale as shown when printing.

While the Department of Water has made all reasonable efforts to ensure the accuracy of this data, the department accepts no responsibility for any inaccuracies and persons relying on this data do so at their own risk.

Sources

The Department of Water acknowledges the following datasets and their custodians in the production of these maps:

Hydrography, Linear (Hierarchy) – DoW – 2007
WA Coastline, WRC (Poly) – DoW – 2006
RIWI Groundwater Areas – DoW – 2012
Groundwater Subareas – DoW – 2012
Groundwater Salinity, Confined Aquifers – DoW – 2001
Perth Basin, Superficial aquifer groundwater salinity – DoW – 2009
DWAID Aquifers – DoW – 2012
WIN Sites – DoW – 2012
Road Centrelines – Landgate – 2012
Western Australian Towns – Landgate – 2012
Local Government Authority and Locality Boundaries – Landgate – 2006
EPP Lakes Policy Area – DEC – 1992

Abstraction	The permanent or temporary withdrawal of water from any source of supply, so that it is no longer part of the resources of the locality.
Allocation limit	Annual volume of water set aside for consumptive use from a water resource. This includes water available for licensing and water for uses exempt from licensing.
Confined aquifer	An aquifer lying between confining layers of low permeability strata (such as clay, coal or rock) so that the water in the aquifer cannot easily flow vertically.
Consumptive use	The use of water for private benefit (consumptive purposes) including irrigation, industry, urban and stock and domestic use.
Dewatering	Removing underground water to facilitate construction or other activity. It is often used as a safety measure in mining below the watertable or as a preliminary step to development in an area.
Domestic bore	A bore that provides water for use in the house and household garden watering requirements
Exempt use	Water use that is not required to be licensed under the <i>Rights in Water and Irrigation Act 1914</i> . This is sometimes referred to as stock and domestic use or a riparian right.
First-in first-served	A process by which groundwater entitlements are allocated consistent with the order in which licence applications are received by the Department of Water.
Groundwater area	An area proclaimed under Part III, Division 3, section 26B (1) of the <i>Rights in Water and Irrigation Act 1914</i> for the purposes of licensing and managing water use.
Groundwater-dependent ecosystem	An ecosystem that is dependent on groundwater for its existence and health.
Groundwater resource	A Department of Water management term to define the portion of an aquifer present in a groundwater subarea.
In situ values	The ecological, social, cultural and resource values supported by natural hydrological and hydrogeological processes
Licence	A formal authorisation which entitles the licence holder to 'take' water from a watercourse, wetland or underground source for a specified quantity and period of time.
Subarea	A smaller area determined by the Department of Water within a proclaimed area used for water allocation planning and management purposes, the boundaries of which are primarily defined by the location of the water resource.
Unconfined aquifer	Is the aquifer nearest the surface, having no overlying confining layer. The upper surface of the groundwater within the aquifer is called the watertable. An aquifer containing water with no upper non-porous material to limit its volume or to exert pressure.
Water entitlement	The quantity of water that a person is entitled to take on an annual basis in accordance with the <i>Rights in Water and Irrigation Act 1914</i> and a licence.

Glossary

Water entitlement transaction	A water entitlement transaction can be a trade, transfer or lease of a licensed entitlement. Trade: Sale of part or all of a licensed entitlement, by a licensee (vendor) to a second party (purchaser). This involves moving the point of abstraction from one property to another. Transfer: A transfer is a change in ownership of the water licence associated with the sale of the property to which the licence applies. There is no change in the location of the abstraction. Lease: A lease is where part or all of a licensed entitlement is leased for a price to another licensee. The abstraction point can be from either the vendor's or the lessee's bore.
Yield	The calculated volume of water that can be taken out of the system renewably after the water requirements for in situ values have been accounted for.

Volumes of water			
One litre	1 litre	1 litre	(L)
One thousand litres	1000 litres	1 kilolitre	(kL)
One million litres	1 000 000 litres	1 megalitre	(ML)
One thousand million litres	1 000 000 000 litres	1 gigalitre	(GL)

List of shortened forms	
EPA	Environmental Protection Authority
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WAPC	Western Australian Planning Commission
DoW	Department of Water
no.	number
pH	In chemistry, pH is a measure of the acidity or basicity of an aqueous solution
mg/L	milligrams per litre
TDS	total dissolved solids
WRC	Water and Rivers Commission

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