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

Blackwood groundwater area

subarea reference sheets

Plan companion for the South West groundwater areas allocation plan

Looking after all our water needs

Blackwood groundwater area subarea reference sheets

Plan companion for the South West groundwater areas allocation plan

Department of Water

May 2009

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Cover photograph
Jalbarragup Bridge, Blackwood River
Rebecca Palandri, 2008

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1 Introduction

1.1 Purpose of the plan

The *South West groundwater areas allocation plan* provides the department's direction on the taking and use of groundwater resources in the plan area (Figure 1). The planning process considered the ecological, social and economic values of the water resources, with the community's input from a range of consultation processes over several years. It aims to achieve a balance between current and future users, and the protection of the water-dependent environment.

The plan provides a clear and consistent direction to current and future water users in areas that are under pressure from increasing abstraction and climate change.

1.2 Purpose of the subarea reference sheets

The subarea reference sheets are designed to assist with licensing of groundwater in the plan area by providing local subarea-based information and guidance on the licensing process. The reference sheets will help to inform prospective licence applicants of their local area requirements for water use in a specific subarea and provide general information to assist in the application process.

1.3 Licensing information and the plan

The *South West groundwater areas allocation plan* contains the specific licensing policies and rules that apply to all subareas and must be used in conjunction with this document in any licence assessment process or new application.

The licensing information detailed in this document follows standard statewide protocols and processes used across all plans. For further information please visit the department's website.

Applicants should be aware of the licensing policies and local area rules that may apply to them before submitting their groundwater licence application to the department.

Licensing forms for licence applications can be found on the Department of Water's website: <www.water.wa.gov.au > Doing business with us > Water licensing > Licensing publications and forms > or by contacting one of the South West regional offices.

☏ Bunbury (08) 9726 4111

☏ Busselton (08) 9781 0100

☏ Manjimup (08) 9771 1878

1.4 How to use the subarea reference sheets

The reference sheets provide background information on a particular groundwater subarea. Each subarea has different issues associated with licensing and water management. The reference sheets provide summarised information on the subarea including:

- proclamation, water use and water management issues (Figure 2 and Figures 4–11)
- allocation limits and water availability
- hydrogeology
- ecological, social, cultural and recreational sites of significance that were considered in the assessment process for groundwater licensing
- management zone rules (see Section 5.2 of the South West groundwater areas allocation plan for more detail) (Figure 3).

For the full technical detail please see the bibliography of the *South West groundwater areas allocation plan* for a complete reference and recommended reading list.

For a licence application to be assessed it should be consistent with, and meet the requirements of, the *South West groundwater areas allocation plan* and the *Rights in Water and Irrigation Act, 1914*. The reference sheets are not a replacement for a clause 7 (2) licence assessment process under the Act (see Appendix A and Table A1). The information contained in the reference sheets must also be used in conjunction with the following information:

- the principles and objectives for water management described in the *South West groundwater areas allocation plan* (Section 1.2 and Chapter 3 of the plan)
- the policies and rules listed in the *South West groundwater areas allocation plan* (Section 5.1–5.2 of the plan)
- State and Commonwealth legislation relating to water and its use (Appendix B)
- licensing process (Appendix A), unless otherwise stated in the plan
- statewide policies, guidance and allocation notes (Appendix A)
- reviewing the allocation limits for the South West groundwater areas (DoW 2008)
- *South West groundwater areas monitoring program* (DoW 2008)
- *Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas* (Del Borrello 2008)
- *Whicher area surface water allocation plan* (DoW 2009).

There are also numerous documents produced by the department and other government agencies that provide information on a range of water management issues that can be used as reference material for licence applications and in the assessment process. The most relevant of these are listed in Appendix B.

Appendix C provides a list of useful departmental websites to access for additional information linked to components of the water management process and used in the licence assessment process. Any licence application should be consistent with other departmental plans and other government agencies plans or strategies where applicable.

Please note that all data presented have specified dates of collection and interpretation. New and updated information should be collected and used where appropriate. All technical and supporting documents are available on the department's website <www.water.wa.gov.au/allocationplanning>.

Prospective licensees and licensing officers need to be aware that within a 2 km buffer along either side of the subarea boundary line the aquifer may or may not be accessible, and that hydrogeological investigations may be needed.

1.5 Water information data requests

The Department of Water monitors water levels and water quality in its monitoring bore network, storing the data on our water information network (WIN). This information is up-to-date and available upon request using the data request form found here:
<www.water.wa.gov.au> Tools >Monitoring and data>
or by contacting one of the department's regional offices in the South West. The form is electronic and can be emailed or posted to us.

For more information on current water level trends please see *Groundwater level trends analysis for the South West groundwater areas* (Golder 2008). Updates of water level monitoring will be available annually in the evaluation statement (See Chapter 6 of the *South West groundwater areas allocation plan*).

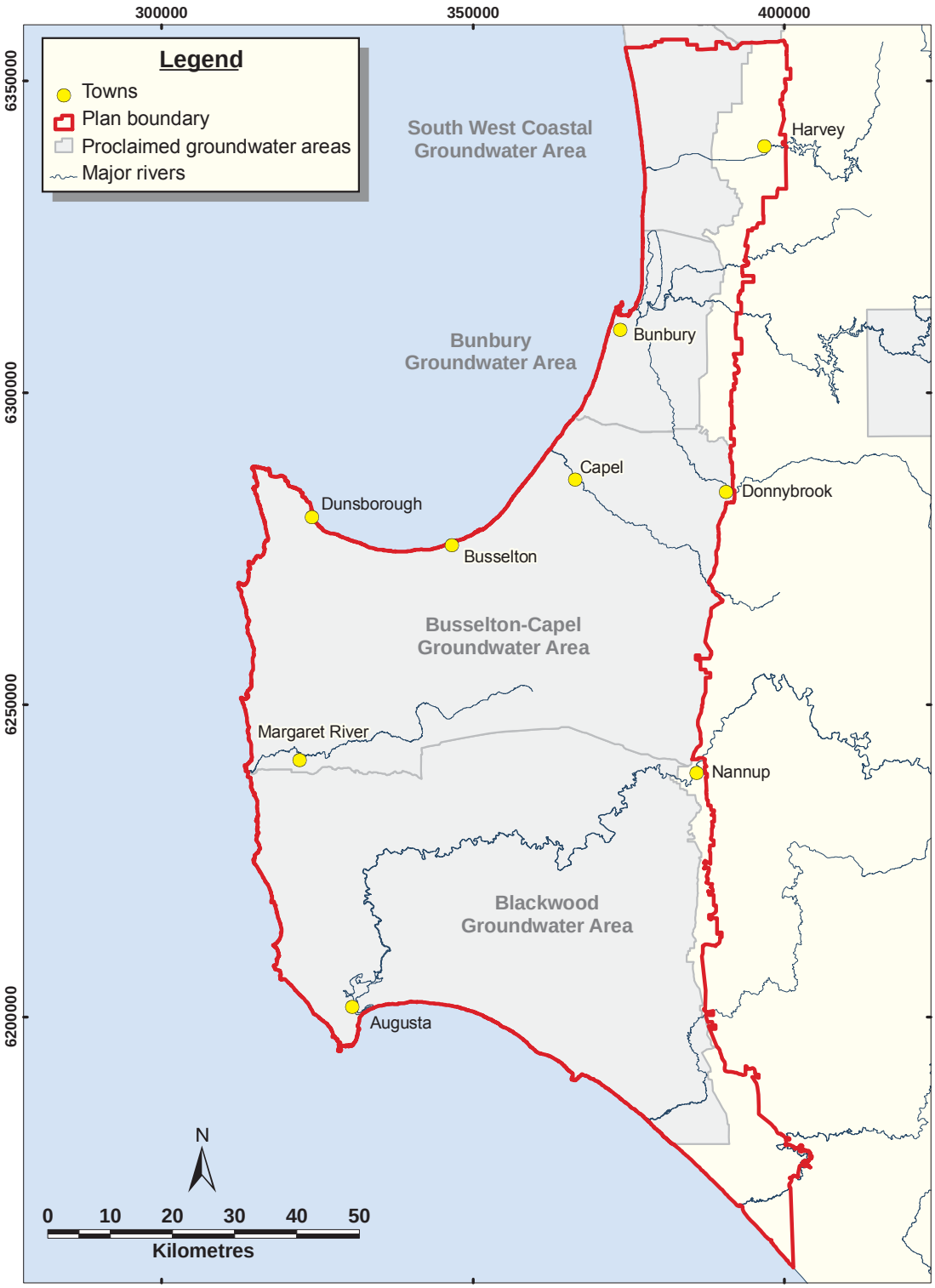


Figure 1 The plan area

Figure 2 Subarea boundaries in the Blackwood groundwater area

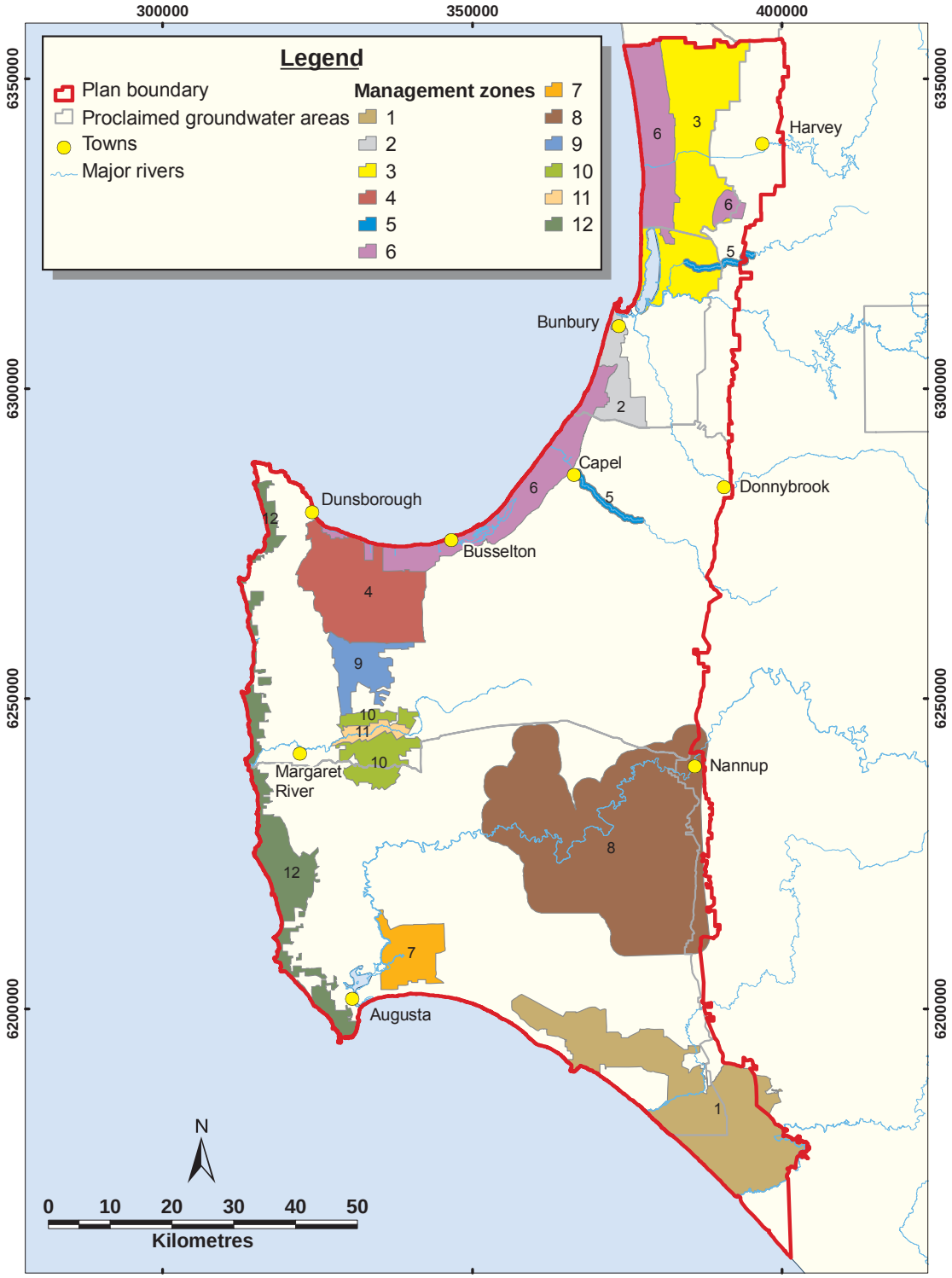


Figure 3 Management zones

2 Subarea reference sheets

In assessing a licence application we undertake a clause 7 (2) assessment under the provisions of the *Rights in Water and Irrigation Act 1914*. In conducting this assessment we consider the impacts from the abstraction of the water and its use on ecological, cultural, social and economic factors.

Important sites and values that we consider have been listed in the subarea reference sheets. These are not the full list of values or sites, but the most relevant to water management for a particular subarea that we consider for all groundwater licence applications. Some of the sections of the subarea reference sheets are discussed below.

Ecological

We currently monitor various groundwater-dependent ecosystem (GDE) sites listed in the subarea reference sheets, including implementing their associated management triggers and responses if the water level criteria are breached (Del Borrello 2008).

There are also ecological water requirement (EWR) sites that have been determined through various investigations and studies across the plan area and are a guide to acceptable water level drawdowns near these sites. These sites are not currently monitored. However they are used in assessing licence applications. The full list of sites is available in Hyde 2006 and Del Borrello 2008.

Many groundwater-dependent ecosystem and ecological water requirement sites contain or are linked to declared rare flora, declared rare fauna, threatened ecological communities, environmental protection policy wetlands, Australian national conservation areas, Ramsar wetlands and numerous water courses and their associated pools, bed and banks.

Where these sites are not covered as groundwater-dependent ecosystem or ecological water requirement sites they are listed in the subarea reference sheets to highlight their presence, as they are considered in managing groundwater abstraction. These sites may or may not be groundwater-dependent and as such, if investigation work has not previously been carried out, licensees may be requested to undertake an investigation in order to prove that the proposed drawdown will not adversely affect these sites.

Cultural

The claimant groups listed and any reference to Aboriginal sites of significance (listed heritage sites) have been extracted from the Department of Indigenous Affairs database. The information only refers to those claims that have been determined and the sites are listed on the permanent register. The listed sites in the subarea reference sheets are directly related to water management and a full search is

always undertaken during a licence assessment to ensure that the proposed impacts are acceptable. Applicants may be required to undertake work associated with Aboriginal heritage if a site is likely to be disturbed.

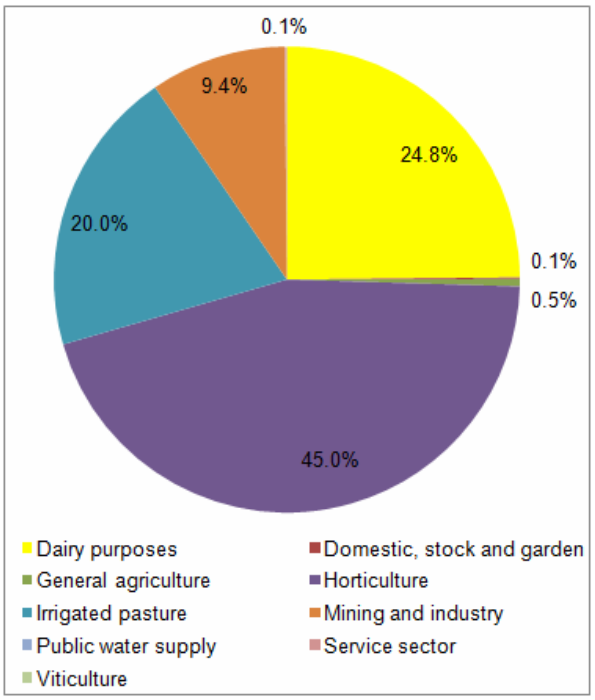
Social

The major social water use values considered are public and private drinking water (including domestic, stock and garden use) and recreational sites. The localities in each subarea are listed to help licensees find out which subarea they are located in. Although there are many different types of recreational sites related to water, only those which are known to be groundwater-dependent are listed.

Economic

The economic aspects of water management are covered by the sections on water use by current licensees, available water and the issues for management. All licence applications are assessed using this information to protect existing uses within the amount of available water and the constraints on accessing the water resource.

2.1 Blackwood–Yarragadee

<table>
<tr><th colspan="4">Blackwood–Yarragadee</th></tr>
<tr><th colspan="4">Subarea description</th></tr>
<tr><td>Area</td><td colspan="2">2243.6 km^2</td><td rowspan="4">Licensed water use (November 2008)
Yarragadee: 8 845 000 kL/yr
 
</td></tr>
<tr><td>Proclamation</td><td colspan="2">Blackwood groundwater area 1989</td></tr>
<tr><td>Shire</td><td colspan="2">Shires of Augusta–Margaret River, Busselton and Nannup</td></tr>
<tr><td>Rainfall</td><td colspan="2">1000–1300 mm</td></tr>
<tr><th colspan="3">Allocation and water availability
kL/yr</th></tr>
<tr><td>Aquifer</td><td>Allocation limit</td><td>Available water</td></tr>
<tr><td>Yarragadee [1]</td><td>15 500 000</td><td>Limited. Contact the Busselton office for up-to-date availability.</td></tr>
<tr><th colspan="4">Issues for water management</th></tr>
<tr><td colspan="4">The Yarragadee Aquifer is currently fully allocated. In areas where the aquifer is connected to another aquifer or surface water feature (recharge or discharge area), abstraction will be restricted (see management zone rules).
Environmental management triggers and responses also apply. See Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas, Del Borrello 2008 for more information.</td></tr>
<tr><th colspan="4">Hydrogeology</th></tr>
<tr><td>Aquifer</td><td colspan="3">Description</td></tr>
<tr><td>Yarragadee</td><td colspan="3">The Yarragadee Aquifer is present within the Bunbury Trough of the Southern Perth Basin. It consists of four units, all of which are present in the subarea. Unit 3 is where the aquifer is predominantly accessed.
This section of the aquifer becomes shallower closer to the Busselton fault (200–400 m below ground level) and deepens and thickens towards the Darling fault (600–1000 m below ground level).
The formation is predominantly sandstone and siltstone. The aquifer is unconfined on the Blackwood Plateau, south of Milyeannup which is a major recharge area. The aquifer is hydraulically connected to Lake Jasper. The aquifer is also connected to the Blackwood River and tributaries and discharges along the river</td></tr>
</table>

Blackwood–Yarragadee	
	in various places (west of Darradup) maintaining pools and tributaries during the summer months.The aquifer has both a north and southward flow line which cuts across the Blackwood Plateau. South of the Blackwood River the aquifer flows out to Flinders Bay. North of the Blackwood River the aquifer flows towards Geographe Bay and Bunbury. The Leederville Aquifer, Parmelia formation and Bunbury Basalt overlie the Yarragadee Aquifer. The base of the aquifer is the Cockleshell Gully formation. The groundwater level falls from around 40 m in the recharge area on the Blackwood Plateau (south-west of Nannup), towards sea level in the Bunbury groundwater area. Water levels have been declining in the recharge area (0.3 m/yr since 1995) and winter water levels have declined by up to 2 m over the last 25 years across the Scott coastal plain. Groundwater salinity in the unconfined area is < 200 mg/L but the water is relatively high in dissolved iron. Groundwater salinity in the confined areas generally ranges from < 200 mg/L to about 400 mg/L.

Considerations for water use include, but are not limited to, the following

Ecological

Wetlands and waterways: The Blackwood and Donnelly rivers and their tributaries receive part of their base flow from the Yarragadee Aquifer. The Australian national conservation areas cover the Gingilup-Jasper wetland system swamps, water body and lakes and the Lower Blackwood River area.

Threatened ecological communities and declared rare flora sites: Numerous threatened ecological communities and declared rare flora species are present in the subarea. Many of these are also associated with the area where the Yarragadee Aquifer discharges and are potentially groundwater-dependent.

Groundwater-dependent ecosystems and ecological water requirement sites: There are numerous ecological water requirement sites which do not have departmental monitoring associated with them but are important and may require additional work if a licence application is submitted near them (see Hyde 2006 for more information).

GDE sites with management trigger and responses	*Location*	*Maximum drawdown m AHD*
Poison Gully	E366758 N6223601	30.47

Cultural

Native Title claimant: South West Boojarah.

Aboriginal Heritage sites: Over 15 sites including Black Point, Donnelly, Blackwood and Scott rivers and their tributaries, and the Lake Jasper sites.

Several pools from Darradup to Sues Bridge, Barrabup pool on St John Brook, Chapman pool, Sues Bridge and Hut Pool are recognised as Aboriginal heritage sites that are not registered.

Social

Towns and localities: Town of Nannup and localities of Lake Jasper, Jalbarragup, Scott River, Schroeder, Carlotta, Biddelia and Darradup cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

Public water supply: There is a public water supply reserve in the Yarragadee Aquifer (3 000 000 kL/yr) which may be used in the future to meet drinking water supply demand for Nannup and Margaret River.

Blackwood–Yarragadee

National Parks, reserves and state forest: Over 70% of the subarea is coved by state forest and National Parks. They include D'Entrecasteaux, Scott, Blackwood and Milyeannup National Parks. St John Brook and Jarrahwood has been proposed as a conservation park as the brook is a perennial tributary which contains several interconnected permanent pools. The proposal allows for St John Brook to function as a wildlife corridor for native fauna.

Recreational sites: Blackwood (Darradup, Sues Bridge, Hut Pool, Barrabup/Workmans Pool, Warner Glen/Chapman Pool), Scott and Donnelly rivers and their tributaries, Lake Jasper and Gingilup swamps, Hardy Inlet, Black Point and all of the National Parks and nature reserves are sites of recreational significance. These sites are important to local people and tourists as the pools are a source of recreation and nature based education, as well as being iconic to their local area. Tourists visit to participate in activities such as fishing, marroning, education and wildlife appreciation.

Management zones that apply in this subarea

8	Discharge and recharge (groundwater) areas of the Blackwood River (including Hut pool, Poison Gully, St John Brook) and Yarragadee outcrop area (recharge zone)	Minimise the potential impacts from regional abstraction which may affect water levels in the recharge area and cause changes to the discharge zones on the Blackwood River and tributaries, affecting associated groundwater-dependent ecosystems. Minimise the potential impact from local abstraction close to the river (downstream of Darradup). Increase monitoring and minimise impacts on the recharge zone from regional abstraction.

Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.

1 The Sue Coal, Lesueur and unconfined Yarragadee are managed together within this allocation limit where each of the aquifers is present within the subarea boundary.

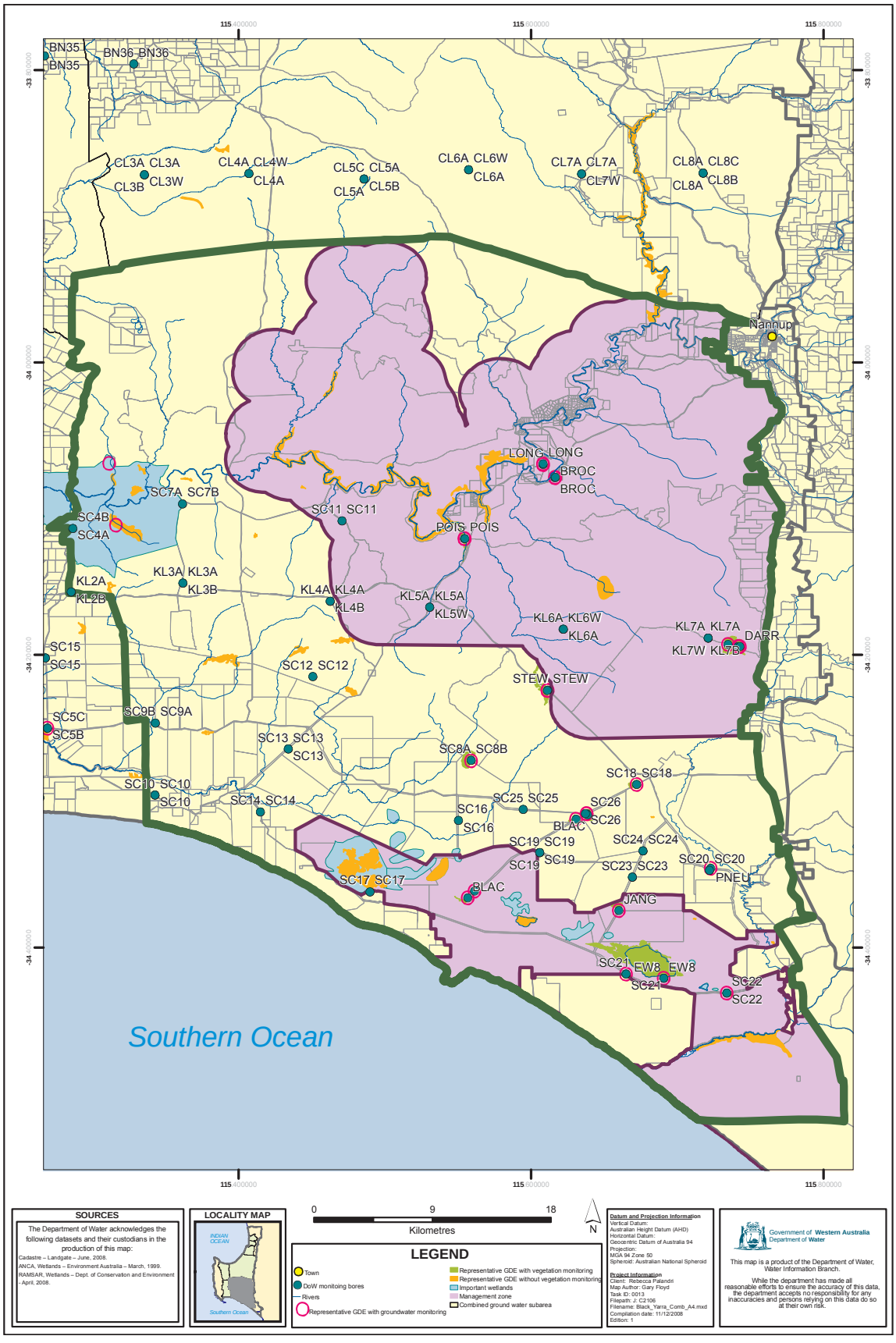


Figure 4 Blackwood–Yarragadee subarea

2.2 Jasper

Jasper		
Subarea description		
Area	391.0 km^2	
Proclamation	Blackwood groundwater area 1989	
Shire	Shire of Nannup	
Rainfall	1000–1300 mm	
Licensed water use (November 2008)	*Superficial:* 78 000 kL/yr. *Use:* Dairy purposes (48%) and general agriculture (52%) *Leederville:* 0 kL/yr. *Use:* No use	
Allocation and water availability kL/yr		
Aquifer	**Allocation limit**	**Available water**
Superficial	1 800 000	Contact the Busselton office for up-to-date availability.
Surficial (Blackwood)	200 000	Access restricted by location of aquifer. Contact the Busselton office for more information.
Leederville	50 000	
Issues for water management		
Although there are large amounts of water available from the Superficial Aquifer there is an allocation cap on the maximum allowable abstraction rate per hectare. Water quality sampling may be required for licences in the Superficial Aquifer (see management zone rules). Environmental management triggers and responses also apply. See *Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas,* Del Borrello 2008 for more information. More information on the hydrogeology in the Jasper subarea can be found in *Hydrogeology of the eastern Scott coastal plain,* Irwin 2007.		
Hydrogeology		
Aquifer	**Description**	
Superficial	The Superficial formations consist of Tamala Limestone, Yoganup formation, Guildford formation and Safety Bay sands (Quindalup dunes). The Superficial Aquifer extends up to 14 km inland on the Scott coastal plain with a saturated thickness of up to 20 m increasing towards the coast and thinning towards the north as the elevation increases. There are areas where the Bunbury Basalt is exposed at the surface and areas of iron oxide-cemented layers within the formation (coffee rock) which can restrict vertical flow. The Superficial overlies the Leederville and the Yarragadee formations. The groundwater level is close to the surface on much of the Scott coastal plain, with flooding occurring extensively during winter. The watertable can exceed 100 m below ground level in the dunal areas. Groundwater contributes to Lake Jasper, Lake Quitjup and other wetlands in the area. Groundwater salinity is generally low (<500 mg/L).	

Jasper	
Leederville	The Leederville Aquifer is largely absent throughout most of the subarea, particularly where the Bunbury Basalt is present. The aquifer outcrops to the north and underlies the superficial aquifer in some areas, increasing in thickness in the north and east. Where the aquifer is present it ranges in depth between 0–50 m below ground level. It overlies the Yarragadee Aquifer and in some places extends under the Superficial Aquifer. In this subarea the Leederville is high in clay content and may act as a confining layer to the underlying Yarragadee Aquifer. Groundwater flows towards the coast, forming mounds in some areas (reflecting topography) and feeds Barlee Brook. Groundwater salinity is < 500 mg/L.

Considerations for water use include, but are not limited to, the following

Ecological sites

Wetlands and waterways: Scott and Donnelly rivers, with minor and major tributaries. The Australian national conservation area covering Gingilup–Jasper wetland system swamps, water body and lakes which are part of the subarea within the National Park and Gingilup Swamps nature reserve.

These rivers and tributaries provide habitat for fauna and protect priority flora and native vegetation. Many of the wetlands within the National Park have recently been categorised as conservation category wetlands, due to their function of providing freshwater fish habitat and breeding grounds for birds.

Threatened ecological communities and declared rare flora sites: No threatened ecological community sites. Seventeen different species (across 15 sites) of declared rare flora throughout the subarea with the majority located within the D'Entrecasteaux National Park.

Groundwater-dependent ecosystems and ecological water requirement sites: The groundwater-dependent ecosystem sites listed below have ecological monitoring associated with them. For more information see Del Borrello 2008. There are numerous ecological water requirement sites which do not have departmental monitoring associated with them but are important and may require additional work if a licence application is submitted near them (see Hyde 2006 for more information).

GDE sites with management trigger and responses	*Location*	*Maximum drawdown m AHD*
Lake Jasper 1	E380329 N6190540	38.50
Black Point Road	E374002 N6202371	42.69

Cultural sites

Native Title claimant: South West Boojarah.

Aboriginal Heritage sites: Fourteen sites including Black Point, Lake Jasper and surrounding sites, the Scott and Donnelly rivers and associated wetlands, and Barlee Brook. Aboriginal stone artefacts exist on the lake bed in Lake Jasper.

Social sites

Towns and localities: Localities of Lake Jasper, Scott River East, Peerabeelup and Yeagarup cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

National Parks, reserves and state forest: Subarea is 50% forested including Gingilup Swamps Nature Reserve, D'Entrecasteaux and Greater Hawke National Parks, and parts of Barlee Brook, Donnelly and Milyeannup State Forest areas.

Jasper		
Recreational sites: The D'Entrecasteaux National Park, Gingilup swamps and Lake Jasper are sites of recreational significance. However only Lake Jasper is promoted and easily accessed for recreation. The cultural, social and ecological values associated with the park have resulted in the park being used for education and scientific research.		
Management zones that apply in this subarea		
1	Scott coastal plain wetlands – including Lake Jasper	Minimise impacts on high value groundwater-dependent ecological and social values. Minimise the potential impact of declining water levels (abstraction) from underlying aquifers and connected systems.
Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.		

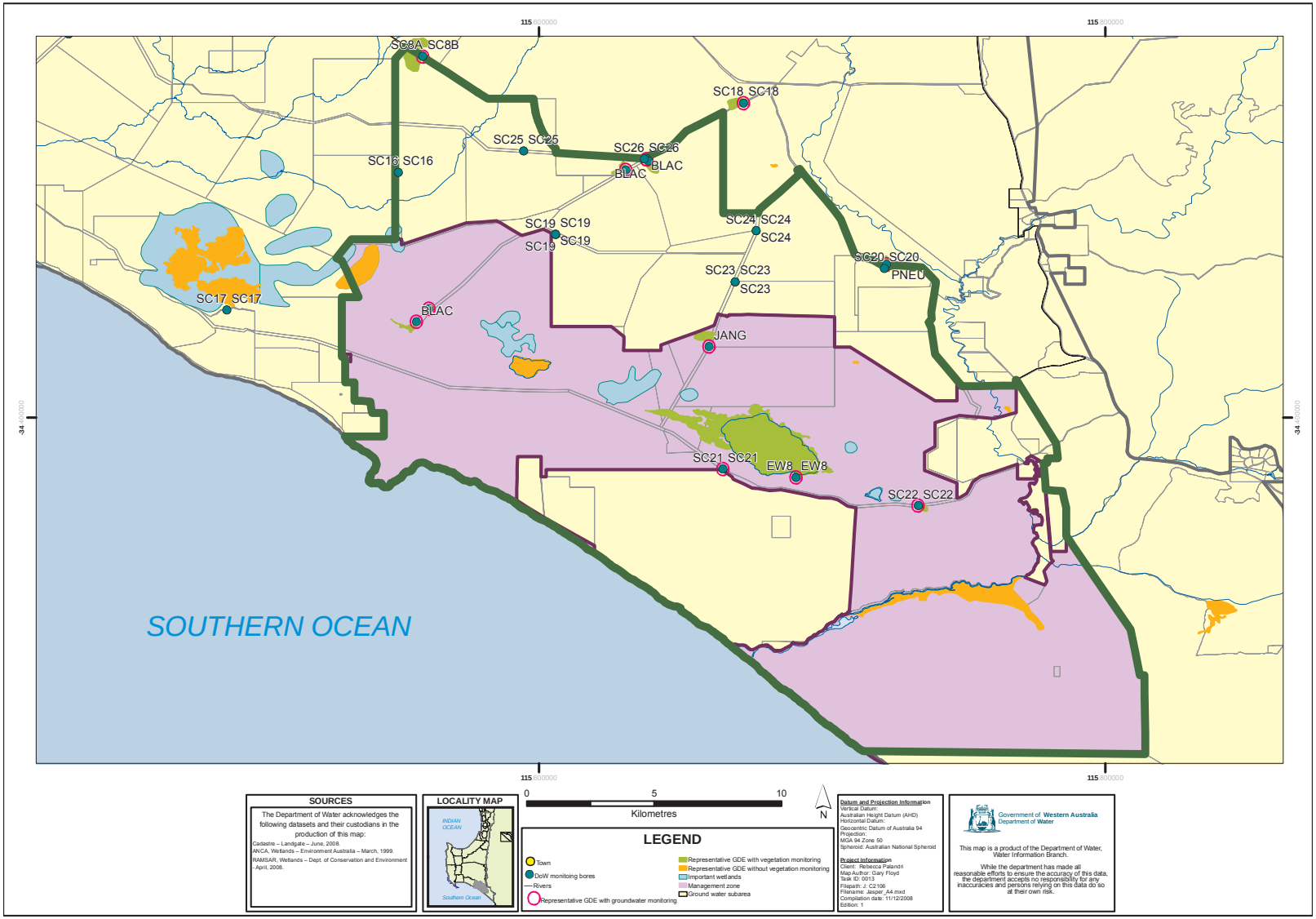


Figure 5 Jasper subarea

2.3 Scott

Scott		
Subarea description		
Area	271.7 km^2	
Proclamation	Blackwood groundwater area 1989	
Shire	Shire of Nannup	
Rainfall	1000–1200 mm	
Licensed water use (November 2008)	*Superficial and surficial*: 271 000 kL/yr. *Use*: Horticulture (85%) and general agriculture (5%) *Leederville*: 24 000 kL/yr. *Use*: Dairy purposes (83%), general agriculture (13%) and stock, domestic and garden use (4%)	
Allocation and water availability kL/yr		
Aquifer	**Allocation limit**	**Available water**
Superficial	1 990 000	Contact the Busselton office for up-to-date availability.
Surficial (Blackwood)	10 000	Access restricted by location of aquifer. Contact the Busselton office for more information.
Leederville	3 200 000	Contact the Busselton office for up-to-date availability.
Issues for water management		
Although there are large amounts of water available from the Superficial Aquifer there is an allocation cap on the maximum allowable abstraction rate per hectare. Water quality sampling may be required for licences in the Superficial Aquifer. Environmental management triggers and responses also apply. See *Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas,* Del Borrello 2008 for more information. More information on the hydrogeology in the Jasper subarea can be found in *Hydrogeology of the eastern Scott coastal plain, Irwin 2007.*		
Hydrogeology		
Aquifer	**Description**	
Superficial	The Superficial formations consist of Tamala Limestone, Yoganup formation, Guildford formation and Safety Bay sands (Quindalup dunes). The Superficial Aquifer extends up to 14 km inland on the Scott coastal plain with a saturated thickness of up to 20 m increasing towards the coast and thinning towards the north as the elevation increases. The superficial formations on the Scott coastal plain thicken from west to east. They overlie the Leederville and the Yarragadee formations. The groundwater level is close to the surface on much of the Scott coastal plain, with flooding occurring extensively during winter. The watertable can exceed 100 m below ground level in the dunal areas. Groundwater contributes to Lake Jasper, Lake Quitjup and other wetlands in the area. Groundwater salinity is generally low (< 500 mg/L).	

Scott	
Leederville	The Upper and Lower Vasse members of the Leederville Aquifer are present throughout most of the subarea, with the aquifer absent where the Bunbury Basalt is present. The aquifer outcrops to the north and also underlies the superficial aquifer in some areas, increasing in thickness in the north and east. Where the aquifer is present it ranges in depth between 50–100 m below ground level. It overlies the Yarragadee Aquifer and in some places extends under the Superficial Aquifer. In this area the Leederville is high in clay content and in some areas acts as a confining layer to the underlying Yarragadee Aquifer. Groundwater salinity is generally < 500 mg/L.

Considerations for water use include, but are not limited to, the following

Ecological

Wetlands and waterways: Scott River runs through the subarea. The Australian national conservation area covering Gingilup-Jasper wetland system swamps, water body and lakes which are part of the subarea within the National Park and Gingilup Swamps nature reserve.

These rivers and tributaries provide habitat for fauna and protect priority flora and native vegetation. Many of the wetlands within the reserve have recently been categorised as conservation category wetlands, due to their function of providing freshwater fish habitat and breeding grounds for birds.

Threatened ecological communities and declared rare flora sites: Two threatened ecological community sites associated with Scott River. Fifteen different species (across over 40 sites) of declared rare flora, with the majority associated with Scott River and Governor Broom Road.

Groundwater-dependent ecosystems and ecological water requirement sites: There are numerous ecological water requirement sites which do not have departmental monitoring associated with them but are important and may require additional work if a licence application is submitted near them (see Hyde 2006 for more information).

Cultural

Native Title claimant: South West Boojarah.

Aboriginal Heritage sites: Blackwood River site, which occurs throughout the Blackwood groundwater area and Dunnett's Farm (Kybra).

Social

Towns and localities: Locality of Scott River East covers this subarea, with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

National Parks, reserves and state forest: Gingilup swamps nature reserve.

Recreational sites: Scott River and Gingilup–Jasper wetlands.

Management zones that apply in this subarea

1	Scott coastal plain wetlands – including Lake Jasper	Minimise impacts on high value groundwater-dependent ecological and social values. Minimise the potential impact of declining water levels (abstraction) from underlying aquifers and connected systems.

Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.

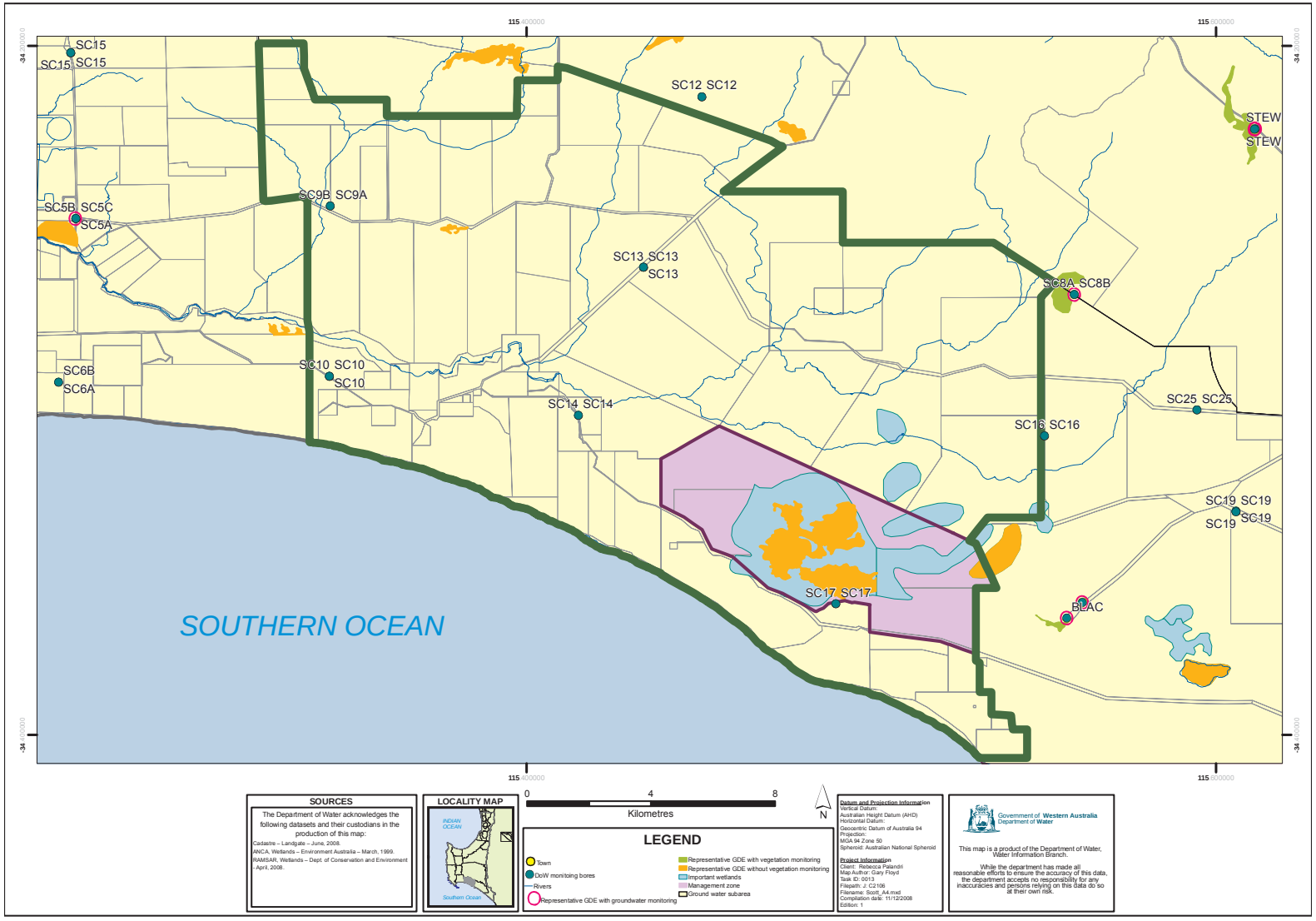


Figure 6 Scott subarea

2.4 Blackwood Plateau South

Blackwood Plateau South		
Subarea description		
Area	1580.9 km^2	
Proclamation	Blackwood groundwater area 1989	
Shire	Shires of Augusta–Margaret River and Nannup	
Rainfall	1000–1200 mm	
Licensed water use (November 2008)	*Surficial:* 0 kL/yr. *Use:* Exempt stock, domestic and garden purposes (100%) *Leederville:* 94 000 kL/yr. *Use:* Stock, domestic and garden (76%), viticulture (23%) and service sector (1%)	
Allocation and water availability kL/yr		
Aquifer	**Allocation limit**	**Available water**
Surficial	50 000	Access restricted by location of aquifer. Contact the Busselton office for more information.
Leederville	250 000	Contact the Busselton office for up-to-date availability.
Issues for water management		
The subarea is predominantly state forest, with some freehold land along the Blackwood River. The subarea is likely to supply public drinking water to towns reliant on surface water in the near future. The Leederville Aquifer supplies surface water base flow in some areas of the Blackwood River and tributaries. Environmental management triggers and responses also apply. See *Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas,* Del Borrello 2008 for more information.		
Hydrogeology		
Aquifer	**Description**	
Surficial	The surficial sediments are thin to absent in most areas and found either side of the Blackwood River and its tributaries and old palaeochannels, and are generally shallow (0–5 m). The groundwater salinity is low, < 500 mg/L.	
Leederville	The Leederville Aquifer is a multi-layered aquifer system comprising of discontinuous interbedded sequences of sand and clay. The Leederville Aquifer includes six distinct members of the Leederville formation – Quindalup, Upper and Lower Mowen, Upper and Lower Vasse and Yelverton members. The formation is exposed at the surface on the Blackwood Plateau between the Whicher Scarp in the north and the Scott coastal plain in the south. It is lateritised at the surface and unconformably overlies older the Yarragadee formation and the Bunbury Basalt. On the Blackwood Plateau the Leederville formation is generally shalely and has few sandstone layers. The groundwater is fresh < 500 mg/L. Where the aquifer is unconfined it is known to discharge into the Blackwood River and tributaries (Rosa Brook).	

Blackwood Plateau South

Considerations for water use include, but are not limited to, the following

Ecological

Wetlands and waterways: The Blackwood River runs through the subarea including its tributaries, many of which are groundwater-dependent. They include St John, Rosa, Adelaide, Carlotta, Layman, McAtee, Milyeannup and Nannup brooks; Boronia and Red gullies; and Poison and Sturke creeks. The subarea also contains the headwaters of Scott River.

Spearwood Creek Swamp and Adelaide Brook Swamp both support populations of declared rare fauna – the White-bellied frog (*Geocrinia alba*) and Yellow-bellied frog (*Geocrinia vitellina*) which are covered by a proposed Ramsar wetland area.

Threatened ecological communities and declared rare flora sites: Nine threatened ecological community sites all associated with Adelaide and Spearwood creeks. Over 100 sites registered with over 30 different species of declared rare flora.

Groundwater-dependent ecosystems and ecological water requirement sites: The groundwater-dependent ecosystems sites listed below have ecological monitoring associated with them. For more information see Del Borrello 2008.

There are numerous ecological water requirement sites which do not have departmental monitoring associated with them but are important and may require additional work if a licence application is submitted near them (see Hyde 2006 for more information).

GDE site with management trigger and responses	*Location*	*Maximum drawdown m AHD*
Reedia South	E344695 N6224241	23.73
Darradup (Blackwood River)	E372580 N6229055	Flow below historical minimum during months of summer base flow
Hut Pool (Blackwood River)	E342488 N6226448	Flow below historical minimum during months of summer base flow

Cultural

Native Title claimant: South West Boojarah.

Aboriginal Heritage sites: The Blackwood River Waugal and Nannup town site which has two art sites, one burial in the town and an artefact site. Several pools from Darradup to Sues Bridge, Barrabup pool on St John Brook, Sues Bridge and Hut Pool are recognised as Aboriginal heritage sites that are not registered.

Social

Towns and localities: Town of Nannup and the localities of Darradup, Schroeder, Jalbarragup, Carlotta, Scott River East and Biddelia cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

Public water supply: Water Corporation currently supplies the town of Nannup with drinking water from a surface water dam on Tanjannerup Creek.

National Parks, reserves and state forest: The majority of the subarea is forested and contains Milyeannup, Blackwood, South Blackwood and Millbrook state forest areas, Pagett nature reserve and Milyeannup, Butler, Blackwood and Hilliger National Parks.

Recreational sites: National Parks, Blackwood River and tributaries, state forest.

Blackwood Plateau South		
Management zones that apply in this subarea		
8	Discharge and recharge (groundwater) areas of the Blackwood River and Yarragadee outcrop area (recharge zone)	Minimise the potential impacts from regional abstraction which may affect water levels in the recharge area and cause changes to the discharge zones on the Blackwood River and tributaries, affecting associated groundwater-dependent ecosystems. Minimise the potential impact from local abstraction close to the river (downstream of Darradup). Increase monitoring and minimise impacts on the recharge zone from regional abstraction.
Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.		

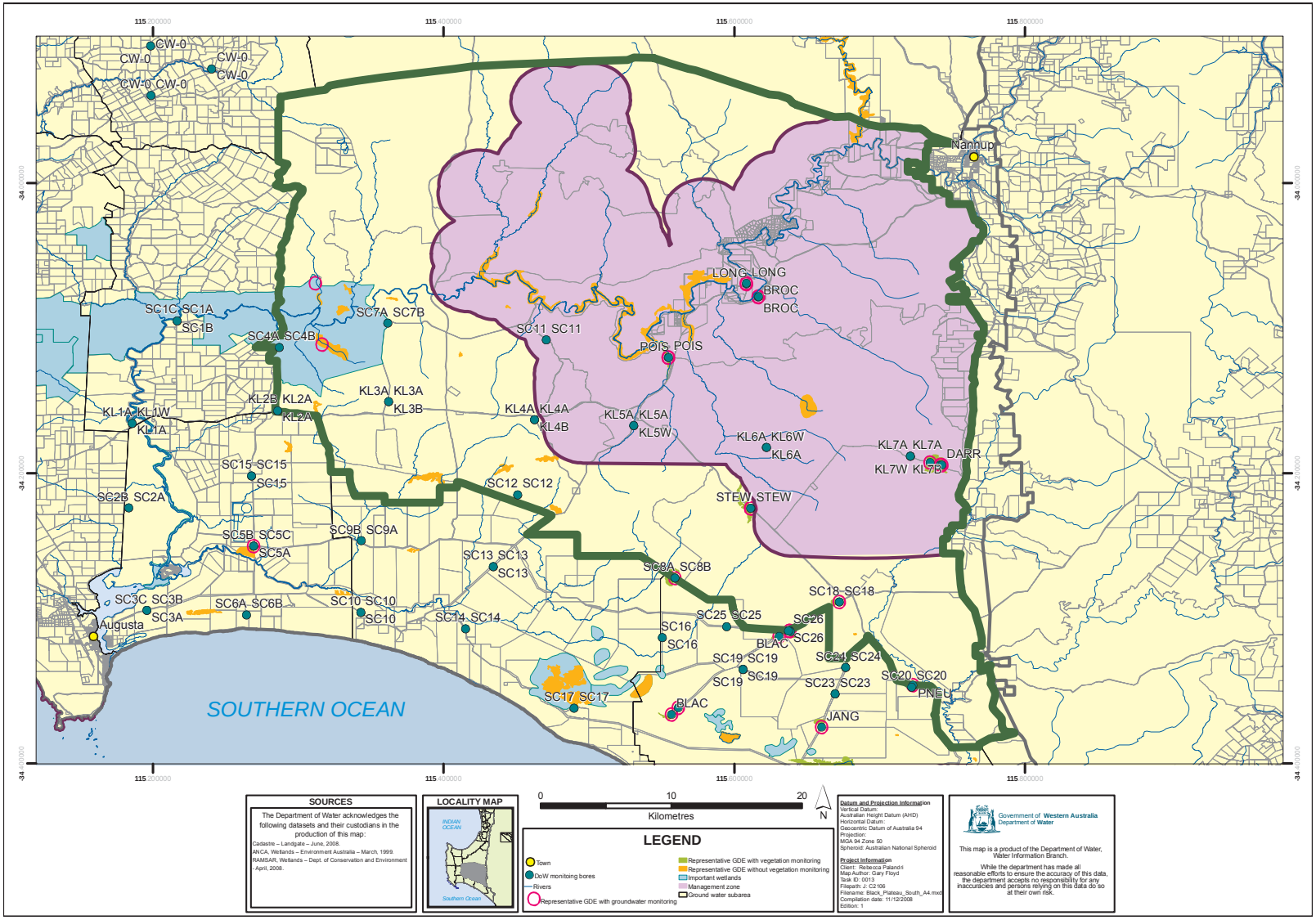


Figure 7 Blackwood Plateau South subarea

2.5 Beenup

Beenup		
Subarea description		
Area	234.6 km^2	
Proclamation	Blackwood groundwater area 1989	
Shire	Shire of Augusta–Margaret River	
Rainfall	1000–1200 mm	
Licensed water use (November 2008)	*Superficial:* 23 400 kL/yr. *Use:* Dairy (90%) and general agriculture (10%) *Leederville:* 401 150 kL/yr. *Use:* Horticulture (96%), general agriculture (3%) and stock, domestic and garden use (1%)	
Allocation and water availability kL/yr		
Aquifer	**Allocation limit**	**Available water**
Superficial	1 370 000	Contact the Busselton office for more information.
Surficial (Leeuwin)	5 000	Access restricted by location of aquifer. Contact the Busselton office for more information.
(Blackwood)	25 000	
Leederville	1 000 000	Access restricted by location of aquifer and by the management zone. Contact the Busselton office for more information.
Issues for water management		
The Leederville Aquifer between the Beenup mine site and the river is contaminated with an acid rock drainage plume (a result of waste rock from the mine which is generating acidic groundwater) and is currently under monitoring and management. As a consequence water use from the Superficial, Leederville and Lesueur (as it is artificially connected to the Leederville in this subarea) aquifers is restricted by management zone no. 7 in this subarea. This means that within the management zone boundary no new allocations and no new bores or excavations are allowed to be constructed into the Superficial or Leederville Aquifers, other than for exempt use, replacement bores, monitoring purposes or remediation.		
Hydrogeology		
Aquifer	**Description**	
Superficial	The superficial formation on the Scott coastal plain changes in thickness from west to east, increasing towards the east of the plain. The groundwater level is close to the surface on much of the Scott coastal plain but is deep beneath the coastal dunes. The groundwater salinity is generally low < 500 mg/L.	

Beenup	
Leederville	The Leederville Aquifer is a multi-layered aquifer system comprising of discontinuous interbedded sequences of sand and clay. The Leederville Aquifer on the Vasse shelf (between Busselton and Dunsborough faults) includes six distinct members of the Leederville formation – Quindalup, Upper and Lower Mowen, Upper and Lower Vasse and Yelverton members. The formation is lateritised at the surface and unconformably overlies the older formation of the Lesueur Sandstone. The Leederville Aquifer is now artificially connected to the Lesueur Sandstone formation through the Beenup mine site. The Upper Vasse member is best for abstraction as it has the higher percentage of sand beds. Depth of the aquifer ranges from 15–200 m below ground level (below the superficial aquifer). The groundwater is fresh and generally < 500 mg/L.

Considerations for water use include, but are not limited to, the following

Ecological

Wetlands and waterways: Scott River and several tributaries, Blackwood River, Glenarty Creek, Hardy Inlet and estuary. Lower Blackwood River is covered as an Australian national conservation wetland area.

Threatened ecological communities and declared rare flora sites: Over 40 threatened ecological community sites, with most associated with Scott National Park, Scott River and some in road reserves. There are over 140 declared rare flora sites recorded, the majority are associated with a threatened ecological community site.

Cultural

Native Title claimant: South West Boojarah.

Aboriginal Heritage sites: Eight registered sites, including the Hardy inlet, Blackwood and Scott rivers (Waugal) and other artefact sites, including burials, art sites, a scarred tree and an ochre deposit.

Social

Towns and localities: Localities of Scott River, Molloy Island, Kudardup, Courtney, Karridale and Alexandra Bridge cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

National Parks, reserves and state forest: Scott National Park and two unnamed nature reserves.

Recreational sites: Hardy inlet, Scott River, Scott National Park and the Blackwood River.

Management zones that apply in this subarea

7	Buffer zone area defined by acid sulfate soil plume from Beenup mine site	Manage the existing acid sulfate soil impact in the Leederville and Lesueur Sandstone aquifers. Increase the monitoring to minimise movement of the acid sulfate soil plume into surface water systems (Scott River and Hardy Inlet). Reduce abstraction to minimise water level changes and exposure of acid sulfate soil.

Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.

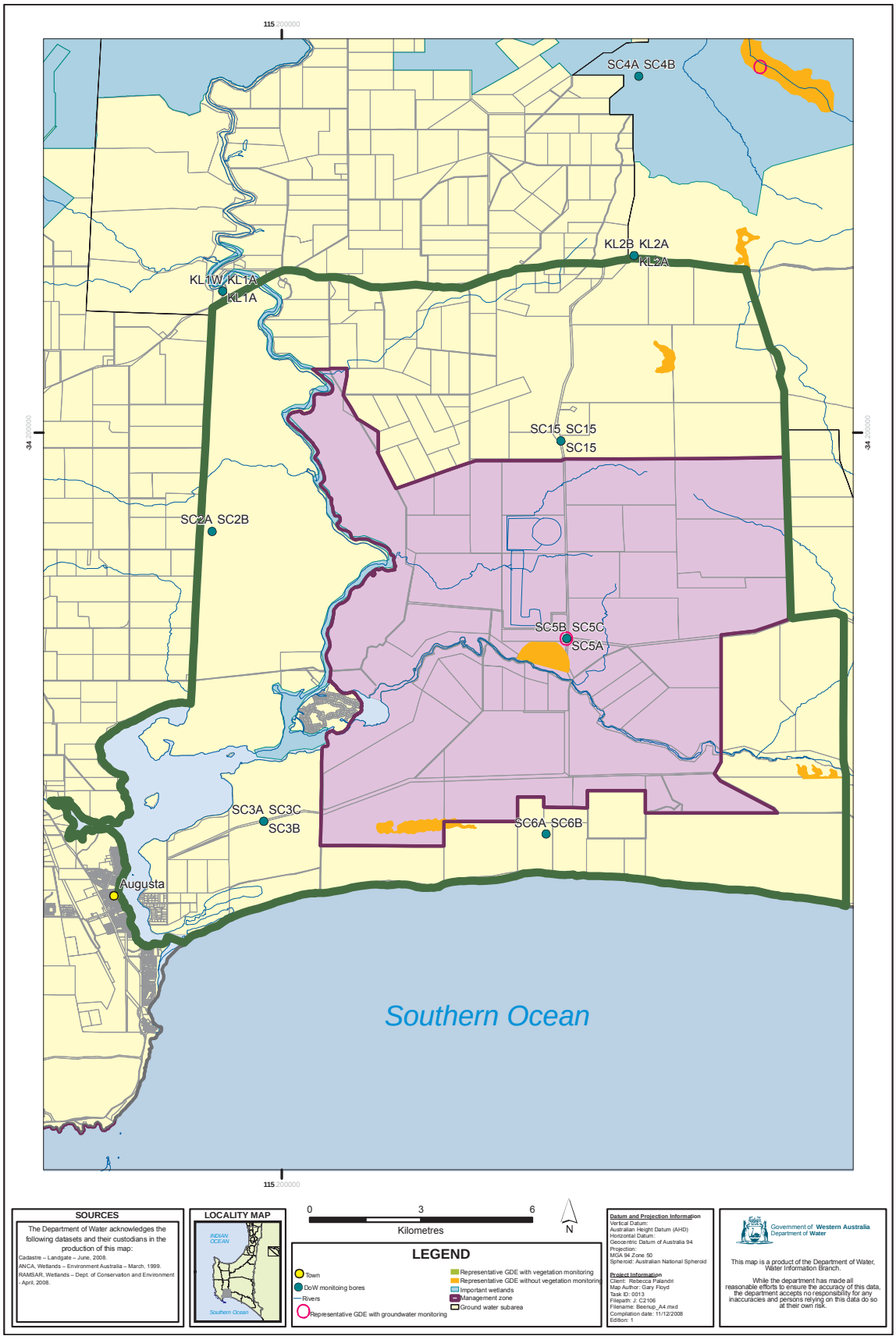
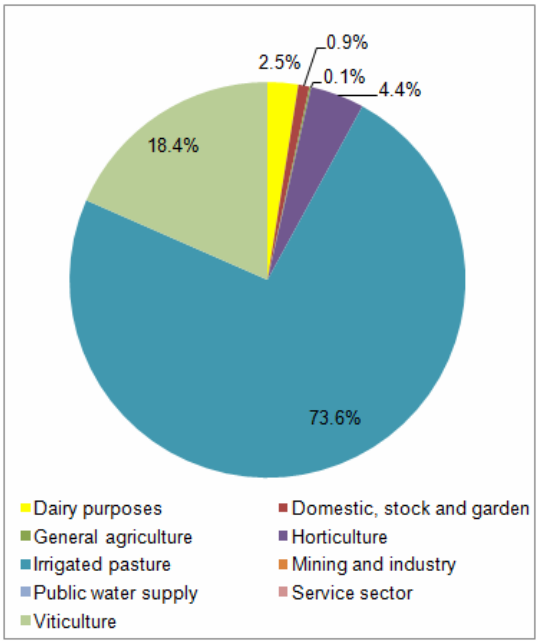


Figure 8 Beenup subarea

2.6 Rosa

<table>
<tr><th colspan="4">Rosa</th></tr>
<tr><th colspan="4">Subarea description</th></tr>
<tr><td>Area</td><td colspan="2">236.8 km^2</td><td rowspan="4">Licensed water use (November 2008)
Superficial: 75 600 kL/yr.
Use: Horticulture (49%) and viticulture (51%)
Leederville: 605 100 kL/yr
 
</td></tr>
<tr><td>Proclamation</td><td colspan="2">Blackwood groundwater area 1989</td></tr>
<tr><td>Shire</td><td colspan="2">Shire of Augusta–Margaret River</td></tr>
<tr><td>Rainfall</td><td colspan="2">1000–1300 mm</td></tr>
<tr><th colspan="3">Allocation and water availability
kL/yr</th></tr>
<tr><td>Aquifer</td><td>Allocation limit</td><td>Available water</td><td></td></tr>
<tr><td>Surficial (Leeuwin)</td><td>5 000</td><td rowspan="2">Restricted by location. Contact the Busselton office for more information.</td><td></td></tr>
<tr><td>(Blackwood)</td><td>95 000</td><td></td></tr>
<tr><td>Leederville</td><td>1 000 000</td><td>Contact the Busselton office for up-to-date availability.</td><td></td></tr>
<tr><th colspan="4">Issues for water management</th></tr>
<tr><td colspan="4">The Surficial and Leederville Aquifers are connected to surface water in the north of this subarea. Any excavation for dam construction is likely to intercept groundwater and will require a groundwater licence. Restrictions on the location of the draw point and the amount to be abstracted may apply. These restrictions apply to abstraction from the Leederville Aquifer and refer to depth requirements, distances between existing and new bores, and maximum draw allowed from any given draw point. Environmental management triggers and responses also apply. See Management triggers and responses for groundwater-dependent ecosystems in the South West groundwater areas, Del Borrello 2008 for more information.</td></tr>
<tr><th colspan="4">Hydrogeology</th></tr>
<tr><td>Aquifer</td><td colspan="3">Description</td></tr>
<tr><td>Surficial</td><td colspan="3">There are a variety of Surficial deposits throughout the subarea where weathering and erosion of the underlying layer of sediments has occurred. The Surficial Aquifer in this subarea is very thin or absent and is difficult to differentiate between the shallow Leederville Aquifer.</td></tr>
<tr><td>Leederville</td><td colspan="3">The Leederville Aquifer is a multi-layered aquifer system consisting of discontinuous interbedded sequences of sand and clay. The Leederville Aquifer on the Vasse shelf (between Busselton and Dunsborough faults) includes six distinct members of the Leederville formation – Quindalup, Upper and Lower Mowen, Upper and Lower Vasse and Yelverton members.</td></tr>
</table>

Rosa	
	The formation is lateritised at the surface and unconformably overlies the older formation of the Lesueur Sandstone. The Quindalup member (where present and deep enough) and the Upper Vasse member are best for abstraction as they have the higher percentage of sand beds. Depth of the aquifer ranges from 15–200 m below ground level (below the superficial aquifer). The Leederville in the subarea is unconfined (Quindalup member) and has a hydraulic connection to the overlying superficial aquifer. The Leederville Aquifer discharges into the upper reaches of several Blackwood River tributaries. The groundwater is fresh and generally < 500 mg/L.
Considerations for water use include, but are not limited to, the following	
Ecological sites	
Wetlands and waterways: The Blackwood River runs through the subarea, with many of its tributaries. The tributaries include Fisher and McLeod creeks; and Upper Chapman and Chapman brooks. Spearwood Creek Swamp and Adelaide Brook Swamp both support populations of declared rare fauna – the White-bellied frog (*Geocrinia alba*) and Yellow-bellied frog (*Geocrinia vitellina*) which are covered by a proposed Ramsar wetland area. *Threatened ecological communities and declared rare flora sites*: Twenty different species of declared rare flora and three sites of threatened ecological community. Most of the species of declared rare flora and threatened ecological community sites are associated with a waterway. *Groundwater-dependent ecosystems and ecological water requirement sites*: There are several ecological water requirement sites which do not have departmental monitoring associated with them but are important and may require additional work if a licence application is submitted near them (see Hyde 2006 for more information).	
Cultural sites	
Native Title claimant: South West Boojarah. *Aboriginal Heritage sites*: Blackwood River, McLeod/Rushy Creek and Upper Chapman Brook and the surrounding areas. Chapman Pool is a recognised site of Aboriginal heritage that is not yet registered.	
Social sites	
Towns and localities: Localities of Warner Glen, Rosa Glen, Schroeder, Nillup, Forest Grove and Alexandra Bridge cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction. *Public Water Supply*: Priority 1 areas for the protection of the public drinking water on the Margaret River – Ten mile Brook catchments cover an area in the north of the subarea. *National Parks, reserves and state forest:* Forest Grove National Park and parts of Blackwood River, Blackwood and South Blackwood National Parks. There are also large areas of timber reserve within the subarea. *Recreational sites:* Warner Glen recreational site (Chapman Pool) at the confluence of the Chapman and Blackwood Rivers is a recreational site of significance.	
Management zones that apply in this subarea	
10	Recharge area for Leederville Aquifer on the Vasse shelf — Manage abstraction in the recharge area of the Leederville Aquifer.
Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.	

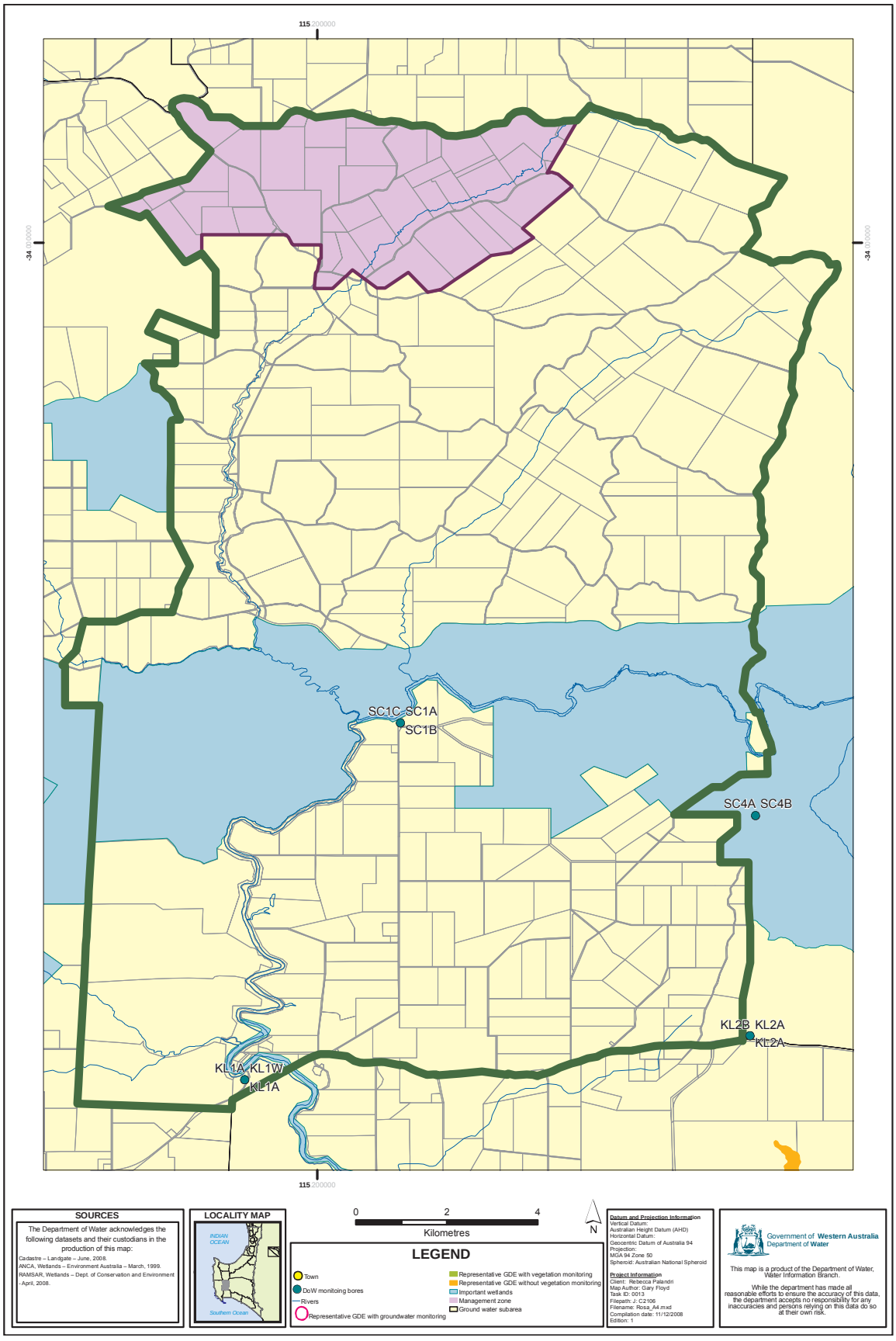
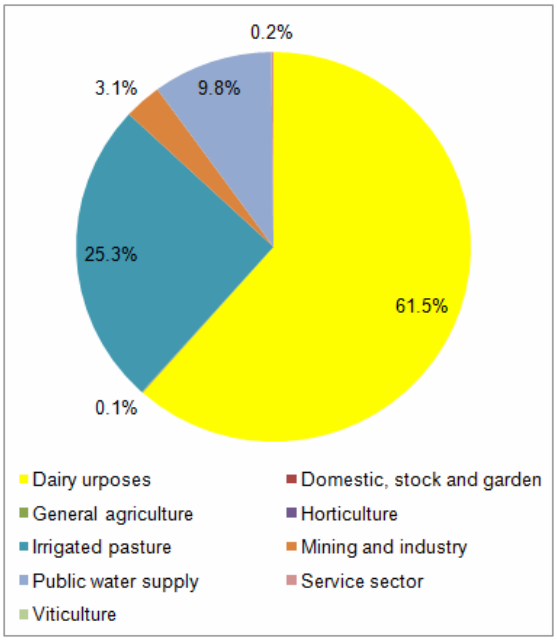


Figure 9 Rosa subarea

2.7 Rosa–Beenup

Rosa–Beenup			
Subarea description			
Area	471.5 km^2		**Licensed water use (November 2008)**
Proclamation	Blackwood groundwater area 1989		*Lesueur:* 2 802 000 kL/yr
Shire	Shire of Augusta–Margaret River		
Rainfall	1000–1300 mm		
Allocation and water availability kL/yr			
Aquifer	**Allocation limit**	**Available water**	
Lesueur / Sue Coal	4 000 000	Restricted. Contact the Busselton office for up-to-date availability.	

Issues for water management
Abstraction from the Lesueur Sandstone Aquifer is restricted by management zone no 7. This means that within the management zone boundary no new bores or excavations are allowed to be constructed into the Lesueur Aquifer, other than for exempt use, replacement bores, monitoring purposes or remediation. Outside the management zone any new licence application will require hydrogeological investigations. There are some areas where the Sue Coal Measures Aquifer is present. This aquifer will be managed together with the Lesueur Sandstone Aquifer in this subarea.

Hydrogeology	
Aquifer	**Description**
Lesueur Sandstone	The Lesueur Sandstone formation is present throughout the Bunbury Trough overlying the Sabina Sandstone and the Sue Coal measures formations. It is shallowest on the Vasse Shelf south of Margaret River. It is absent west of the Busselton fault in the north and in places along the Dunsborough fault in the west of the subarea. The Sabina and Lesueur Sandstone formation make up the Lesueur Aquifer. The aquifer is generally greater than 200 m below ground and ranges in thickness from 500 m (west) to <1500 m (east). The Lesueur formation underlies the Leederville and Superficial formations and is unconfined in a small area on the Blackwood Plateau (west of the Blackwood River). It is currently unknown where the aquifer is recharged or if it discharges into the lower reaches of the Blackwood River.

Rosa–Beenup		
	It is known to outcrop as ferruginous sandstone south of the Scott River. The aquifer is artificially hydraulically connected to the Leederville Aquifer through the Beenup mine site. It is about 500 m thick near Beenup mineral Sands mine site, and may be thicker to the north of the subarea. Groundwater salinity is generally < 500 mg/L.	
Considerations for water use include, but are not limited to, the following		
Ecological sites		
The Lesueur Sandstone Aquifer is not known to support any sites of ecological significance.		
Cultural sites		
The Lesueur Sandstone Aquifer is not known to support any sites of cultural significance.		
Social sites		
Public water supply: The Water Corporation supplies water to the Augusta town site from the Lesueur Sandstone aquifer which is used in conjunction with the spring water from the Leeuwin Springs.		
Management zones that apply in this subarea		
7	Buffer zone area defined by acid sulfate soil plume from Beenup mine site	Manage the existing acid sulfate soil impact in the Leederville and Lesueur Sandstone aquifers. Increase the monitoring to minimise movement of the acid sulfate soil plume into surface water systems (Scott River and Hardy Inlet). Reduce abstraction to minimise water level changes and exposure of acid sulfate soil.
Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.		

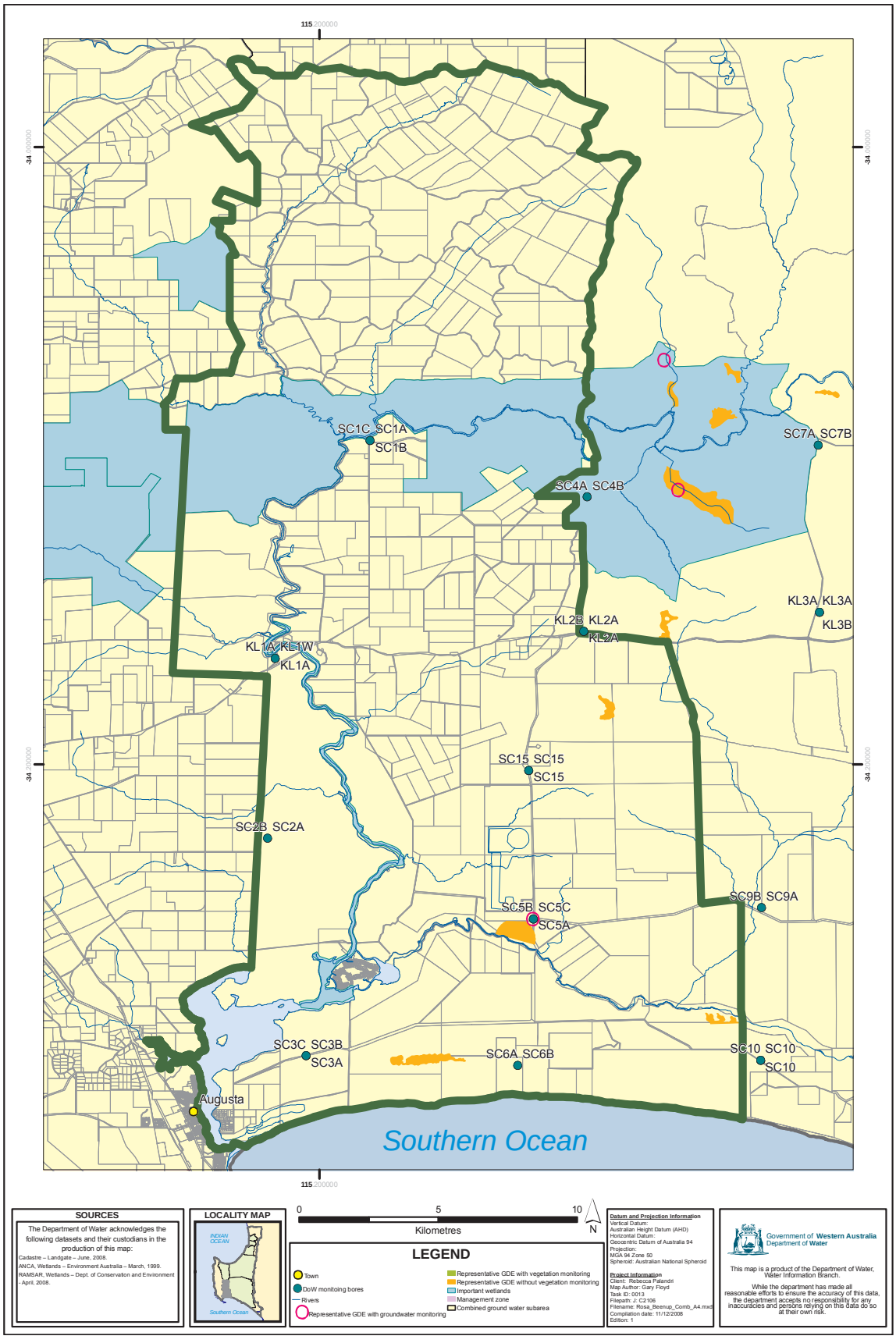
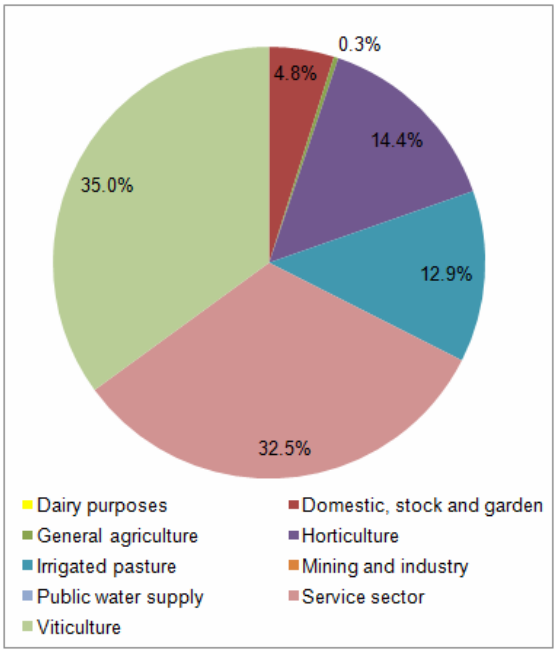


Figure 10 Rosa–Beenup subarea

2.8 Cape to Cape South

<table>
<tr><th colspan="4">Cape to Cape South</th></tr>
<tr><th colspan="4">Subarea description</th></tr>
<tr><td>Area</td><td colspan="2">548.4 km^2</td><td rowspan="4">Licensed water use (November 2008)
Surficial: 311 125 kL/yr
 

Fractured rock: 13 000 kL/yr.
Use: Service sector (68%) and stock, domestic and garden (32%)</td></tr>
<tr><td>Proclamation</td><td colspan="2">Blackwood groundwater area – variation 1997</td></tr>
<tr><td>Shire</td><td colspan="2">Shire of Augusta–Margaret River</td></tr>
<tr><td>Rainfall</td><td colspan="2">1000–1300 mm</td></tr>
<tr><th colspan="3">Allocation and water availability kL/yr</th></tr>
<tr><td>Aquifer</td><td>Allocation limit</td><td>Available water</td></tr>
<tr><td>Surficial (Leeuwin)
(Blackwood)</td><td>585 000
5 000</td><td>Access restricted by location of aquifer Contact the Busselton office for up-to-date availability.</td></tr>
<tr><td>Fractured rock</td><td>N/A</td><td>Access restricted by location of aquifer Contact the Busselton office for more information.</td></tr>
<tr><td>Leederville</td><td>10 000</td><td rowspan="2">Access restricted by location of aquifer Exploration is required. Contact the Busselton office for more information.</td></tr>
<tr><td>Lesueur</td><td>10 000</td></tr>
<tr><th colspan="4">Issues for water management</th></tr>
<tr><td colspan="4">The Surficial and Fractured rock aquifers are limited in their capacity to supply water. There is no guarantee that the supply will be constant. Both aquifers rely on rainfall recharge, and as such the allocation limits and the allocation of the water resource are limited. As a result, restrictions on the location of excavations and bores may apply.
Within the boundary of management zone 12 no new bores or excavations are allowed to be constructed, other than for exempt use, replacement bores, monitoring purposes or remediation. Outside the management zone any new licence application may require hydrogeological investigations, in particular pump tests, which will be required from the point of abstraction before a licence can be issued. There are some areas where the Leederville or Lesueur Sandstone aquifers may be present along the eastern boundary of the subarea. It is currently unknown to what extent these aquifers are present. A groundwater exploration licence would be required to prove the resource is present before a licence to take could be issued.</td></tr>
</table>

Cape to Cape South	
Hydrogeology	
Aquifer	**Description**
Surficial	The Surficial Aquifer in the Cape to Cape South subarea ranges from alluvial and colluvial deposits in river valleys to dunes and swales which can reach a thickness exceeding 100 m, but the saturated thickness of the aquifer is small and in places, dune sands lie over dry bedrock with no watertable development. The groundwater is generally fresh. The sand and limestone deposits are restricted to a few kilometres along the coast. Bores can reach up to 30 m in depth and remain in the Surficial Aquifer, particularly between the Leeuwin Ridge granitic bedrock and the coastal limestone areas along Caves Road.
Fractured rock	In the east of the subarea the fractured rock is the basement rocks of the Leeuwin Complex, which are granitic with an overlying weathered profile. They are overlain by shallow surficial deposits and in some areas thin unconfined Leederville (north-east of the subarea). Along the western coastline are limestone formations where numerous caves have developed. The caves bottom on basement gneisses, with the limestone and sand deposits on top (up to 100 m deep). In fractured rock aquifers, the rock body is solid, and groundwater storage and movement can occur only along fractures in the rock, which are usually relatively limited and in most instances are not well connected. There is considerable uncertainty associated with the development of a sustainable groundwater resource from the fractured rock aquifer, due to the nature of the aquifer system and irregular recharge from rainfall. Groundwater conditions are highly variable, the yields are generally very low and the salinity reaches as much as 4000 mg/L. The fractured rock aquifer is poorly understood. The fractures in the rock are recharged through rainfall and groundwater seepage, which can be fed by nearby surface water streams (seepage down into the fractures), springs and underground streams (which may then discharge into surface water systems). The complex nature of the water flow makes it impossible to predict how a specific fracture is going to behave and as a result the aquifer has a high risk involved in continued supply and flow rates.
Considerations for water use include, but are not limited to, the following	
Ecological	
Wetlands and waterways: The four main surface waterways are Turner, Boodjidup, Chapman and Calgardup brooks; McLeod and West Bay creeks. There is a proposed Ramsar site covering Spearwood Creek area which extends into the Cape to Cape South subarea (from Rosa and Blackwood Plateau). *Threatened ecological communities and declared rare flora sites*: Over 15 different species (48 in sites) of declared rare flora, with 22 sites of threatened ecological community. The majority of the declared rare flora and threatened ecological community found within the national estate Leeuwin–Naturaliste Ridge area and other forest block areas. Most of the species of declared rare flora and threatened ecological community sites are associated with a waterway. The subarea supports many areas of stygofauna, within the myriad of limestone cave systems. Many of these species are groundwater-dependent. This subarea supports several species of declared rare fauna, including the Cape Leeuwin freshwater snail (*Austroassiminea letha*).	

Cape to Cape South

Cultural

Native Title claimant: South West Boojarah, the Harris family

Aboriginal Heritage sites: Over 30 registered sites. Most are natural features within the landscape including caves, shelters, cliffs, swamps and lakes, scarred trees, rivers (McLeod Creek and Chapman Brook), town sites and the Hardy Inlet. They include sites of natural significance, several sites with burials and scatters.

Social

Towns and localities: Towns of Augusta, Prevelly and Witchcliffe. Localities of Margaret River, Witchcliffe, Prevelly, Redgate, Gnarabup, Forest Grove, Kudardup, Boranup, Hamelin Bay, Deepdene, Leeuwin, Augusta, East Augusta, Karridale, Rosa Brook and Rosa Glen cover this subarea with water supply for domestic purposes from rainwater tanks and exempt groundwater abstraction.

Public water supply: The Water Corporation currently supplies a portion of the town of Augusta's drinking water from the Leeuwin springs. There is a public drinking water source area for the Margaret River and Ten mile Brook (priority 1 and 3) public water supply,[1] under the *Country Areas Water Supply Act 1947* and a proposed area covering Leeuwin Springs (priority 1).[2]

National Parks, reserves and state forest: Leeuwin-Naturaliste Ridge, Forest Grove and part of Bramley National Parks, and Stockdill Road nature reserve.

Recreational sites: All of the sites of national heritage and national estate, National Parks, water courses and Hardy Inlet are recreational sites of significance.

Management zones that apply in this subarea

12	Cave systems and coastal vegetation	Manage the potential connected cave and vegetation communities dependent on groundwater from fractured rock and Surficial sediments.

Additional assessment and licensing requirements apply in the areas covered by a management zone. Please refer to Section 5.2 of the *South West groundwater areas allocation plan* for more detail.

1 Department of Environment 2005, *Margaret River catchment area (including Ten-Mile Brook catchment) drinking water source protection plan*, Water source protection series report no 53, Department of Environment, Government of Western Australia.

2 Department of Water 2007, *Leeuwin Spring catchment area and Fisher Road water reserve drinking water source protection plan*, Water resource protection series report no 79, Department of Water, Government of Western Australia, Perth.

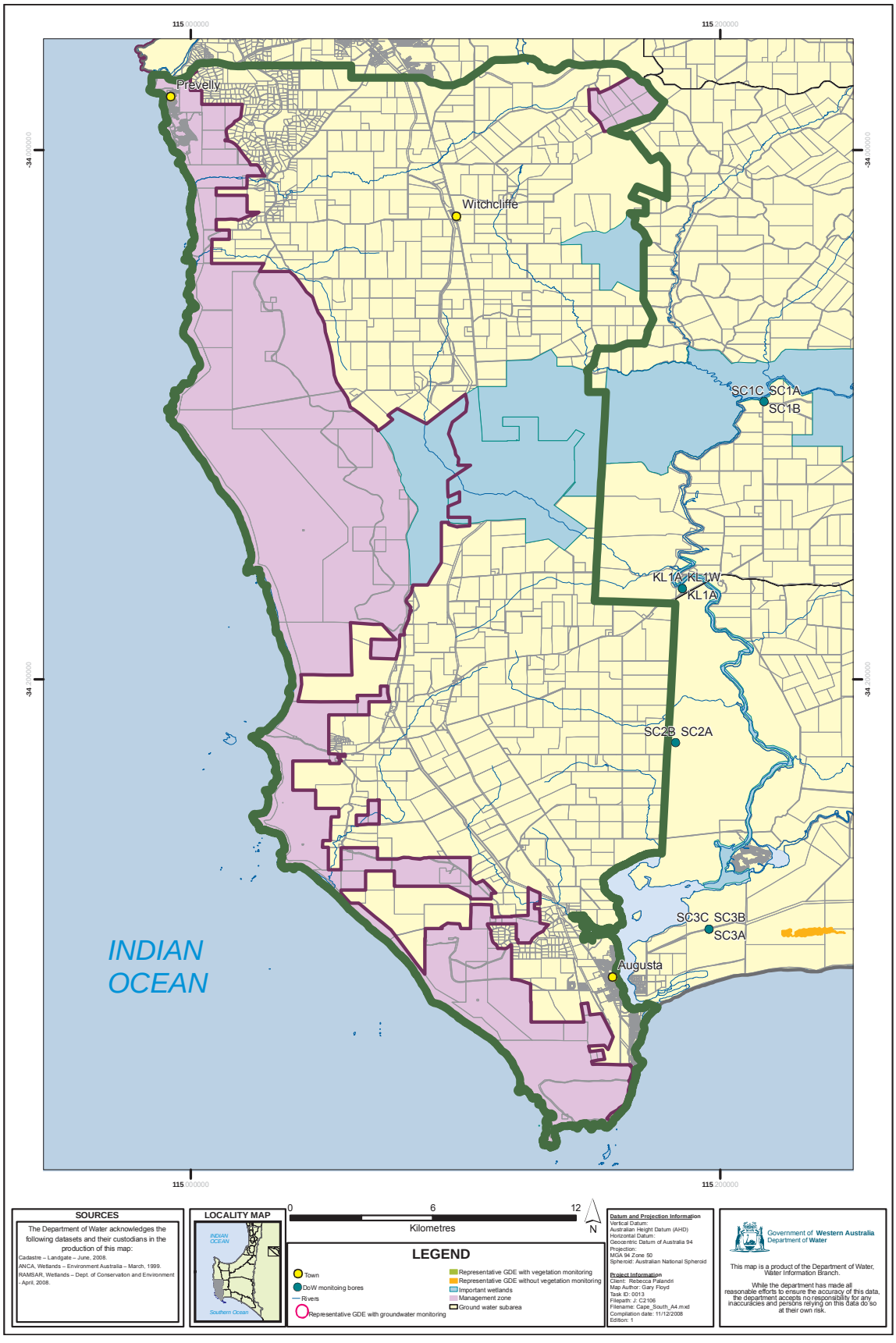


Figure 11 Cape to Cape South subarea

Appendices

Appendix A Statewide licensing policies

Policy name	Brief description
Statewide policy no. 2 – Pesticide use in public drinking water source area	Provides the department's position on the use of pesticides within proclaimed public drinking water source areas.
Statewide policy no. 3 – Policy statement on water sharing	Provides guidance on the overall policy approach to sharing water between competing users.
Statewide policy no. 5 – Environmental water provisions policy for Western Australia	Outlines the department's approach on ensuring that the water needs of the environment are addressed in water allocation decision-making.
Statewide policy no. 6 – Transferable (tradeable) water entitlements for Western Australia	Provides guidance on the transfer and trade of water licences.
Statewide policy no. 8 – Giving an undertaking to grant a licence or a permit under the Rights In Water and Irrigation Act 1914	Defines the circumstances under which the department will give undertakings for the granting of licences to take water, the approval of agreements with respect to water entitlements, permits to interfere with a water course or licences to construct a well.
Statewide policy no. 9 – Water licensing – staged developments	Describes the licensing policy and process used for developments and land uses with a prolonged establishment phase, where water requirements will alter significantly during the life of the project.
Statewide policy no. 10 – Use of operating strategies in the water licensing process	Provides guidance on the structure of operating strategies and on the circumstances and purposes under which they are requested.
Statewide policy no. 11 – Management of unused licensed water entitlements	Outlines how to manage licence allocations to ensure that reducing unused allocations to a minimum effectively uses the water resources.
Draft statewide policy no. 14 – Managing unlicensed groundwater use	Provides the department's position on managing groundwater taken by unlicensed users.
Statewide policy no. 16 – Water conservation and efficiency plans	Provides direction on preparing water conservation and efficiency plans required by water users as part of the water licensing process.
Statewide policy no. 17 – Timely submissions of required further information	Describes the department's policy on the timeframes for submission of further information that is required in the licence assessment process.
Statewide policy no. 19 – Hydrogeological reporting associated with a groundwater well licence.	Provides guidance on when hydrogeological assessments and groundwater monitoring reports are required and the information that they should contain.

All statewide policies are available on the department's website <www.water.wa.gov.au> Managing our water > Statewide policies>.

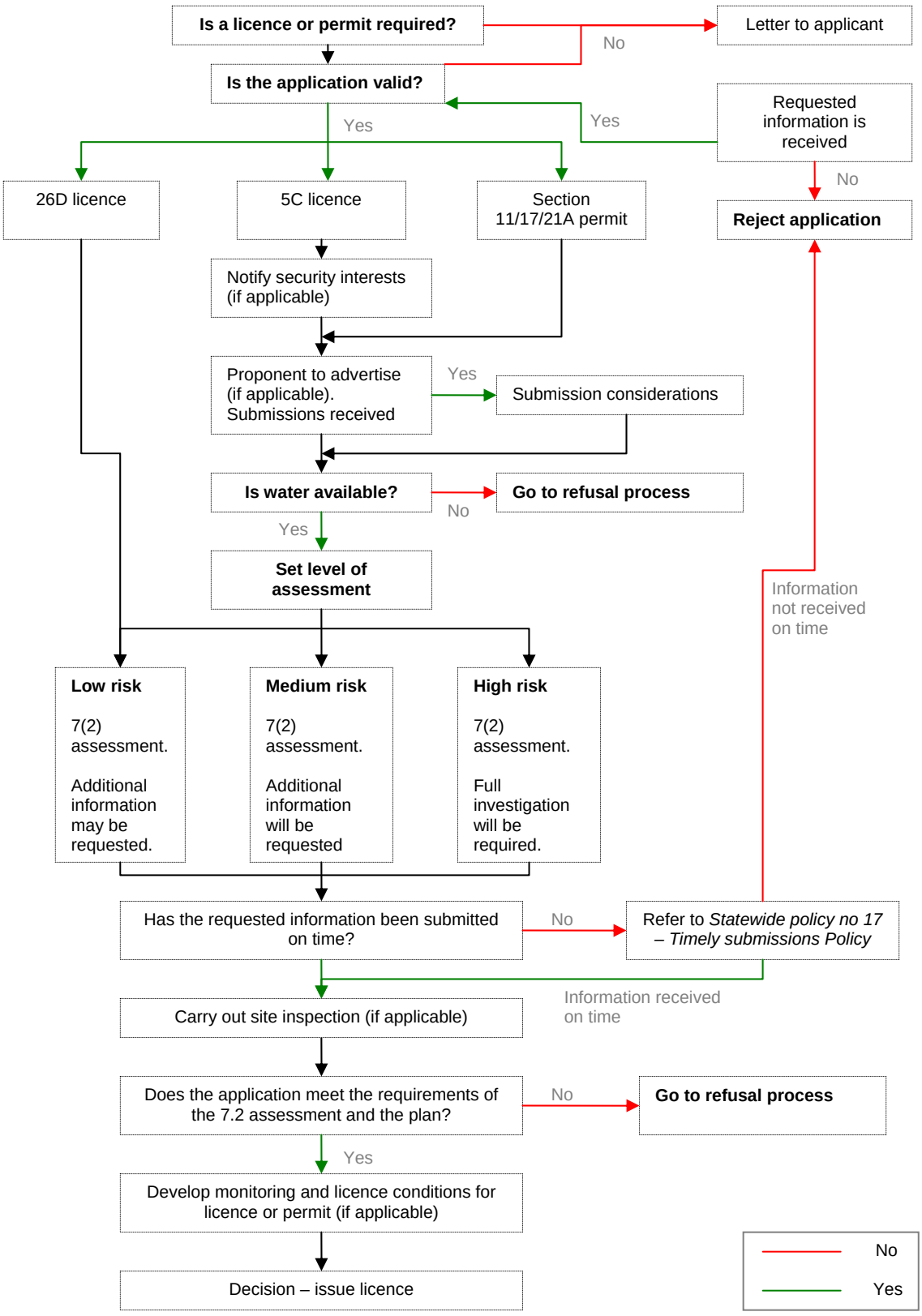


Figure A1 Standard licensing process flowchart

7(2) assessments and groundwater licensing

The Department of Water assesses individual licence applications to construct a bore (26D) and to take water (5C licence) under Schedule 1, Division 2, clause 7(2) of the *Rights in Water and Irrigation Act, 1914*. The level of assessment will vary depending on the level of risk to the environment and existing users. Table 1 provides a brief summary of the clause 7 (2) assessment process with regard to a groundwater licence application (5C and 26D) and what the department considers against each of the requirements under clause 7 (2).

Table A1 Clause 7(2) assessment process for groundwater licensing

Relevant consideration under clause 7(2)		What the department considers
7(2)(a)	**Public interest** Does the proposal have any economic, social or recreational benefits to the public? This is assessed from a regional or state-wide point of view.	• social benefit (including water for community parks and gardens) • recreational benefit (including aesthetics of a natural system, camping, fishing) • economic benefit (including regional development, prospective employment) • advertising of proposals under *Rights in Water and Irrigation Act, 1914* which provides information to assess public interest
Sustainability assessment A sustainability assessment considers economic, social and ecological factors together and attempts to satisfy as many factors as possible, with minimal trade-offs, applying the principles below: • long-term economic health • equity and human rights • biodiversity and ecological integrity.		
7(2)(b)	**Ecologically sustainable**	• water availability • requirements of relevant allocation plan • hydrogeological assessment • impact on any ecologically significant sites • an assessment is made on the requirements to protect the ecology: - monitoring as part of the licensing conditions - an operating strategy - nutrient impact or irrigation development assessment - a water conservation/efficiency plan - a water quality assessment • clearing approval requirements • land capability assessment

Relevant consideration under clause 7(2)		What the department considers
7(2)(c)	**Environmentally acceptable** Can the economic, social and ecological considerations be satisfied? If not, are the impacts acceptable?	
	Economic Long-term economic health Recognise needs of current and future demand	• any economic values identified through allocation planning • categorisation of economic status: public–commercial or non-commercial, or private–commercial or non-commercial • economic benefit to local, regional or state market
	Social Equity and human rights	• any social and recreational values identified through allocation planning: - cultural and heritage considerations: - Aboriginal sites of significance - Native title claims • Australian heritage listings • social and recreational benefits or liabilities (including fishing)
	Ecological Biodiversity and ecological integrity	• findings of the 7(2) (b) assessments
7(2)(d)	**May prejudice other current and future needs for water** The regional view	• hydrogeological assessment – effects on current and future needs for water and possible environmental impacts on surrounding areas
7(2)(e)	**Detrimental effect on another person** The local view	• need for advertising process • need for an operating strategy • hydrogeological assessment (impact on existing use)
7(2)(f)	**Could be provided for by another source** Assessment considers alternative options and sources	• most appropriate resource – hydrogeological assessment and water availability • availability of other sources such as surface water, recycled water, scheme water • most economically viable source
7(2)(g)	**Are in keeping with:** **(i) Local practices** Local practices and planning requirements	• local government authority approval and/or compatible with current land use zoning • application has other relevant government approvals including: - Department of Agriculture and Food - Department of Mines and Petroleum - Department of State Development - Department for Planning and Infrastructure

Relevant consideration under clause 7(2)		What the department considers
		- Western Australian Planning Commission - Department of Environment and Conservation. • common practice within the local area
7(2)(g) cont.	**(ii) Relevant local by-law**	• by-laws under *Rights in Water and Irrigation Act, 1914* or *Environmental Protection Act 1986* – there are none at present in the South West groundwater areas
	(iii) Plan approved under Part III Division 3d Subdivision 2	• meets the requirements of the plan approved under Part III Division 3d Subdivision 2 (statutory)
	(iv) Relevant previous decisions of the department	• departmental policies and plans • previous licensing decisions where relevant
7(2)(h)	**Are consistent with:** **(i) Land use planning Instruments**	• application is consistent with Environmental Protection (Clearing of Native Vegetation) Regulations 2004 • local government approval • Western Australian Planning Commission approval • other relevant planning and scheme text.
	(ii) The requirements and policies of other government agencies Issue of a licence cannot pre-empt approvals under the *Native Title Act 1993* and Part V of the *Environmental Protection Act, 1986*.	• department refers proposal to other government departments, where appropriate
	(iii) Any inter-governmental agreement or arrangement	• related inter-governmental agreements or arrangements (such as State Development Acts)

Appendix B Other plans and strategies to be considered

Plan	Consideration	Agency
State water plan	Strategic direction	DoW
South West regional water plan – strategic direction; supporting detail	Strategic direction, South West community issues, principles and issues that guide subordinate plans	DoW
Whicher area surface water allocation plan	Surface water management plan for the majority of the plan area	DoW
Better managing the urban water cycle – the urban drainage initiative	Urban water drainage and management for better urban design.	DoW
Better urban water management	Urban water management for public services and urban design	DPI
Leeuwin Springs and Fisher Road well field water reserve drinking water source protection plan	Manages land and water use activities in this area to ensure safe drinking water quality	DoW
Margaret River catchment area (including Ten Mile Brook catchment area) drinking water source protection plan	Manages land and water use activities in this area to ensure safe drinking water quality	DoW
South West natural resource management strategy	Natural resource planning and management	SWCC
Tanjannerup creek dam catchment area drinking water source protection plan	Manages land and water use activities in this area to ensure safe drinking water quality	DoW
Augusta–Walpole coastal strategy	Planning scheme for land use and zoning	WAPC
Leeuwin–Naturaliste Ridge statement of planning policy report	Land use change and planning	WAPC

DoW = Department of Water
DPI = Department of Planning and Infrastructure
SWCC = South West Catchments Council
WAPC = Western Australian Planning Commission

Major legislation relating to water resource management in the South West

Commonwealth legislation:

- *Environmental Protection and Biodiversity Conservation Act 1999*
- *National Water Commission Act 2004*
- *Natural Heritage Trust Act of Australia 1997*
- *National Environmental Protection Council Act 1994*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*
- *World Heritage Properties Conservation Act 1995*.

State legislation:

- *Conservation and Land Management Act 1984*
- *Native Title (State Provisions) Act 1999*
- *Aboriginal Heritage Act 1972*
- *Country Areas Water Supply Act 1947*
- *Environmental Protection Act 1986, amendment 1998*
- Environmental Protection Regulations 1987
- *Heritage of Western Australia Act 1990*
- *Metropolitan Water Supply, Sewerage and Drainage Act 1909 (including by-laws)*
- *National Trust of Australia (WA) Act 1964*
- *Rights in Water and Irrigation Act 1914,* Regulations 2000
- *Water Agencies (Powers) Act 1984*
- *Soil and Land Conservation Act 1945,* Regulations 1992
- *Town Planning and Development Act 1928*
- *Water and Rivers Commission Act 1995*
- *Waterways Conservation Act 1976*
- *Western Australian Planning Commission Act 1985*
- *Wildlife Conservation Act 1950,* Regulations 1970
- *Pollution of Waters by Oil and Noxious Substances Act 1987*
- *Contaminated Sites Act 2003.*

Other documents to consider

National Parks management plans (Department of Environment and Conservation):

- *Leeuwin–Naturaliste National Park*, 1989
- Draft '*Parks of the Leeuwin–Naturaliste Ridge, Scott National Park and Gingilup Swamps nature reserve*,' 2008
- *Shannon and D'Entrecasteaux National Parks*, 1988, amended 2001 and 2005 (Draft)

Appendix C Useful information and websites for other government departments

Government department	Website	Contact for more information on:
Department of Environment and Conservation	<www.dec.wa.gov.au>	Acid sulfate soils and contaminated sites. Vegetation clearing and declared rare flora, fauna and threatened ecological sites. Environmental protection policy wetlands. National Park management.
Environmental Protection Authority	<www.epa.wa.gov.au>	EPA approvals and processes
Department of Environment and Heritage	<www.deh.gov.au>	Information and approvals under the *Environmental Protection and Biodiversity Conservation Act 1999*
Department of Agriculture and Food	<www.dafwa.wa.gov.au>	Best management practices and information on agriculture and food
Bureau of Meteorology	<www.bom.wa.gov.au>	Rainfall, evaporation and climate related information
Department of Mines and Petroleum	<www.dmp.wa.gov.au>	Mining tenements, best-management practices and approvals
Geological Survey of Western Australia		Geological survey maps and reports
Department of State Development	<www.dsd.wa.gov.au>	State agreement Acts and state developments
Department for Planning and Infrastructure	<www.dpi.wa.gov.au>	Cadastral information, land planning information
Western Australian Planning Commission	<www.wapc.wa.gov.au>	Planning and land use development approvals
Department of Fisheries	<www.fish.wa.gov.au>	Aquaculture
Forestry Products Commission	<www.fpc.wa.gov.au>	Plantations
Department of Indigenous Affairs	<www.dia.wa.gov.au>	Aboriginal heritage sites
Office of Native Title	<www.nativetitle.wa.gov.au>	Native title determination
Heritage Council of Western Australia	<www.heritage.wa.gov.au>	Heritage sites
Office of Development Approvals Coordination	<www.odac.dpc.wa.gov.au>	Full list of approvals processes for every government agency
State land information platform (SLIP)	<www.slip.wa.gov.au>	Public mapping information for government agencies

Glossary

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	The volume of water that can be abstracted for consumptive uses each year from a water resource with acceptable impacts.
aquifer	A geological formation or group of formations capable of receiving, storing and transmitting large quantities of water.
artesian aquifer	A confined aquifer in which the hydraulic pressure will cause water to rise in a bore or spring above the land surface. If the pressure is insufficient to cause the well to flow at the surface, it is called a sub-artesian aquifer.
base flow	The component of stream flow supplied by groundwater discharge.
bore	An opening in the ground, normally vertical hole drilled in soil or rock, made or used to obtain access to underground water. This is equivalent to the description of a 'well' in *the Rights In Water and Irrigation Act 1914.*
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.
discharge	The water that moves from the groundwater to the ground surface or above, such as a spring or the ocean. This includes water that seeps onto the ground surface, evaporation from unsaturated soil, and water extracted from groundwater by plants (evapotranspiration) or engineering works (groundwater pumping).
domestic bore	A bore used for providing the in-house and household garden watering requirements.
drawdown	The lowering of a watertable resulting from the removal of water from an aquifer or reduction in hydraulic pressure.
ecological water requirements	The water regime needed to maintain ecological values of water-dependent ecosystems at a low level of risk.
environmental water provisions	The water regimes that are provided as a result of the water allocation decision-making process taking into account ecological, social, cultural and economic impacts. They may meet in part or in full the ecological water requirements
first-in first-served	A process by which groundwater entitlements are allocated in the order in which licence applications are received by the Department of Water.
groundwater	The water that occurs in pore spaces and fractures in rocks beneath the ground surface. *See also* aquifer, confined aquifer and unconfined aquifer.
groundwater area	An area proclaimed under the *Rights in Water and Irrigation Act 1914* for the purposes of licensing and managing water use.
groundwater-dependent ecosystem	An ecosystem that is dependent on groundwater for its existence and health.
hydrogeology	The hydrological and geological science concerned with the occurrence, distribution, quality and movement of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.

licence (5C)	A formal permit which entitles the licence holder to 'take' water from a watercourse, wetland or underground source.
m AHD	Australian Height Datum – height in metres above Mean Sea Level + 0.026m at Fremantle.
non-artesian well	A well, including all associated works, from which water does not flow, or has not flowed, naturally to the surface but has to be raised, or has been raised, by pumping or other artificial means.
public water supply reserve	Reservation of a volume of water to supply drinking water for human consumption.
recharge	Water that infiltrates into the soil to replenish an aquifer
salinity	The measure of total soluble salt or mineral constituents in water. Water resources are classified based on salinity in terms of total dissolved solids (TDS) or total soluble salts (TSS). Measurements are usually in milligrams per litre (mg/L) or parts per thousand (ppt).
social value	A particular in-situ quality, attribute or use that is important for public benefit, welfare, state or health (physical and spiritual).
social water requirement	Elements of the water regime that are needed to maintain social and cultural values.
stock bore	A bore that provides drinking water for stock.
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 based on the location of the water resource.
surface water	Water flowing over or held in streams, rivers and wetlands on the surface of the land.
throughflow	The flow of water within an, and between, aquifers.
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. The aquifer contains water with no upper non-porous material to limit its volume or to exert pressure.
unconformity	A discontinuity in rock sequence indicating interruption of sedimentation, commonly accompanied by erosion of rocks below the break or the interface between such strata.
water efficiency	The minimisation of water use through adoption of best management practices.
water reserve	An area proclaimed under the *Metropolitan Water Supply Sewerage and Drainage Act 1909* or *Country Areas Water Supply Act 1947* to allow the protection and use of water on or under the land for public water supplies.
watertable	The saturated water level of the unconfined aquifer. Wetlands in low-lying areas are often seasonal or permanent surface expressions of the watertable.

wetland	For the purposes of this plan (unless otherwise specified) the department adopts the Ramsar Convention definition of a wetland as *an area that is permanently, seasonally or intermittently waterlogged or inundated with water that may be fresh, saline, flowing or static, including areas of marine water of which the depth at low tide does not exceed 6 metres*.
yield	The volume of water that may be drawn from a well or water supply system measured in cubic metres per day, gigalitres per year, or equivalent

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)

Shortened forms

AHD	Australian height datum
ANCA	Australian national conservation area – wetlands
DoW	Department of Water
DEC	Department of Environment and Conservation
DPI	Department for Planning and Infrastructure
DRF	Declared rare flora or fauna
EPA	Environmental Protection Authority
EPP wetland	Environmental protection policy wetland
EWR	Ecological water requirement
GDE	Groundwater-dependent ecosystem
PASS	Potential acid sulfate soils
PWS	Public water supply
SLIP	State land information platform (formerly Landgate)
SWCC	South West Catchments Council
TEC	Threatened ecological community
WAPC	Western Australian Planning Commission

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