



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

Peel Coastal

groundwater allocation plan



Securing Western Australia's water future

Water resource allocation
and planning report series
Report no 66
October 2015



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October 2015

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ISSN 2204-9983 (print)

ISSN 2204-9991 (online)

ISBN 978-1-925387-20-9 (print)

ISBN 978-1-925387-19-3 (online)

Acknowledgements

The Department of Water would like to acknowledge the following project team and board members: Michelle Antao, Leon Brouwer, John Connolly, Alan Cook, Ben Drew, Melissa Gaikhorst, Jade Gorton, Tim Grose, Carey Johnston, Scott Macaulay, Sandie McHugh, Rebecca Palandri, Patrick Ridley, Carmel Sullivan, Susan Worley.

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Message from the Minister



Peel is one of the fastest growing regions in Western Australia with Mandurah at its centre.

It supports a diverse range of urban, industrial, commercial and rural land uses, as well as unique natural features like the internationally recognised Peel-Yalgorup wetland system.

Groundwater resources are an integral part of supporting this area's lifestyle and economy and are used to irrigate public open space, support commercial and agricultural activities and meet stock and domestic needs.

Groundwater is also critical to wetlands, and the diverse ecosystems they support in this coastal area, including a significant migratory bird population and the prehistoric thrombolite communities located on Lake Clifton.

The *Peel Coastal groundwater allocation plan* spans across 380 km² of the south-west coastline from City of Mandurah to just north of Myalup.

With the plan area's groundwater allocation limit of 11 gigalitres per year now fully allocated, the *Peel Coastal groundwater allocation plan* resets the balance of the system's resources for the existing water users and the environment.

In putting this plan together, the government has recognised that any further allocation of water from this area would pose a significant risk to the area's unique biodiversity, particularly with the drying climate trend in the state's south-west.

Future demand for water will be met by improved water use efficiency, trading or transferring existing water licences, or by utilising alternative water source options such as wastewater recycling.

A demonstration of this is the Ocean Road Active Reserve and Waste Water Reuse Scheme funded by the state government's Royalties for Regions Regional Grants Scheme.

These types of innovations are essential to ease demand on our precious groundwater resources as identified in the *Peel Coastal groundwater allocation plan*, which is the roadmap to ensuring the region's future vitality and water sustainability.

A handwritten signature in black ink, appearing to read 'Mia Davies'.

Hon Mia Davies, MLA
Minister for Water



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Summary

Peel Coastal groundwater allocation plan

Purpose of the plan

The Department of Water is responsible for regulating and managing the state's water resources sustainably and productively. The *Peel Coastal groundwater allocation plan* sets out how we will regulate and manage groundwater in coastal parts of the Peel region from Mandurah and south along the coast, to just north of Myalup. This plan is a decisive step towards ensuring that water resources and their dependent values in the Peel Coastal area are protected from additional abstraction and that water users are adapting to the drying climate.

Until now allocation management was guided by the *South West Coastal groundwater area groundwater management review* (Water Authority 1989). We have updated our management of groundwater resources by:

- setting new allocation limits that incorporate the effects of the drying climate
- updating local licensing policies to protect current licensed entitlements and important wetland values
- aligning water planning with land use planning
- encouraging trading
- outlining alternative water source options
- improving water accounting, including exempt (from licensing) domestic groundwater use
- putting in place targeted groundwater monitoring, including water quality
- providing an adaptive management framework.

The *Peel Coastal groundwater allocation plan* supports the Strategic Assessment of the Perth and Peel regions being conducted by the Government of Western Australia. This is assessing the effect of our growing population and proposed future development on matters of national environmental significance listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) such as the Ramsar-listed Peel-Yalgorup wetland system. Further, the plan will inform the Office of the Environmental Protection Authority's related strategic advice to the Minister for the Environment.

This plan does not address the supply of household water for Mandurah and surrounding urban areas, as potable water is obtained from outside the plan area through the Water Corporation's Integrated Water Supply Scheme.

Summary

Water availability in the Peel Coastal plan area

More than 11 gigalitres (GL) per year of groundwater is used in the Peel Coastal plan area. This includes licensed and unlicensed stock and domestic use.

Our review of allocation limits identified that abstracting more water from aquifers in this area of unique coastal geography would result in significant risks to current users, the ongoing productivity of the resource, water quality and important natural values. These risks are further increased by the drying climate.

Groundwater resources (Subarea and aquifer)	Allocation limit (kL/year)	Water availability
Coastal Superficial	192 550	Groundwater resources in the plan area are effectively fully allocated; however, water may become available from time to time through the relinquishment of licences or unused licence volumes being recouped. Trading and transferring of water licences and use of alternative water sources will need to be utilised to meet future water needs.
Coastal Leederville	20 000	
Colburra Downs Superficial	70 000	
Colburra Downs Leederville	0	
Falcon Superficial	2 321 923	
Falcon Leederville	1 606 420	
Island Point Superficial	568 375	
Island Point Leederville	0	
Lake Clifton Superficial	661 440	
Lake Clifton Leederville	0	
Mandurah Superficial	4 653 729	
Mandurah Leederville	802 100	
Whitehills Superficial	335 909	
Whitehills Leederville	0	
Total	11 232 446	

We have identified, through this planning process, that future demands for water will need to be met through trading or transferring water licences, or by utilising alternative water source options. Alternative sources such as wastewater recycling are already an important component of water supply in some parts of the plan area.

Water may become available from time to time through the relinquishment of licences or unused licence volumes being recouped. For more information on current groundwater availability, contact the Kwinana Peel regional office or visit the Water Register <atlases.water.wa.gov.au/ags/waterregister/>.

Allocation and licensing approach for the Peel Coastal plan area

To make best use of the available groundwater we will:

- promote efficiency improvements, conduct compliance surveys and, where necessary, recoup unused entitlements
- encourage trades and transfers of entitlements
- work with local government, developers and private users to identify viable alternative water source options such as the use of treated wastewater for managed aquifer recharge and recovery
- apply our local licensing policies to ensure that any possible adverse effects on water quality and important natural values are addressed through licensing.

Managing water resources in a drying climate

Reduced rainfall is being observed across most parts of south-west Western Australia. This is significantly impacting on the *Peel Coastal groundwater allocation plan* area. In addition to affecting the amount of water we can make available for use, the drying climate is:

- increasing the risks of water quality problems, primarily from saltwater intrusion
- contributing to further declines in the quality and quantity of water supporting wetlands and vegetation.

We will continue to monitor how the drying climate is affecting groundwater resources across the plan area through a targeted monitoring program that includes collecting water quality information. We will also apply an adaptive management framework which involves regular evaluations against the plan.



Chapter One

Plan context and scope

1.1 Purpose of the plan

Mandurah and surrounding areas have grown significantly since the *South West Coastal groundwater area groundwater management review* (Water Authority 1989) was prepared as a guide to water licensing.

The *Peel Coastal groundwater allocation plan* updates the way in which the Department of Water will regulate and manage the abstraction of groundwater through allocation limits, licensing, monitoring and evaluation.

The area's unique geography and the influence of the drying climate mean the local community needs to use the available groundwater efficiently and look for smart water supply alternatives.

This plan:

- sets new allocation limits that incorporate the effects of the drying climate and minimise risks of further abstraction on the Ramsar-listed Peel-Yalgorup wetlands and other groundwater-dependent ecosystems
- updates local licensing policies to protect current licensed entitlements and important wetland values

- accounts for use exempt from licensing
- aligns water planning with current and future land use planning
- encourages water use efficiency, trades and transfers, and alternative water source options in response to reduced groundwater availability
- puts in place a targeted monitoring program, including water quality
- provides an adaptive management framework.

The plan does not address:

- household potable water supply in Mandurah and surrounding urban areas, as this is obtained from outside the plan area through the Water Corporation's Integrated Water Supply Scheme (IWSS)
- the protection of public drinking water supply areas, flooding or drainage issues¹
- water quality (nutrient) management².

The *Peel Coastal groundwater allocation plan* is a non-statutory plan prepared to guide licensing under the *Rights in Water and Irrigation Act 1914* (WA).

¹ These issues are addressed through other Department of Water plans which may be obtained from our website <www.water.wa.gov.au> or by contacting our Kwinana Peel regional office.

² For more information see *Water quality improvement plan for the rivers and estuary of the Peel-Harvey system – phosphorus management* (EPA 2008). Water quality in the Peel-Harvey estuary is also being considered through the state government's Strategic Assessment of the Perth and Peel regions. Information about this process can be found at: <www.dpc.wa.gov.au/Consultation/StrategicAssessment/Pages/Default.aspx>.

1.2 Plan area

Location

The area covered by the *Peel Coastal groundwater allocation plan* extends along the Swan Coastal Plain from the northern surrounds of Mandurah (about 70 km south of Perth) to just north of Myalup. It is bordered to the east by the Peel-Harvey estuary and west by the Indian Ocean.

The plan area covers approximately 380 km² (Figure 1), most of which is in the local government areas of the City of Mandurah and Shire of Waroona.

The plan area also borders the areas covered by the *Murray groundwater allocation plan* (DoW 2012a) to the east, the *South West groundwater areas allocation plan* (DoW 2009a) to the south and the *Rockingham-Stakehill groundwater management plan* (DoW 2007) to the north.

Proclamation

The plan incorporates most of the proclaimed South West Coastal Groundwater Area. The groundwater area was first proclaimed in 1977 under the *Rights in Water and Irrigation Act 1914* to support the development of horticulture. The groundwater area boundary was varied in 1986 to include the Harvey area and modified again in 1988 to include Mandurah.

The proclaimed groundwater area includes nine subareas, two of which are managed under the *South West groundwater areas allocation plan*. The remaining seven subareas are managed under this plan (Figure 2).

As the groundwater area is proclaimed, water users require a licence to lawfully abstract groundwater under section 5C of the *Rights in Water and Irrigation Act 1914*, unless exemptions apply.

Land use

Land use in the plan area's north is primarily urban. Groundwater is used to irrigate public open space, sporting grounds and domestic gardens in and around Mandurah. Groundwater in the plan area's south is used for small-scale agriculture, horticulture and domestic purposes. Also located in the plan area's south is a small area of pine plantation.

On the plan area's western side is the Yalgorup National Park, which includes areas of natural bushland and wetlands, including the Ramsar-listed Peel-Yalgorup wetland system. These areas have important value as recreation, tourism and cultural sites.

The horticultural belt of Myalup is located south of, and not within, the Peel Coastal plan area. However, abstraction and land use practices in Myalup may affect Lake Preston in the plan area. How we manage this particular area is outlined in the *South West groundwater areas allocation plan*.

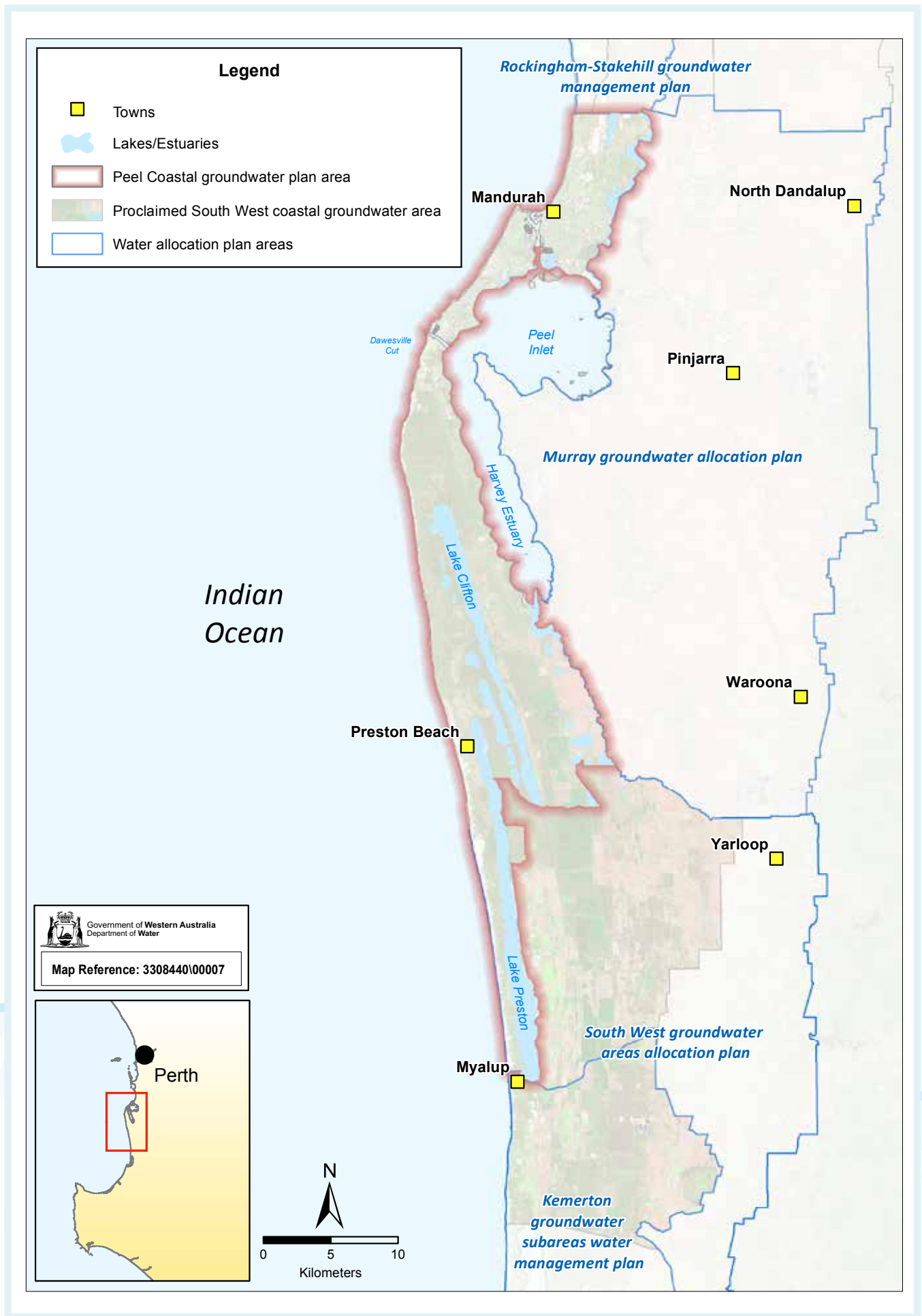


Figure 1
 Peel Coastal groundwater allocation plan area

Peel Coastal groundwater allocation plan

1.3 Water resources covered

The Peel Coastal plan area is divided into seven subareas for allocation planning and licensing purposes:

- Coastal
- Colburra Downs
- Falcon
- Island Point
- Lake Clifton
- Mandurah
- Whitehills.

The department defines a 'groundwater resource' as being a particular aquifer in a particular subarea. We set allocation limits for each of the 14 groundwater resources in the plan area (Table 1).

Three aquifers are present in the plan area. In order of increasing depth, these are the Superficial and Leederville aquifers and the Cattamarra Coal Measures. The resource boundaries for the Superficial and Leederville aquifers are shown in Figure 2.

Superficial aquifer

In this location, the Superficial aquifer is an unconfined, stratigraphically complex, multilayered aquifer, consisting mainly of porous Tamala limestone. It is a shallow aquifer with a maximum saturated thickness of 25 m. The Superficial aquifer is recharged directly by rainfall, with a thin lens of fresh water over more saline water across most of the plan area. This thin lens is prone to saline up-coning when over-abstracted at a local scale.

The Superficial aquifer in the plan area supports groundwater-dependent ecosystems including lakes, wetlands, terrestrial vegetation and rare thrombolite communities (Figure 3). These ecosystems rely on either access to the watertable or freshwater throughflow and discharge.

For more information on groundwater-dependent ecosystems in the plan area, see the *Peel Coastal groundwater allocation plan: groundwater-dependent ecosystems report* (DoW 2015a).

Infiltration ponds at the Water Corporation's wastewater treatment plants recharge the Superficial aquifer locally in the Mandurah and Falcon subareas. The artificial recharge appears to be supporting some localised abstraction, as well as preventing saltwater intrusion in the Falcon subarea, just south of the Dawesville Cut.

Leederville aquifer

The Leederville aquifer is a major regional, mostly confined aquifer, with a thickness that ranges between 140 m and 180 m. In some subareas a sandy, green clay marker bed subdivides the Leederville aquifer. Above this marker bed, there is fresh to marginal groundwater; however, saline water is also present due to the influence of the Peel Inlet and Harvey Estuary. Below the marker bed, groundwater is marginal to brackish and its salinity increases with depth.

The Leederville aquifer is mainly recharged in the plan area's east, at the foot of the Darling Range, where it is in direct hydraulic connection with the Superficial aquifer.

Cattamarra Coal Measures

The Cattamarra Coal Measures aquifer contains brackish to saline groundwater and occurs at depths greater than about 290 m. It is confined by the South Perth Shale.

The plan does not discuss this aquifer in detail, given its depth, low water quality and the unlikely demand for such a resource. It may be suitable as a future fit-for-purpose water source option, subject to assessment.

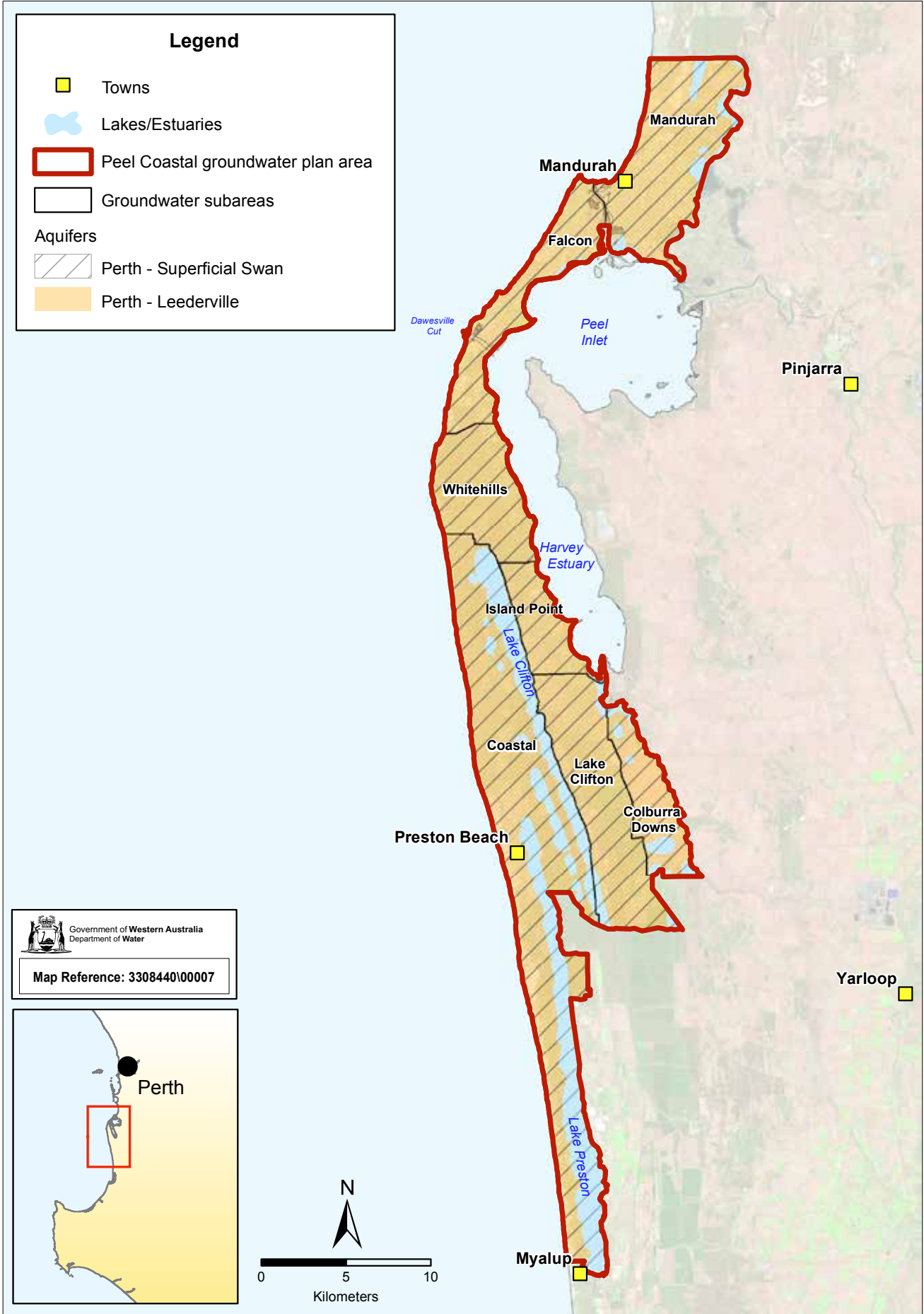


Figure 2
Subareas and groundwater resources

Peel Coastal groundwater allocation plan



Figure 3
Groundwater-dependent ecosystems
 Peel Coastal groundwater allocation plan

1.4 How we developed the plan

Work on the *Peel Coastal groundwater allocation plan* began after we identified that the *South West Coastal groundwater area groundwater management review* (Water Authority 1989) was no longer sufficient to manage the area's water use issues, particularly in a drying climate.

Using the best-available hydrogeological, environmental and groundwater use information, we identified the need to:

- align our water planning with current and future land use planning
- improve our accounting of all groundwater use
- account for the continuing effect of the drying climate on groundwater resources
- adjust allocation limits
- update our local licensing policies.

In February 2012 we published the *South West Coastal information report* (DoW 2012b) together with a Notice of intent to plan. These publications identified the water resource management issues the plan would address and invited comments and feedback from stakeholders. We followed up during development of the plan by consulting directly with stakeholders (see Section 1.5).

Through the plan development period we referred to the plan as the 'South West Coastal groundwater allocation plan'. We have changed the title to the 'Peel Coastal groundwater allocation plan' to clearly identify the area it applies to.

The department released the plan for public comment on 18 November 2014. We received 10 formal submissions during the comment period, which closed on 27 February 2015. During this period we also conducted two stakeholder forums and met directly with those unable to attend.

We have used the content of the submissions, as well as feedback obtained through the forums and direct consultation, to modify and improve this final plan. Our response to submissions is detailed in the *Peel Coastal groundwater allocation plan: statement of response* (DoW 2015c).

The plan is accompanied by two other supporting documents:

- *Peel Coastal groundwater allocation plan: methods report* (DoW 2015b)
- *Peel Coastal groundwater allocation plan: groundwater-dependent ecosystems report* (DoW 2015a)

For more information about how we develop allocation plans, see *Water allocation planning in Western Australia: a guide to our process* (DoW 2011a).

1.5 Stakeholder interests

We consulted the following stakeholders during the planning process:

- City of Mandurah
- Peel-Harvey Catchment Council
- Peel Development Commission
- Office of the Environmental Protection Authority
- Water Corporation
- Department of Parks and Wildlife (then the Department of Environment and Conservation)
- local environmental and community groups
- holders of large water licences.

The broader community was also given an opportunity to provide input into the planning process; we advertised the Notice of intent in the *Mandurah Coastal Times*, *The West Australian* and *Mandurah Mail* newspapers.

Stakeholders were generally very supportive of the need for this plan. Through our early consultations some important issues were raised, including:

- ensuring that water planning is aligned with existing and future land use planning

- concern that groundwater abstraction would adversely affect groundwater-dependent ecosystems (especially Ramsar-listed wetlands and the Lake Clifton thrombolite communities)
- the large number of domestic bores exempt from licensing and their potential effect on the groundwater resource
- the potential for salinity to affect people's ability to access groundwater.

Some additional issues were raised during the public comment period. These were particularly in relation to the new allocation limits and included:

- whether capping any further allocations might be a constraint to future development
- how much hydrogeological information is available to make decisions
- concerns about the long-term climate trend and its impacts.

We have ensured that all the issues raised by stakeholders are addressed in the plan to the extent possible. More detail on these issues and our specific responses are documented in the *Peel Coastal groundwater allocation plan: statement of response* (DoW 2015c).

1.6 Related plans and strategies

A number of planning strategies and planning-related documents have supported development of this plan. The Western Australian Planning Commission's *Directions 2031 and beyond* (WAPC 2010) and the *Draft South Metropolitan Peel sub-regional planning framework* (DoP & WAPC 2015) provide a clear strategic planning context for the plan area to 2031. This has allowed us to align our water planning and signal the need to develop alternative water sources where required.

In developing our plan we also considered the recommendations of the Office of Environmental Protection Authority's *Strategic environmental advice on the Dawesville to Binningup area* (EPA 2010). It recommended that a comprehensive groundwater management program be put in place to manage risks to the Peel–Yalgorup wetland system from potential urban development between Mandurah and Bunbury.

Similarly, the Australian and Western Australian governments are undertaking a Strategic Assessment of the Perth and Peel regions under section 146 of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The assessment will consider the effect of future development and land use on matters of national environmental significance listed under the EPBC Act, which include the Ramsar-listed Peel–Yalgorup wetland system. This plan forms a key part of the department's management of this area by specifically addressing the management of groundwater abstraction.

1.7 Plan timeframe

The *Peel Coastal groundwater allocation plan* will remain in effect until it is replaced by a new water allocation plan, amended or revoked by the Minister for Water. We will consider the need to replace this plan in 2020 unless it is identified earlier through a plan evaluation process (Chapter 6).

Chapter Two

What the plan will achieve

The Department of Water is responsible for managing water resources in Western Australia, consistent with the objects of the *Rights in Water and Irrigation Act 1914*, specifically:

- 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
 - 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.
- b) To promote the orderly, equitable and efficient use of water resources.

In administering the Act, the department makes provision for the sustainable use and development of water resources as well as the protection of ecosystems associated with water resources. Water licences are issued under the *Rights in Water and Irrigation Act 1914* to manage and regulate the individual take of groundwater.

This plan ensures that current licensed entitlements are secure and, despite limited groundwater availability, considers future land use and its water requirements.

We accounted for all groundwater use, including that used for exempt from licensing stock and domestic purposes, and set out to minimise the risks to groundwater-dependent ecosystems and the resource's long-term viability from saline water movement.

The setting of allocation limits, development of the licensing policy and our monitoring and evaluation program were guided by the outcomes and resource objectives described below. These will continue to inform our water resource management as we implement the plan.

2.1 Outcomes

Outcomes are what we aim to achieve by managing the water resource in the way described in this plan. The outcomes for this plan are to:

- support the water needs of current and future land uses in the Peel region
- protect valuable ecosystems dependent on groundwater, including those of the Peel-Yalgorup wetland system, from any additional adverse effects of abstraction
- encourage water trading and the use of alternative water sources.

We will assess and report on these outcomes by conducting regular plan evaluations.

2.2 Resource objectives

To meet the plan's outcomes, our management is directed towards meeting specific water resource objectives. These objectives must be measurable and relate to maintaining, increasing, improving, restoring, reducing or decreasing groundwater levels or water quality.

The water resource objectives of this plan are that:

1. Abstraction does not cause the seawater interface to move inland.
2. Saltwater up-coning does not affect other users.
3. Groundwater levels are sufficient to minimise risks to groundwater-dependent ecosystems.
4. Fresh groundwater discharge into Lake Clifton, Lake Preston and Martin's Tank is sufficient to minimise further risks to dependent ecological values.

The measurable performance indicators for the resource objectives are described in Chapter 5.

The drying climate is having a noticeable effect on water resources and their dependent values in the plan area. In some circumstances, particularly where there is exempt use, low volumes of licensed use and no alternative source options, the department's interventions to meet resource objectives may be limited in their effectiveness. The response to the drying climate is further described in Section 3.2.

2.3 Strategies

To meet the plan's water resource objectives, our strategies are to:

- license the 14 groundwater resources in accordance with the allocation limits (Chapter 3)
- apply the local licensing policies outlined in this plan (Chapter 4)
- encourage water efficiency through trading and alternative water supply options such as the reuse of treated wastewater (Chapter 4)
- investigate non-compliance with licence conditions and take appropriate enforcement action (Chapter 4)
- monitor groundwater resources using the department's monitoring network (Chapter 5)
- regularly evaluate whether the plan's outcomes and resource objectives are being met and adjust our management accordingly (Chapter 6).

2.4 Measuring the plan's success

We will evaluate against the plan regularly to see if the outcomes and resource objectives are being met. We will assess:

- the condition of water resources and groundwater-dependent ecosystems using monitoring information and performance indicators
- licensing and water use data
- the effect of the drying climate and reduced rainfall.

We will publish how successful we have been in meeting the outcomes and resource objectives in evaluation statements at least every three years. Chapters 5 and 6 provide more information about how we will monitor and evaluate this plan's performance.

Chapter Three

Water allocation limits

This chapter sets out:

- the allocation limits for consumptive use in each groundwater resource
- the water to be left in aquifers to maintain water quality, aquifer productivity and groundwater-dependent ecosystems.

3.1 Allocation limits

Allocation limits are the annual volume of water set aside from a water resource for consumptive use such as household, urban, irrigation, stock, mining or industrial use. Allocation limits are the main tool we use to ensure that the take of water is sustainable and to ensure security of supply at the resource scale. The allocation limit now includes exempt (from licensing) use, but does not include the water that is left in an aquifer.

The allocation limits for the 14 groundwater resources across the seven groundwater subareas in the plan area are shown in Table 1.

The department allows the take of groundwater up to the allocation limit for each resource in accordance with

the licensing and allocation approach described in Chapter 4. Where a resource is fully allocated we are likely to refuse applications for new licence entitlements (including increases to existing licence entitlements) and encourage trading, improving water use efficiency or using alternative water sources to meet water requirements.

Please phone our Kwinana Peel regional office on 08 9550 4222 for up-to-date water availability information or to discuss opportunities for obtaining water by trading or from alternative sources. Water availability can also be viewed on our online Water Register at atlases.water.wa.gov.au/ags/waterregister/.

Components of the allocation limit

For administrative and accounting purposes, the allocation limit is divided into the following components:

- water that is available for licensing
 - general licensing
 - public water supply licensing
- water that is exempt from licensing (unlicensed)
- water that is reserved for future public water supply.

General licensing

The general licensing component of the allocation limit is the total volume of water which can be issued as annual licensed entitlements for all uses other than public water supply.

The 11.2 GL/year in this component, across all aquifers at the time of publishing, is fully allocated.

Public water supply

The public water supply component of the allocation limit is the volume of water that is licensed to water service providers. Groundwater in the plan area is not generally accessed for public water supply. Only 0.02 GL/year is licensed in the Coastal subarea to supply the Preston Beach town site.

Reserved water

No water is reserved for future public supply. Demand for potable water in Mandurah and surrounding areas is met through the Water Corporation's IWSS from sources outside the plan area.

Unlicensed use - water that is exempt from licensing

The unlicensed use component is the volume of water for uses that are exempt from licensing under the *Rights in Water and Irrigation Act 1914*. This includes water for rural households, gardens, minor stock and domestic uses and emergency fire-fighting purposes only.

Exempt water use is now included in allocation limits in the plan area. The methodology used to estimate the

exempt volume is documented in the *Peel Coastal groundwater allocation plan: methods report* (DoW 2015b).

The total exempt use is 5.42 GL/year, which is about 48 per cent of total annual abstraction in the plan area. Although exempt use is a large component of the allocation limit, domestic bores generally present a low risk to the resource and other users. They individually draw low volumes of groundwater, are spread out, and the number of bores is unlikely to increase significantly in the future.

The City of Mandurah has indicated the density of stock and domestic bores in the Island Point subarea may increase in the future due to the rezoning of rural blocks. Given it is unlikely this new development will have access to scheme supply, we have accounted for this potential increase in water use in the exempt component of the allocation limit.

How has total water availability changed?

By totalling the allocation limits for all resources in the plan area, annual water availability has been reduced from 20.7 GL/year (set in 1989) to 11.2 GL/year. Reducing the volume of groundwater available by almost half is a decisive step towards protecting current water users' entitlements, ensuring both current and future water users are adapting to the drying climate, and minimising the risks to water quality and important natural, groundwater-dependent values.

3

Water allocation limits

Table 1
Allocation limits for the water resources

Water resources		Allocation limit kL/year	Allocation limit components kL/year			
			Licensed		Unlicensed	Reserved water
Subarea	Resource		General	Public water supply	Exempt	Public water supply
Coastal	Superficial	192 550	59 550	0	133 000	0
Colburra Downs	Superficial	70 000	0	0	70 000	0
Falcon	Superficial	2 321 923	654 923	0	1 667 000	0
Island Point	Superficial	568 375	239 775	0	328 600	0
Lake Clifton	Superficial	661 440	306 440	0	355 000	0
Mandurah	Superficial	4 653 729	2 025 729	0	2 628 000	0
Whitehills	Superficial	335 909	92 909	0	243 000	0
Coastal	Leederville	20 000	0	20 000	0	0
Colburra Downs	Leederville	0	0	0	0	0
Falcon	Leederville	1 606 420	1 606 420	0	0	0
Island Point	Leederville	0	0	0	0	0
Lake Clifton	Leederville	0	0	0	0	0
Mandurah	Leederville	802 100	802 100	0	0	0
Whitehills	Leederville	0	0	0	0	0
Total		11 232 446	5 787 846	20 000	5 424 600	0

3.2 How the allocation limits were set

The new allocation limits are based on analysis of the available hydrogeological, environmental, climate and water use information (both current and projected). Using this information we applied a risk-based approach to determine whether more, the same or less groundwater could be allocated while still achieving the plan's outcomes and objectives (see Chapter 2).

We decided to adopt a risk-based approach to set allocation limits after first using a number of recharge estimation methodologies. Because of the unique nature of the groundwater system, these initial methods, combined with our environmental assessments, produced a large range of possible allocation options with high levels of uncertainty.

Given we have already observed salinity increases and bores have had to be decommissioned, collecting additional data before making allocation decisions would have delayed the plan and postponed the actions we have now taken.

To manage risk, we reduced allocation limits by almost 50 per cent for both the Superficial and Leederville aquifers, and set them at the level of current use (existing licences and exempt use) for all resources. Allowing more water to be abstracted would increase the risk of licensees not being able to access their entitlements in the future. It would also accelerate impacts on valuable ecosystems dependent on groundwater, including the Ramsar-listed Peel-Yalgorup wetland system. We also identified opportunities for accessing water to meet future demand

through improvements in water use efficiency, water trades and transfers, and using alternative water sources like recycled wastewater.

We considered the option of reducing allocations below current use to further reduce the risks to water levels, water quality and groundwater-dependent ecosystems. However, this was not considered a reasonable approach given the reliance on local groundwater in the area and because we are able to regulate and manage the effects of individual licences.

Setting allocation limits at current use levels allows our resource objectives and outcomes to be met. The risk assessment for each resource is summarised in the *Peel Coastal groundwater allocation plan: Methods report* (DoW 2015b).

How we considered the drying climate

We have continued to observe significant reductions in rainfall across south-west Western Australia since the mid-1970s. This is affecting surface water runoff and groundwater recharge and is a critical factor in our water planning.

The department uses the most up-to-date climate modelling from the Intergovernmental Panel on Climate Change to project future rainfall across the state (DoW 2015d). Our projections indicate that by 2020 the long-term average annual rainfall for Mandurah (which is 845 mm/year for the baseline period of 1961 to 1990) will decline by 2.5, 5.8 and 8.9 per cent under a wet, mid or dry scenario respectively, and by 2030 by 3.4, 9.0 and 13.6 per cent. Figure 4 shows these predicted declines. In all cases Mandurah and its surrounding areas are likely to get dryer.

3

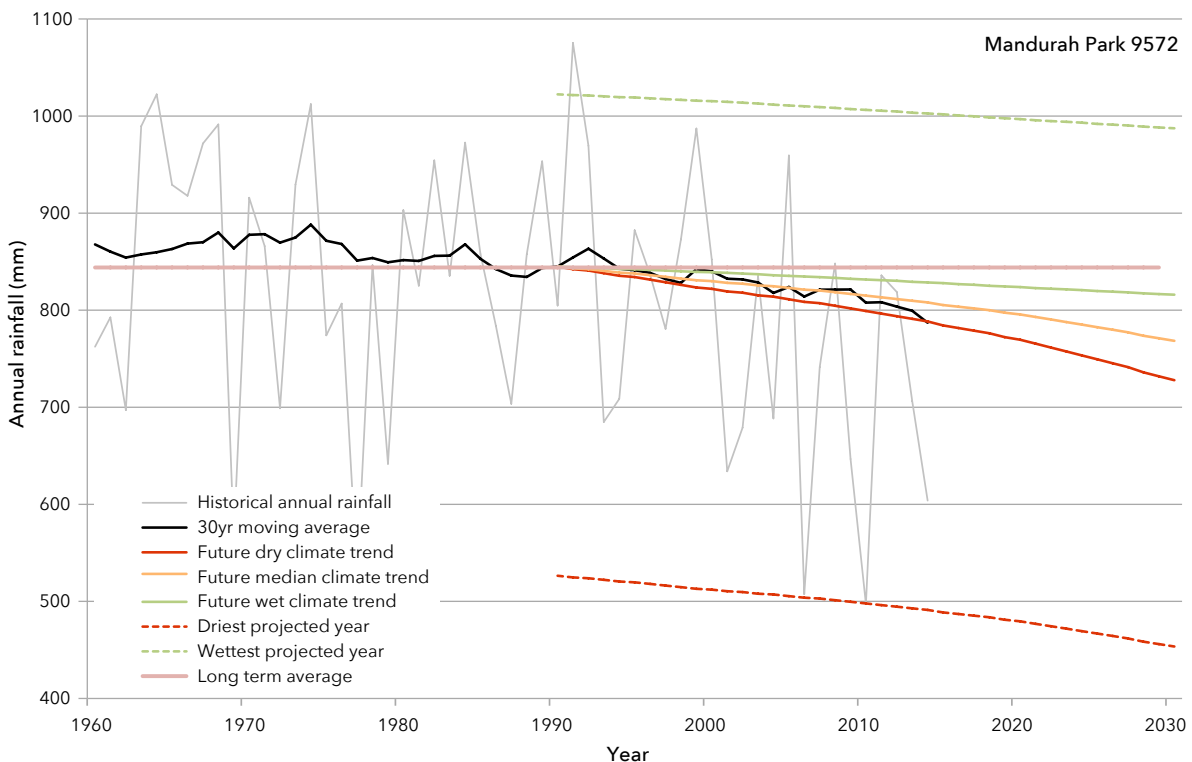
Water allocation limits

Given the likely range of future rainfall in the plan area, the volume of fresh water recharging groundwater resources will continue to decline. This will increase the risk of water level declines and water quality deterioration across the region, including those areas with limited or no abstraction.

Groundwater-dependent ecosystems will also continue to undergo changes as a result of declining rainfall and recharge, changes in water quality, and other climate change effects such as rising sea levels.

Our decision to reduce allocation limits to the current level of use is supported by our climate risk assessment. Allowing any further water to be allocated would pose unacceptable risks to current and future users and the environment, especially when there are other options such as improving efficiency, trading and transferring water entitlements, and accessing alternatives.

It will be important to continue to monitor and track the effects of changes in climate over time to inform whether we need to revise our management.



The future scenarios are calculated relative to a 1961 to 1990 baseline, so the climate trends are plotted using 1990 as the starting year.

Figure 4
Historical rainfall and projected rainfall for wet, median and dry scenarios at the Bureau of Meteorology site Mandurah Park 9572

3.3 Water that is left in the aquifers

Leaving water in the aquifer (water not available for abstraction) supports the plan's outcomes and water resource objectives. It reduces the risks of abstraction impacting on both groundwater-dependent ecosystems and water users.

As a part of our risk management approach, the department assessed the risk of different allocation options on groundwater-dependent ecosystems using reference groundwater levels (DoW 2015a). Reference groundwater levels are the minimum groundwater levels required to support ecological outcomes for groundwater-dependent terrestrial vegetation, wetland sites and thrombolite communities. At these reference levels, the ecology and the water resource are protected from exposure of acid sulfate soils. Hydrograph analyses show that groundwater levels have remained above the reference levels in all but the driest years (years with less than 20th percentile rainfall).

Groundwater levels in the plan area are likely to remain relatively stable into the future because it is close to the Indian Ocean and the Peel-Harvey Estuary (Figure 5). However, water quality declines are likely to pose an increasing risk to water users and groundwater-dependent ecosystems over time. With less rainfall in a drying climate to replenish the fresh groundwater, saline water from the ocean, estuary and deeper in the aquifer will continue to move inland and upward, reducing water quality in the aquifer (Figure 5).

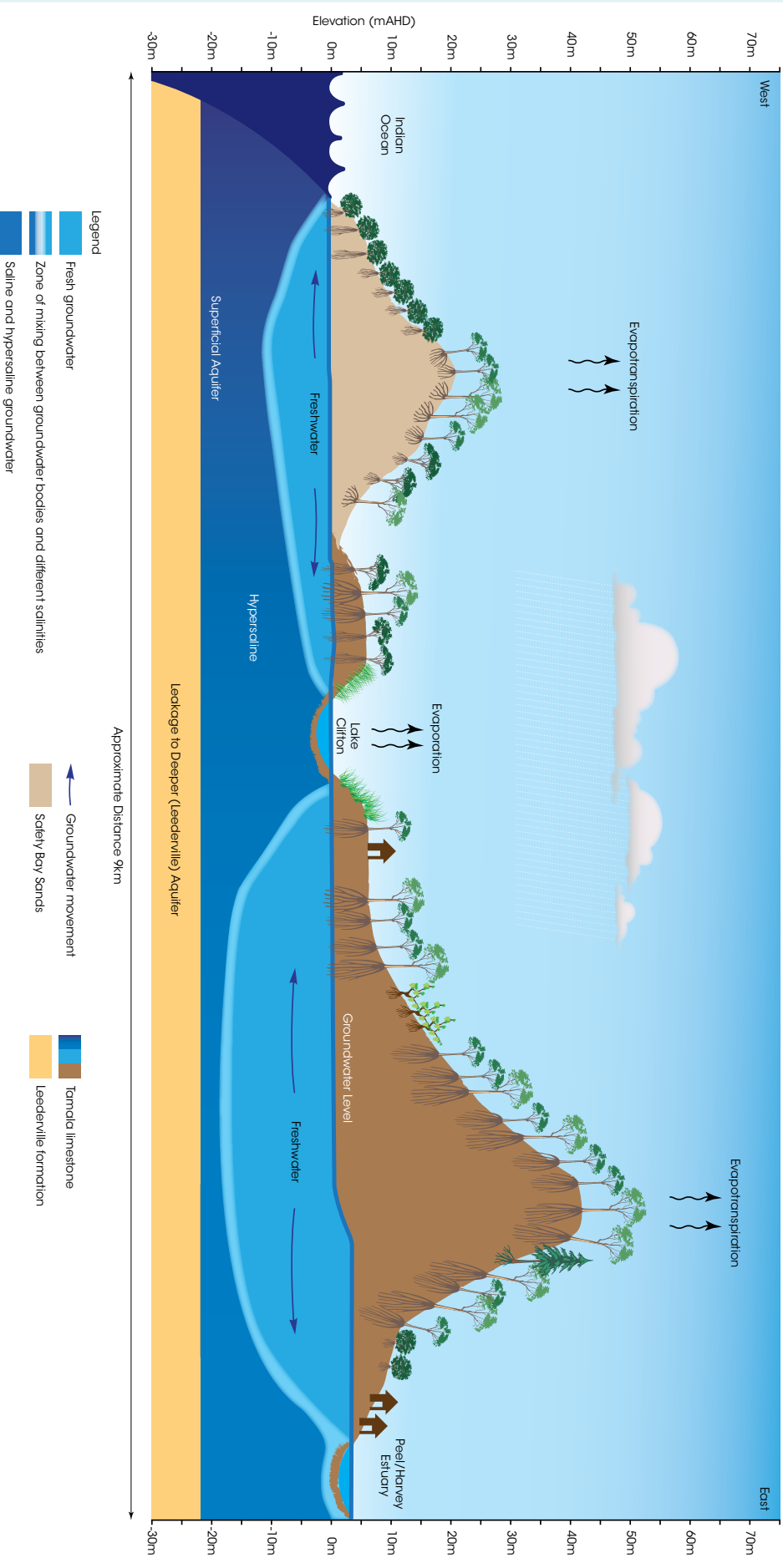


Figure 5 Cross-section of the Island Point and Coastal subareas, which shows the interaction of fresh and hypersaline groundwater with the lakes

The effects of changing climate on Lake Clifton

Lake Clifton makes up part of the Ramsar-listed Peel-Yalgorup wetland system and is located within Yalgorup National Park. The lake is known to be groundwater fed and is home to rare thrombolite communities (Figure 6).



Figure 6
Rare thrombolite communities in Lake Clifton

Based on predicted, long-term rainfall declines, salinity levels are likely to continue to increase in Lake Clifton. Our options to manage this are limited because of minimal groundwater use up-gradient of the lake and the lack of alternative water sources.

The report *Ecological character description for the Peel-Yalgorup Ramsar site* (Hale and Butcher 2007) recognised the impact that climate change, abstraction and land use are having on the system's values.

Managing to the *Peel Coastal groundwater allocation plan* will minimise the risks of climate change to the lake and its values.

For further reading visit the Department of Environment Regulation's website <www.der.wa.gov.au>

3

Water allocation limits

Salinity levels in Lake Clifton have significantly increased while groundwater levels have remained relatively stable. High salinity levels represent a risk to the rare thrombolite communities that inhabit the lake, which require water in the lake to remain within an optimal salinity range to survive.

Since the 1980s, the lake was hyposaline (less than 35 grams per litre total dissolved solids) until the early to mid-2000s when the lake became hypersaline (above 35 g/L TDS) (Figure 7). Groundwater discharge to the lake also provides the calcium and bicarbonate that thrombolites form from. If Lake Clifton becomes permanently hypersaline, it is likely that thrombolite growth will slow or stop. Diversity of macroinvertebrates, a food that supports waterbirds, would also be affected.

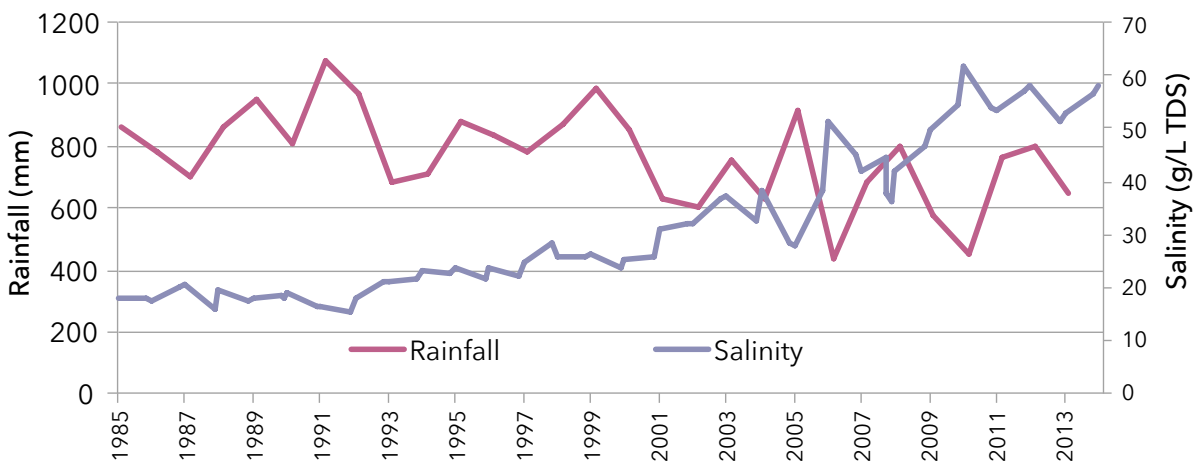


Figure 7
Annual rainfall and salinity measured in Lake Clifton, showing how salinity has increased as rainfall has decreased over time

CSIRO’s modelling suggests that the main cause of the salinity increase has been reduced rainfall, with the impacts of groundwater abstraction being secondary (Barr 2003). The department’s more recent analysis, of the relationship between rainfall and end-of-spring salinity, also suggests that increasing salinity is largely because of reduced rainfall changing how groundwater recharges the lake.

Assessment of hydrogeology and water quality inputs to Yalgorup lakes (Water and Rivers Commission 1999) study of the lake's water balance estimated that 60 per cent of water in the lake comes from direct rainfall and 40 per cent from groundwater discharge. Since then, rainfall contributions have declined while groundwater contributions appear to have increased. As direct rainfall and fresh rainfall recharge to groundwater continue to decline with the drying climate, the amount of fresh water entering the lake will also continue to decline. These effects may be compounded by increased evaporation.

Groundwater abstraction in nearby rural areas is also likely to reduce groundwater levels and groundwater flow into Lake Clifton. Recharge patterns may also change over time as land uses change.

To reduce the risk of groundwater abstraction impacting on groundwater flow into the lake, we have reduced all groundwater allocation limits in the Lake Clifton catchment through this plan. We reduced the combined allocation limits for the Lake Clifton and Island Point subareas, to the west of the lake, from 4.6 GL/year to 1.23 GL/year.

Water use is now capped at current water use. Over half of the water used in this area is for small scale stock and domestic purposes and, apart from rainwater tanks, there are no alternative water supplies for these rural residential areas.

To make sure we are delivering the plan's outcomes and objectives, and reduce risks to the environment and water users, we will use the reference groundwater levels as interim indicators (Table 3, section 5.1). We will later introduce more specific water quality indicators after targeted monitoring of groundwater salinity.

For more information on how we set the reference groundwater levels and assessed risks to the environment and water users, refer to:

- *Peel Coastal groundwater allocation plan: Groundwater-dependent ecosystems report* (DoW 2015a)
- *Peel Coastal groundwater allocation plan: Methods report* (DoW 2015b).

For further reading, please refer to the References section and visit the Department of Environment Regulation's website <www.der.wa.gov.au>

Chapter Four

Water licensing

Water licences are issued under the *Rights in Water and Irrigation Act 1914* to manage and regulate the individual take of surface water and groundwater. The department applies policies for assessing licence applications and applying licence conditions. Allocation plans specify the local policies and water resource management outcomes that apply to a particular plan area.

This chapter describes the policies for managing water allocation and licensing in the Peel Coastal plan area.

4.1 Legislative requirements

Rights in Water and Irrigation Act 1914

The *Rights in Water and Irrigation Act 1914* establishes the legislative framework for managing and allocating water in Western Australia. All of the groundwater resources in the plan area are within the South West Coastal Groundwater Area, which is proclaimed under the Act (Figure 1).

Water licences

Water users in the *Peel Coastal groundwater allocation plan* area require a water licence under section 5C of the Act to lawfully take groundwater, unless exempt (see section below). A licence issued under section 26D is also required to construct or alter wells.

The department regards the allocation plan, clause 7(2) of Schedule 1 of the Act and statewide policies when assessing water licence applications or the reissue of licences. In granting a licence, or reissuing a licence, the department may apply terms, conditions and restrictions to licences under clause 15 of Schedule 1 of the Act.

Our requirements for altering any licence condition are specified under clause 24(1) of Schedule 1 of the Act. The rights of licensees are covered under clause 26. Any decision made on a licence application can be reviewed through the State Administrative Tribunal.

Exemptions

Under the Rights in Water and Irrigation Act Exemption and Repeal (Section 26C) Order 2011, some uses of water do not require licensing in proclaimed areas. This applies to water taken from non-artesian wells in the watertable aquifer (Superficial aquifer) for:

- fire-fighting purposes
- temporary dewatering
- watering of stock, other than those raised under intensive conditions
- domestic garden and lawn irrigation
- other ordinary domestic uses.

The department does not generally consider the plan area suitable for the drilling of new bores for domestic purposes as:

- water quality may not be suitable in some areas
- there is risk to the groundwater resource and potential for adverse effects on other groundwater users from further abstraction.

The *Perth groundwater atlas* <atlases.water.wa.gov.au/idelve/gwa/> provides general information about garden bore suitability areas. More specific groundwater data for your location may be available from our Water Information Reporting site <wir.water.wa.gov.au/SitePages/SiteExplorer.aspx>.

Under the Rights in Water and Irrigation Exemption (section 26C) Order 2012, a licence is not required to construct or alter non-artesian wells that are used solely to monitor water levels and/or water quality.

Compliance and enforcement

Under the *Rights in Water and Irrigation Act 1914*, water users in proclaimed areas must be licensed to take surface water or groundwater, unless otherwise exempted.

The department carries out regular compliance monitoring surveys across the state to ensure that the take and use of water is authorised and in accordance with the annual water entitlement, licence terms, conditions and restrictions.

Water resources located within the Peel Coastal plan area will be categorised according to risk for compliance monitoring purposes. Water resources that are categorised as high risk will be subjected to a greater level of on-ground compliance monitoring activity. We will also review monitoring and metering data for the Peel Coastal plan area and assess any local effects, thus ensuring the licence conditions applied within the plan area are appropriate.

Public drinking water source protection areas

The Peel Coastal plan area has one proclaimed public drinking water source protection area, the *Preston Beach public drinking water source protection area*. This is proclaimed under the *Country Areas Water Supply Act 1947*.

For information about protection of this water source, see the *Preston Beach Water Reserve drinking water source protection plan* (DoW 2006) located on our website <www.water.wa.gov.au>.

Other legislation

In administering the *Rights in Water and Irrigation Act 1914*, we abide by other state and federal legislation.

Environmental Protection Act 1986

Significant development projects may require an environmental impact assessment under Part IV of the *Environmental Protection Act 1986* (WA). This assessment is the responsibility of the Office of the Environmental Protection Authority (OEPA). The department may refer a licence application to OEPA if potentially significant impacts are predicted.

4.2 Water licensing approach

A water licence provides legal and secure access to water. Water allocation plans help us manage licences and abstraction at a collective scale by guiding licence decisions and providing an adaptive management framework for the plan area.

This section outlines our licensing approach across the plan area. The approach is generally consistent with that applied across the state; however, specific local issues are addressed in this section.

Statewide policies, used to support and guide the water licensing approach, are available from our website <www.water.wa.gov.au>. Please note: it is important to consult with us early if you are seeking water or have any issues with an existing licence. Contact the department's Kwinana Peel regional office to discuss water licensing in the Peel Coastal plan area.

Meeting water demands in fully allocated resources

Groundwater resources in the plan area are fully allocated. It is unlikely the department will grant any new licences in fully allocated resources. To ensure that planning authorities, local governments and developers are given sufficient time to identify their long-term water supply, the department will provide advice as early as possible in accordance with *Better urban water management* (Western Australian Planning Commission 2008).

Where water becomes available in a subarea through relinquishment or recouping of licence volumes, we may reallocate that water following an assessment of the risks and consideration of recommendations from our annual plan evaluations.

Up-to-date groundwater availability in the plan area is available from our Kwinana Peel regional office or from our Water Register at <atlases.water.wa.gov.au/ags/waterregister/>.

Water use efficiency

The department will seek to ensure that water licensees use their water licence entitlement in an efficient manner and make the most of the water available under their allocation limit. Water saved through efficiency improvements can also be traded in accordance with Operational policy 5.13: *Water entitlement transactions for Western Australia* (DoW 2010).

We may require certain licensees to develop and implement water conservation and efficiency plans as part of the operating strategy of a licence. Our policy on water conservation and efficiency plans can be found at <www.water.wa.gov.au/PublicationStore/89951.pdf>.

Water trading and transfer

People wishing to obtain new or increased groundwater licence entitlements should consider transacting with existing licensees. This could involve transferring or trading existing water licence entitlements, or reaching an agreement to use an existing water licence entitlement.

Portions of current groundwater licence entitlements may become available for trading or transfer if improvements to water use efficiency are demonstrated, or if those water licence entitlements are supplemented with treated wastewater (see Alternative water sources options). We allow for both permanent and temporary transactions of water licence entitlements.

The department's trading policy can be found on our website. Proponents seeking to trade water can contact current licensees using our Water Register <atlases.water.wa.gov.au/ags/waterregister/>. See Assessing the effects of trades, transfers and new applications for more information.

Alternative water source options

As groundwater resources are fully allocated, the department expects that alternative water sources will supply any significant new water demand. An estimated 268 ha of new urban areas were identified in the plan area, mostly in the Mandurah subarea. While household needs in new urban areas will be met by expansion of scheme supply as part of the development, alternatives to local groundwater will be needed for new parks and open space.

Alternative water sources are already becoming an important part of meeting the growing water demands. Alternative water sources may include the use of treated wastewater, harvested

stormwater or managed aquifer recharge (MAR)(Figure 8). As examples, the Water Corporation's Kwinana water recycling plant provides significant volumes of recycled water to local industry, while scheme water use has been reduced in an urban development in Baldivis with a third-pipe scheme to supply treated wastewater for public open space and households. Within the plan area three wastewater treatment sites at Gordon Road, Caddadup and Halls Head are being used to irrigate public open space.

Of these alternative water source options, only MAR requires licensing. The department developed Operational policy 1.01: *Managed aquifer recharge in Western Australia* (DoW 2011b) to provide policy guidance on MAR proposals. All future MAR proposals will be regulated in accordance with this policy.

The City of Mandurah, in partnership with the Water Corporation, proposes to increase the use of treated wastewater to meet public open space needs in the Mandurah and Falcon subareas. With Mandurah being one of the fastest growing cities in Western Australia, the need to dispose of excess wastewater has provided the opportunity to reuse fit-for-purpose water for community benefit.

Although not considered in this plan, the Cattamarra Coal Measures may be a suitable fit-for-purpose resource in the future. Proponents would need to consider its considerable depth (greater than 290 m), poor water quality and any risks associated with abstraction.

The department will work with existing and potential water users to explore and facilitate new and alternative water source options. We have developed the *Guideline for the approval of non-drinking water systems in Western Australia: urban developments* (DoW 2013) to facilitate this process.

4

Water licensing



Figure 8
An example of an alternative water source – the stormwater harvesting system being built at the Graham Heal Reserve (courtesy of the City of Mandurah)

Allocations from the Leederville aquifer in the Falcon subarea

The Leederville aquifer in the Falcon subarea is a non-renewable resource. As fresh water is abstracted from the aquifer, it is recharged by saline water from the overlying Peel–Harvey estuary. To minimise risks to existing users, the department is unlikely to support any additional demand on this resource. Additionally, where licensed allocations are relinquished or cancelled, water will not be re-allocated for new licence entitlements.

Assessing the effects of trades, transfers and new applications

Although no new water is available for licensing in the plan area at present, from time to time some volumes may become available through the relinquishment or recouping of licence entitlements. Water is also available through trading and transfers.

We will assess any application for new water or trades to ensure that any possible adverse effects on groundwater-dependent ecosystems and water quality can be managed.

The local licensing policies given in Table 2 will be considered as part of the clause 7(2) assessment. The department may refuse a licence application or require changes to a proposal if local effects are deemed to be unacceptable, even if water is available within the allocation limit.

4.3 Local licensing policies

The local licensing policies in Table 2 provide specific considerations for licence assessments and management in the Peel Coastal plan area. The policies apply either because the local issues are not addressed in state-wide policy, or because an alternative, more specific approach is required for managing a local issue. Where local policy in the allocation plan differs from a state-wide policy, the policy in the allocation plan is applied.

Table 2
Local licensing policies specific to the Peel Coastal plan area

Policy group		Policy detail
Licence assessment		
1.1	Assessing the impacts of a proposal on groundwater-dependent environmental values and water quality	<p>1.1.1 If water becomes available, depending on the location new 5C licence applicants may need to assess and demonstrate how they will prevent, or manage, the impacts of their proposal on significant wetlands. Significant wetlands include:</p> <ul style="list-style-type: none"> • Ramsar-listed sites • Environmental Protection (Swan Coastal Plain Lakes) Policy sites, Office of the Environmental Protection Authority • Conservation category wetland sites, Department of Parks and Wildlife <p>Approvals from other agencies may also be required.</p> <p>1.1.2 Proponents must assess and demonstrate how they will prevent, or manage, the effect of their proposal on acid sulfate soils, local saltwater up-coning, and the landward movement of the seawater interface when applying for a 5C licence.</p>
Managing impacts		
2.1	Managing impacts on groundwater-dependent vegetation	<p>2.1.1 New or replacement production bores are unlikely to be permitted within 200 m of:</p> <ul style="list-style-type: none"> • Ramsar-listed sites • Environmental Protection (Swan Coastal Plain Lakes) Policy sites, Office of the Environmental Protection Authority • Conservation category wetland sites, Department of Parks and Wildlife.
2.2	Managing impacts on water quality	<p>2.2.1 New or replacement production bores should be spaced as far as practical away from existing production bores (including bores on a proponent's or adjacent properties) to minimise risk of salinity increases and to bore productivity.</p> <p>2.2.2 If there are significant water quality risks to existing users or the water resource, the department may apply licence conditions that specify:</p> <ul style="list-style-type: none"> • a rate of abstraction • installation of monitoring bores • water quality monitoring and reporting.
2.3	Licences requiring operating strategies	<p>2.3.1 Renewed groundwater licences or any new licences may require an operating strategy. Examples of water uses requiring an operating strategy in this plan area are:</p> <ul style="list-style-type: none"> • irrigation of parks, gardens, public open space and maintenance of artificial wetlands or lakes • dewatering that is likely to affect an existing user, expose acid sulfate soils or affect the environment.
2.4	Amending licences if impacts on groundwater-dependent environmental values or water quality are observed	<p>2.4.1 Where the department observes impacts on water quality, or groundwater-dependent environmental values, through assessment of our monitoring data, we may:</p> <ul style="list-style-type: none"> • restrict abstraction (e.g. timing, rate of abstraction) • require relocation of production bores • require the licensee to install new monitoring bores • amend or require an operating strategy.

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Water licensing

Table 2 (continued)
Local licensing policies specific to the Peel Coastal plan area

Policy group		Policy detail
Metering		
3.1	Requirements for metering	<p>3.1.1 In addition to Strategic policy 5.03: <i>Metering the taking of water</i> (DoW 2009b), the department may require a meter to be installed where the following uses pose further risks specific to local area conditions:</p> <ul style="list-style-type: none"> • where a community bore is supplying water for irrigation of domestic gardens • a bore for irrigation of public open space, parks and gardens or maintenance of artificial lakes • where groundwater is supplying school grounds • a bore is abstracting from a confined aquifer in the Falcon subarea.

Statewide licensing policies

The department has statewide policies that guide our licensing processes and decisions. They ensure that licences are assessed and issued consistently and equitably across the state.

These policies may be viewed on our website <www.water.wa.gov.au> or obtained from the Kwinana Peel regional office.

4.4 Factors that may affect future licensing

How we licence the taking of water in the plan area in the future may include, but not be limited to, the following:

- changes to current land use
- new information on hydrogeology and ecology from departmental and private sources
- the extent to which the climate continues to dry and other climate change related factors, such as sea level rise.

In the future, alternative water sources may need to gradually replace some groundwater use in the Mandurah and Falcon subareas. This will depend on how groundwater resources, in particular water quality, respond to the drying climate and continued abstraction.

Chapter Five

Monitoring program

This chapter sets out how the Department of Water will monitor water resources in the plan area. Monitoring allows us to understand how water resources are performing over time and in particular how they are responding to abstraction and changes in climate. We use this information to evaluate if the plan's outcomes and objectives are being met and whether we need to adapt how we regulate and manage abstraction.

We have a network of 29 monitoring bores in the plan area that have been recording groundwater levels from as early as 1975. Most of the monitoring bores are in the Superficial aquifer. There are fewer bores in the confined Leederville aquifer and some subareas have minimal to no monitoring data available (see Figure 9). We use other data in our assessments where it is available.

We continually maintain our monitoring network and upgrade it where more

information is necessary. In 2012, as part of the Murray–Peel groundwater investigation project (DoW in prep.), two additional monitoring bores were installed in the confined Leederville aquifer in the Island Point and Lake Clifton subareas.

In the future we will continue to improve the information gathered from across the plan area. The focus will be on understanding the effects both of climate change and abstraction, as well as on ensuring we can identify and manage increasing risks to water quality from saltwater intrusion.

We will also continue to obtain and use water resource information from licensees, other water users and agencies.

See Appendix A for a full list of departmental monitoring sites used in the Peel Coastal plan area at present.



Figure 9
 Groundwater monitoring sites in Peel Coastal plan area
 Peel Coastal groundwater allocation plan

5.1 Evaluating against resource objectives

We will use the monitoring and performance indicators shown in Table 3 to assess whether the plan's objectives are being met. Each objective and performance indicator will be assessed annually.

Table 3
Monitoring in the plan area

Resource objective	Monitoring sites	Performance indicator
1 Abstraction does not cause the seawater interface to move inland	All 29 sites (Appendix A)	Interim indicator ¹ <ul style="list-style-type: none"> Assess water level trends Indicator to be developed <ul style="list-style-type: none"> Water level monitoring Pressure transducers Salinity profiling
2 Saltwater up-coning does not affect other users	Private bores, where information from licensees is received	Private monitoring data or other information, including salinity profiling, indicates no change in water quality
3 Groundwater levels are sufficient to minimise risks to groundwater-dependent ecosystems	Groundwater-dependent vegetation monitoring sites: <ul style="list-style-type: none"> Lake Thompson T630 Harvey Shallow HS62C YSH4 Lake Clifton B2 Lake Clifton C2 	Groundwater levels at groundwater-dependent ecosystem target sites remain above reference groundwater levels (see Appendix B for levels). Indicator to be developed <ul style="list-style-type: none"> Pressure transducers Salinity profiling
4 Fresh groundwater discharge into Lake Clifton, Lake Preston and Martin's Tank is sufficient to minimise further risk to dependent ecological values	Groundwater discharge monitoring sites: <ul style="list-style-type: none"> Yalgorup Lakes NLP Y2-4B YSH4 Lake Clifton B2 Lake Clifton C2 	Interim indicator ¹ <ul style="list-style-type: none"> Assess water level trends Indicator to be developed <ul style="list-style-type: none"> Water level monitoring Pressure transducers Salinity profiling

¹ Water level trends cannot reliably indicate changes to water quality, which is why we have included Indicator to be developed. As discussed in Section 3.3, changes in groundwater salinity may occur even though groundwater levels remain stable. Although we will continue to measure groundwater levels, the primary indicator will be determined from targeted monitoring of groundwater salinity and pressure transducers.

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Monitoring program

We will develop performance indicators to help assess the increasing risk of the water quality declines described in Section 3.3. This will be done as part of implementing the plan (see the implementation actions in Table 4, Section 6.1).

We will consider the influence of climate, abstraction and changes to land use when assessing the data during our plan evaluation process. This will inform our management response if significant issues with water levels or quality are detected. Our response could include further assessment work if the causes are not clear, increased compliance activity or, where necessary, changes to abstraction.

Over time, performance indicators may not be met because of the long-term drying trend, rather than the impacts of the relatively low abstraction in this area. If this happens we will consult with other relevant agencies and stakeholders to consider management options.

5.2 Ecological monitoring

Groundwater reference levels informed the setting of allocation limits (see Section 3.3) and provide a benchmark for monitoring risks to groundwater-dependent ecosystems. If water levels reach or approach reference levels, impacts on groundwater-dependent vegetation, wetlands or thrombolites are likely. Water quality performance indicators will also be developed to specifically manage the risks to ecological values.

At this point the department may take management action to rectify any obvious impacts, or conduct further ecological monitoring if the causes or extent of the impacts is not clear. As most of the significant groundwater-dependent ecosystems in the plan area are located in a national park or protected lands, we will work with the Department of Parks and Wildlife to undertake further ecological monitoring when it is required.

Chapter Six

Implementing and evaluating the plan

The Department of Water will implement this plan by following the strategies listed in Section 2.3. Once the plan is in place, we will regularly evaluate whether its objectives are being met by conducting periodic evaluations.

This chapter sets out some additional actions necessary to implement and evaluate this plan.

6.1 Implementing the plan

To ensure we can effectively manage groundwater abstraction in accordance with this plan, we have identified a number of further actions to be taken. These are listed in Table 4.

Table 4
Actions to implement the Peel Coastal groundwater allocation plan

Action	Timeline
Alternative water sources	
<p>1 Work with developers, the Water Corporation, local governments and other regulatory agencies to facilitate the use of alternative water sources such as wastewater recycling and managed aquifer recharge (MAR) in the plan area. This may include:</p> <ul style="list-style-type: none"> • providing timely advice in accordance with <i>Better urban water management</i> (WAPC 2008) • helping developers use the <i>Guideline for the approval of non-drinking water systems in Western Australia: urban developments</i> (DoW 2013) • providing technical support for MAR studies to map infiltration zones • working with proponents to transition them to alternative sources. 	Ongoing
Compliance	
<p>2 Undertake compliance inspections on high-risk resources in the plan area.</p>	Annually or as identified in the state compliance plan

Table 4 (continued)
Actions to implement the Peel Coastal groundwater allocation plan

Action	Timeline
Monitoring	
3 Review and implement a Peel Coastal water quality monitoring program, including development of water quality performance indicators.	Within three years of plan release
4 Establish groundwater reference levels where a level is not set.	Within three years of plan release
5 Review Peel-Murray drilling program results to inform evaluations and the monitoring program.	Report due 2016
Plan evaluation	
6 Assess performance against indicators and resource objectives.	Annually
7 Publish an evaluation statement on the plan and its implementation.	At least every three years

To ensure we are continuing to manage groundwater resources appropriately in the Peel Coastal plan area, we will undertake the actions in Table 5.

Table 5
Actions to support ongoing water resource management

Action	Timeline
8 Review exempt use estimates to guide future resource management.	Align with land use planning timelines and decisions
9 Review changes in current and future land use.	At least every three years
10 Refine understanding of the water requirements of groundwater-dependent ecosystems.	When reference levels are reached
11 Review climate trends and projections.	At least every three years
12 Review and implement outcomes of the Strategic Assessment of the Perth and Peel regions including advice to the Minister for the Environment from the Office of Environmental Protection Authority.	Through annual evaluation against objectives of this allocation plan

6.2 Evaluating the plan

The department annually evaluates monitoring and water use information to check whether resource objectives are being met and that the strategies and actions in our allocation plans are delivering the desired outcomes. We will publish the evaluation results in an evaluation statement at least every three years.

The evaluation statement will include:

- the allocation status for each resource, including any changes in licensed entitlements since the previous year
- the status of plan actions due in the evaluation period
- the department's performance against the plan outcomes and resource objectives
- how we will adapt our water resource management (if necessary).

The statement will be available on the department's website or by contacting our Kwinana Peel regional office.



Appendices

Peel Coastal groundwater allocation plan

Appendix A
Monitoring sites in the Peel Coastal plan area

Table A1
Monitoring sites in the Peel Coastal plan area

Aquifer	Subarea	Bore name	ID number	Period of record	Readings per year	Easting	Northing	
Superficial	Mandurrah	Lake Thomson T630	61410026	1975-present	2	384310	6403811	
Superficial		Lake Thomson T580A	61410723	2009-present	2	386077	6407238	
Yarragadee North		Artesian Monitoring AM67	61415004	1980-present	12	382835	6402182	
Leederville		Artesian Monitoring (AM 67A)	61415005	1983-present	12	382834	6402157	
Leederville		Mandurrah Line (1/86)	61419333	1989-present	6	382943	6398560	
Superficial		Lake Clifton A1	61319123	1979-present	6	370553	6382267	
Superficial	Whitehills	Lake Clifton A2	61319124	1979-present	6	371439	6382324	
Superficial		Lake Clifton A3B	61319126	1978-present	6	372507	6382292	
Superficial		Lake Clifton A4	61319127	1979-present	6	373883	6382587	
Superficial		Lake Clifton A5	61319128	1979-present	6	374689	6382599	
Superficial		MPL1C	61300136	2012-current	TBD	372300	6381563	
Lower Leederville		MPL1A	61300134	2012-current	TBD	372396	6381558	
Upper Leederville		MPL1B	61300135	2012-current	TBD	372396	6381558	
Superficial		Island Point	Yalgorup Lakes NLP Y2-4A	61319507	1995-present	6	374983	6376152
Superficial			Yalgorup Lakes NLP Y2-4B	61319508	1995-present	6	374983	6376152
Superficial			Yalgorup Lakes NLP Y2-5A	61319509	1995-present	6	376065	6376171
Superficial	Harvey Shallow HS62B		61330102	1982-present	6	377710	6372224	
Superficial	Harvey Shallow HS62C		61330103	1982-present	6	377710	6372224	
Superficial	YSH4		61319530	1995-1998	6	374262	6375456	
Superficial	Yalgorup Lakes Y2-5B		61319510	1995-present	6	376063	6376170	
Superficial	Lake Clifton	Lake Clifton B5	61319133	1979-present	6	378506	6366690	
Superficial		Lake Clifton E2A	6139152	1979-present	6	380956	6340476	
Superficial		MPL6C	61300139	2012-current	TBD	377156	6368538	
Lower Leederville		MPL6A	61300137	2012-current	TBD	377160	6368539	
Upper Leederville	Coastal	MPL6B	61300138	2012-current	TBD	377160	6368539	
Superficial		Lake Clifton B2	61319130	1979-present	6	374889	6365948	
Superficial		Lake Clifton C2	61319137	1979-2008	1	375789	6357248	
Superficial	Colburra Downs	Lake Clifton B6	61319134	1979-present	6	380533	6366760	
Superficial		Harvey Shallow HS63A	61330104	1982-present	6	381783	6362356	
Superficial		Harvey Shallow HS63B	61330105	1982-present	6	381783	6362356	
Superficial		Harvey Shallow HS63C	61330107	1982-present	6	381783	6362356	

Table B1
Locations of reference groundwater levels for environmental assessment sites

Resource objective	Subarea	Monitoring bore	Ecological value	Reference groundwater levels
Groundwater levels are sufficient to minimise risks to groundwater-dependent ecosystems	Mandurah	T630 (61410026)	Remnant groundwater-dependent vegetation	Groundwater level above 0.13 m AHD
	Island Point	YSH4 (61319530)	Riparian vegetation	Currently collecting data for determination of level
		HS62C (61330103)	Riparian vegetation and EPP wetland	Groundwater level above 0.01 m AHD
	Coastal	Lake Clifton C2 (61319137)	Riparian vegetation	Groundwater level above -0.45 m AHD
		Lake Clifton B2 (61319130)	Riparian vegetation	Groundwater level above -0.26 m AHD
Fresh groundwater discharge into Lake Clifton, Lake Preston and Martin's Tank is sufficient to minimise further risk to dependent ecological values	Island Point	Y2-4B (61319508)	Throughflow to Lake Clifton	Groundwater level above -0.05 m AHD
		YSH4 (61319530)	Discharge into Lake Clifton	Currently collecting data for determination of level
	Coastal	Lake Clifton C2 (61319137)	Discharge into Lake Preston	-0.45 m AHD
		Lake Clifton B2 (61319130)	Discharge into Martin's Tank	-0.26 m AHD

Appendix C Map information and disclaimer

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: Tim Grose
Map author: Michael Fifield, Maia Williams, Martin Drake
Filepath: J:\gisprojects\Project\330\80000_89999\3308440_WAP\00007_SouthWest_Allocation_Plan\mxd]
Compilation date: March 2014

Disclaimer

These maps are a product of the Department of Water, Water Assessment and Allocation Division.

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

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 this map:

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Groundwater Subareas – DoW – 2013
Perth Basin, Superficial aquifer, groundwater salinity – DoW – 2009
Towns – Western Australia – Landgate – 2013
Cadastre – Landgate – 2014
DWAID Aquifers – DoW – 2013
Hydrography, Lakes – AUSLIG – 2013
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DWAID Groundwater subareas – DoW – 2013
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WIN Groundwater Sites, Monitoring (Aquifer) – Perth Superficial – DoW – 2014
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State Roads – Landgate – 1999
Swan Coastal Plain South Feb 15 cm Orthomosaic – Landgate12 – Landgate – 2012
Local Government Authority and Locality Boundaries – Landgate – 2013
Native Vegetation Current Extent – Department of Agriculture and Food, WA – 2011
Ramsar Sites in Western Australia – CALM – 2013
"Register areas for Lakes EPP, 1992" – EPA WA – 1992

Shortened forms

List of shortened forms	
AHD	Australian height datum
DER	Department of Environment Regulation
DPaW	Department of Parks and Wildlife
DoW	Department of Water
DoP	Department of Planning
DWAID	Divertible water allocation information database
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
FPC	Forest Products Commission
IWSS	Integrated Water Supply Scheme
OEPA or EPA	Office of the Environmental Protection Authority
WAPC	Western Australian Planning Commission
WIN	Water Information Network
WRC	Water and Rivers Commission

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)

Glossary

Abstraction	Withdrawal of water from any surface water or groundwater source of supply.
Allocation limit	Annual volume of water set aside for use from a water resource.
Conservation category wetland	Wetlands identified in geomorphic wetland mapping (Hill et. al 1996) which are considered to be of high conservation significance.
Consumptive use	Water used for consumptive purposes considered as a private benefit including irrigation, industry, urban and stock and domestic use.
Ecological values	The natural ecological processes occurring within water-dependent ecosystems and the biodiversity of these systems.
Ecological water requirement	The water regime needed to maintain the current ecological values (including assets, functions and processes) of water-dependent ecosystems consistent with the objectives of an ecological water requirements study.
Environmental Protection Policy wetland	Wetlands deemed to be of high conservation value under the <i>Environmental Protection Act 1986 (WA)</i> .
Fit-for-purpose water	Water that is of suitable quality for the intended end purpose. It implies that the quality is not higher than needed.
Groundwater area	The boundaries proclaimed under the <i>Rights in Water and Irrigation Act 1914 (WA)</i> and used for water allocation planning and management.
Groundwater-dependent ecosystem	An ecosystem that is at least partially dependent on groundwater for its existence and health.
Groundwater-dependent social value	An in situ quality, attribute or use associated with a groundwater resource (or dependent on a groundwater resource) that is important for public benefit, welfare, state or health.
Licence (or licensed entitlement)	A formal permit which entitles the licence holder to take water from a watercourse, wetland or underground source under the <i>Rights in Water and Irrigation Act 1914 (WA)</i> .
Marker bed	A stratigraphic unit of distinctive composition and appearance that can be used to correlate geology over a large geographic area.
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.

Ramsar-listed wetland	Wetlands recognised as internationally significant and listed under the Convention on Wetlands of International Importance (Ramsar 1971).
Reference groundwater level	A groundwater level that triggers management actions or responses to be implemented so that the risk of abstraction having an adverse effect on the water resource and dependent values is reduced.
Reliability	The frequency with which a water licence holder can take their full licensed volume.
Seawater or saltwater intrusion	The inland or upgradient intrusion of salt water into a layer of fresh groundwater, from the sea or from the edges of the aquifer.
Saltwater up-coning	The upward movement of saline water caused by excessive pumping, affecting the fresh groundwater resources above.
Subarea	A subdivision, within a surface or groundwater area, defined to better manage water allocation. Subarea boundaries are not proclaimed and can therefore be amended without being gazetted.
Water reserve	An area proclaimed under the <i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i> or <i>Country Areas Water Supply Act 1947</i> to protect and use water for public water supply.

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Notes



RECYCLED CONTENT

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