Government of **Western Australia**
Department of **Water and Environmental Regulation**

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Environmental management of groundwater from the Jandakot Mound

Annual compliance report July 2017 – June 2018

May 2019

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Department of Water and Environmental Regulation
Prime House, 8 Davidson Terrace
Joondalup Western Australia 6027
Locked Bag 10 Joondalup DC WA 6919

Phone: 08 6364 7000
Fax: 08 6364 7001
National Relay Service 13 36 77

dwer.wa.gov.au

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LIB80041

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For more information about this report, contact:

Manager Water Allocation Planning
Water Allocation Planning Branch
Department of Water and Environmental Regulation PO Box K822
Perth Western Australia 6842

Disclaimer

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1 Summary

This report describes the Department of Water and Environmental Regulation's compliance with conditions and commitments for the Jandakot Mound for the period 1 July 2017 to 30 June 2018, under Part IV of the *Environmental Protection Act 1986 – Ministerial statement no. 688: Jandakot Mound groundwater resources* (Government of Western Australia 2005a). The report also outlines the environmental monitoring, management, research and consultation the department is doing to improve sustainable management of the Jandakot groundwater system.

Rainfall at Jandakot Airport station over the reporting period was 894.4 mm, which was above both the long-term (73 year) average of 841.5 mm and short term (10 year) average of 764.7 mm.

In 2017–18 three of the 23 sites were non-compliant with the absolute minimum water level criteria, an improvement of one site compared to 2016–17. Minimum levels at Banganup Lake were compliant for the first time since 2014–15.

Public water supply abstraction from the Superficial aquifer remained at 3.90 GL in 2017–18 and we continued to work with Water Corporation to distribute take in response to groundwater level trends and to move away from non-compliant sites.

Although total private licensed abstraction increased across the Jandakot Mound by 0.8 GL over the reporting period, most of this volume was taken in subareas that do not affect non-compliant sites.

Table 1 Rainfall, licensing totals from the superficial aquifer and compliance with Ministerial criteria

	2016–17	2017–18
Rainfall[1]	739.8 mm	894.4 mm
Public water supply entitlements	3.90 GL	3.90 GL
Private licensed entitlements	37.37 GL	38.17 GL
No. of non-compliant sites[2]	4 out of 23	3 out of 23

1 Rainfall figures are for July–June and taken from Jandakot Airport (BoM station no. 9172).

2 For full details of compliance see Table 4 and Appendix A.

2 Background

2.1 Ministerial statement no. 688

Ministerial statement no. 688: Jandakot Mound groundwater resources (Government of Western Australia 2005a) sets environmental water provisions in the form of water level criteria at 23 groundwater-dependent sites across the Jandakot Mound. These comprise of 10 wetland, nine terrestrial phreatophytic vegetation (bushland) and four rare flora sites across the Jandakot, Perth and Cockburn groundwater areas (Figure 1). Phreatophytic vegetation is vegetation that uses groundwater to meet at least part of its water needs.

The conditions and commitments under Part IV of the *Environmental Protection Act 1986* were first established in 1992 to manage how groundwater is abstracted for public water supply and the expected growth in private licensed use. Since then, the conditions and commitments have been revised to remove sites where environmental values were lost due to causes other than abstraction (see Appendix A). These include reduced rainfall due to climate change, land clearing and disturbance related to changed land use.

The most recent revision in 2005 resulted in removal of 15 sites and amended water level criteria at five sites. The water level criteria at the current sites represent contemporary environmental water provisions suitable for protecting significant environmental values of groundwater-dependent ecosystems on the Jandakot Mound.

Since the merging of the Department of Water, Department of Environment Regulation and the Office of the Environmental Protection Authority in July 2017, the Department of Water and Environmental Regulation has become the proponent of Ministerial Statement no. 688. To ensure there is no possible apprehension of bias, the Director General will not be involved in monitoring compliance with the Statement. The Executive Director, Compliance and Enforcement has been formally delegated to exercise the duties under the Act.

2.2 Allocation limits and licensing

The department uses allocation limits, licensing of groundwater abstraction and monitoring of water levels as the main mechanisms to manage groundwater resources. An allocation limit is the annual volume of water set aside for consumptive use from a water resource. This usually includes:

- water that is available for licensing
- water that is exempt from licensing, including water used by domestic garden bores
- water set aside for future public water supply.

Water for the environment is not included in as part of an allocation limit as it is left in the groundwater system and considered a non-consumptive use. The water level criteria set at high value wetland and bushland sites on the Jandakot groundwater system (see Section 5.1) inform the allocation limits. This ensures that the water left in the system is sufficient to meet environmental needs.

Allocation limits are set considering recharge estimates, modelling, environmental objectives and benefits of groundwater use. The limits guide water availability for individual licence assessments. We also manage the appropriate use of domestic garden bores through sprinkler restrictions and identifying the areas that are unsuitable for the installation of bores.

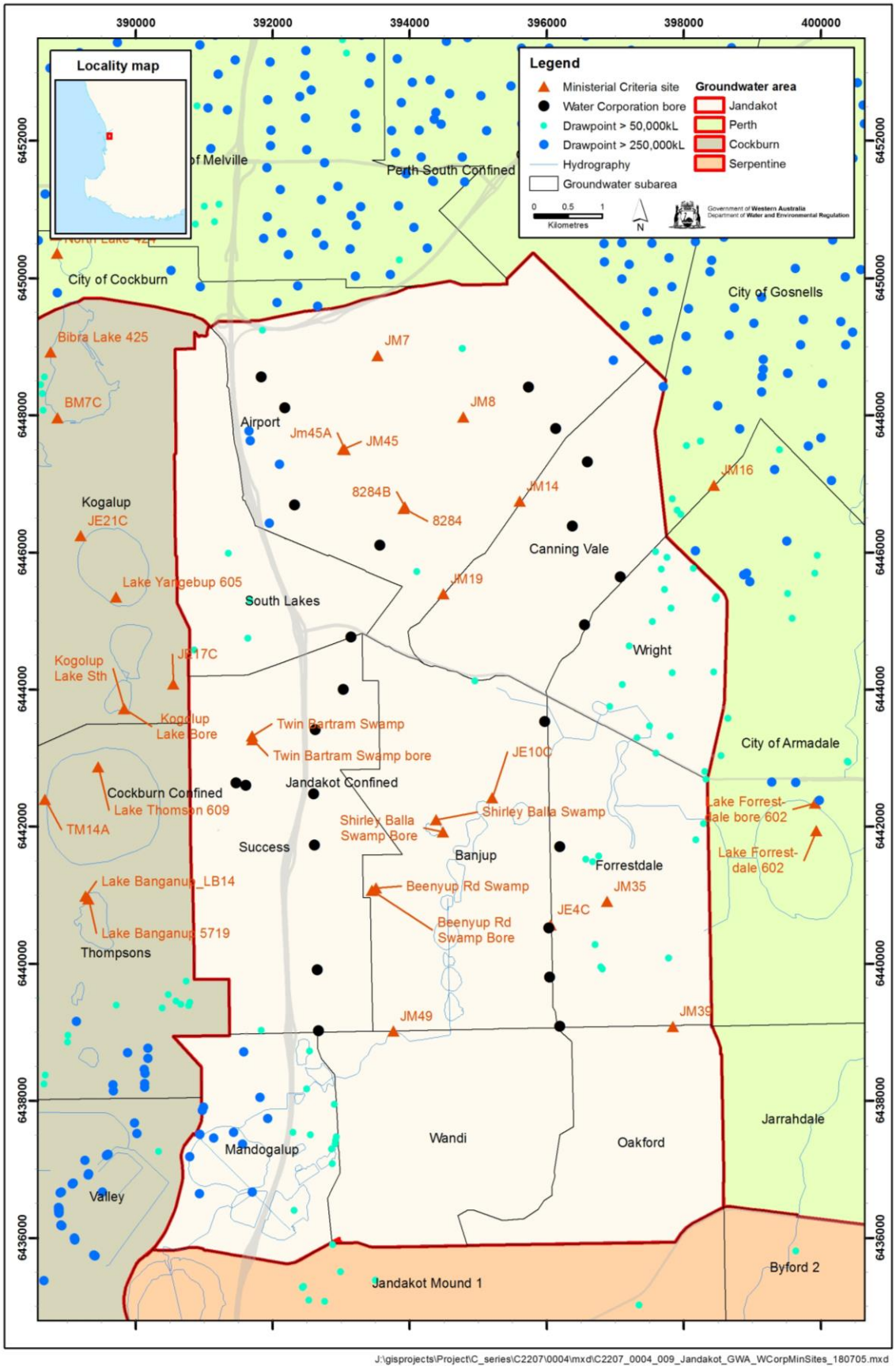

Figure 1 Location of Jandakot Ministerial sites, public water supply production bores (Water Corporation) and private licensed drawpoints

2.3 The Jandakot groundwater system

The Jandakot groundwater system is located south of Perth. It extends from Rockingham in the south to the Swan–Canning River in the north, and from the coast to close to the Darling Scarp in the east. The system comprises three main aquifers:

- the shallow, unconfined Superficial (watertable) aquifer known as the Jandakot Mound
- the deep, partially-confined Leederville aquifer
- the deep, mostly-confined Yarragadee aquifer.

Most of the Jandakot Mound is separated from the deeper Leederville aquifer by a confining layer of Kardinya shale that extends under all of the Ministerial sites except Lake Forrestdale. This separation means that abstraction from the Superficial aquifer has a greater impact on Jandakot Mound wetlands than abstraction from the deep aquifers.

Groundwater levels across the Jandakot Mound have generally declined over the last 40 years, but at a slower rate than seen across the Gnangara Mound, north of the Swan River. In many areas of the Jandakot Mound water levels have improved over the last five years due to:

- annual rainfall being greater than the extreme dry years of 2006 and 2010
- increased recharge rates from clearing and urbanisation
- localised management of abstraction.

3 Rainfall

Groundwater in the Superficial aquifer is recharged by rainfall. How much groundwater levels rise and fall each year is affected by the amount of rainfall that falls in the catchment, but also by how it falls (timing, pattern and intensity). Recharge is also affected by temperature – warmer weather will increase evaporation and allow less rainfall to reach the aquifer.

Across south-west Western Australia climate change has caused a general trend of declining annual rainfall since the mid 1970's (Figure 2). Average temperatures have also risen. CSIRO's investigation of climate change (Bates et al. 2010), as well as other relevant climate models, predict continued rainfall declines in this region. Short term and annual variation can mask the overall trend as shown over the 2017–18 reporting period when rainfall at the Bureau of Meteorology's (BoM) Jandakot Airport station was 894.4 mm. This was above both the long-term (841.5 mm) and the 10 year average (764.7 mm) (Figure 2).

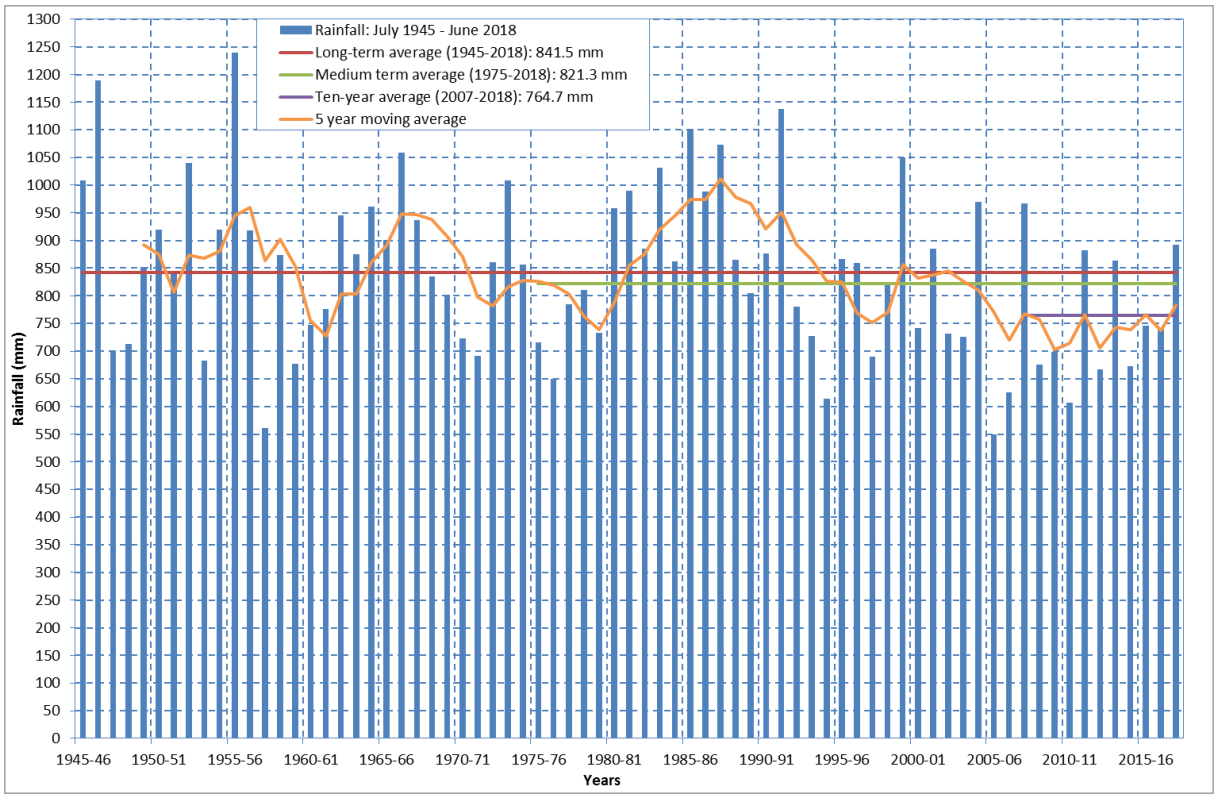

Figure 2 Annual and average water-year (July-June) rainfall at Jandakot Airport (BoM site no. 9172)

4 Groundwater use

The Jandakot groundwater system provides water for public open space, agriculture and industry, contributes to Perth's public water supply and supplies water for domestic garden bores.

This report summarises allocation limits, licensed entitlements and estimates of use exempt from licensing for water management subareas on the Jandakot Mound, where groundwater abstraction impacts sites with criteria set under the *Environmental Protection Act 1986.*

Most of the criteria sites are located in the Jandakot groundwater area with the remainder found in the Cockburn and the Perth South groundwater areas (Figure 1). The hydrogeology of the Jandakot Mound means that sites within the Jandakot groundwater area are those most impacted by abstraction from within that area. Sites located in the Cockburn and the Perth South groundwater areas, to the west and east respectively, are also impacted by abstraction from the Jandakot groundwater area as groundwater flows into them from this area. They are also impacted by local abstraction in the Cockburn and the Perth South groundwater areas.

4.1 Public water supply

The Department of Water and Environmental Regulation licenses the Water Corporation to take groundwater from the Gnangara and Jandakot groundwater systems for Perth's public water supply. Groundwater abstracted from these systems forms an important part of supply to Perth's Integrated Water Supply Scheme (IWSS).

In 2017–18 a total of 17.90 GL was licensed for public supply from all aquifers of the Jandakot system (Table 2).The licensed volume from the Superficial aquifer remained at 3.9 GL. Two years before, in 2015–16, an additional 1.3 GL was licensed from the Superficial aquifer for public water supply as part of a two-year trial to test the system response and determine if the volume could be taken sustainably over a longer term. The trial volume was reduced to 1 GL for 2016–17 in response to the additional non-compliance at Shirley Balla Swamp and Lake Banganup, with bores closest to these sites having been targeted. Following an assessment of impacts of the additional licence volume, the trial has been extended for a further five years at 1 GL per year. We continue to work with Water Corporation to distribute public water supply abstraction, in response to groundwater level trends, and to move abstraction away from non-compliant sites.

The total licensed volume from the deeper aquifers increased by 0.45 GL from 2016–17 to 2017–18. The additional licensed volume was associated with licensing as part of the groundwater replenishment (GWR) scheme. GWR is a form of managed aquifer recharge. GWR occurs at Beenyup wastewater treatment plant where water is treated to drinking water standard and recharged/injected into the Leederville and Yarragadee aquifers. As part of the 14 GL GWR scheme, 0.7 GL was licensed to Leederville and 0.3 GL to Yarragadee bores in the Jandakot groundwater area. The

distribution of GWR licensing considers IWSS operating constraints while aiming to limit overall impacts to groundwater-dependent ecosystems supported by the Gnangara and Jandakot systems.

Licensed entitlements for public water supply from the Superficial aquifer are further broken down into groundwater subareas in Table 3 (Section 4.3).

Table 2 Public water supply entitlements from all aquifers of the Jandakot groundwater system

Aquifer	Public water supply entitlements (GL)		
	2016–17[2]	2017–18	
		Licensed volume	GWR licensed volume
Superficial	3.90	3.90	-
Leederville	6.90	6.60	0.70
Yarragadee[1]	6.95	6.70	0.30
TOTAL	**17.75**	**16.30**	**1.00**

1 Includes groundwater licensed from the new Yarragadee bore in the Jandakot groundwater area (6 GL in 2016–17 and 5.85 GL in 2017–18) and volumes licensed to bore MR17 in the Perth South groundwater area (0.95 GL in 2016–17 and 1.15 GL in 2017–18).

2 No water was licensed against GWR in 2016–17 due to the upgrading of Beenyup Treatment Plant.

4.2 Private licensed use

Groundwater licensed for private use from the Jandakot system mostly comes from the Superficial aquifer and is mainly for irrigation of parks, public open spaces, agriculture, industry and commercial uses.

Over the reporting period, private licensed entitlements from the Superficial aquifer increased by 0.8 GL (Table 3) in the Jandakot and Perth subareas.

Table 3 shows private licensed entitlements for the groundwater subareas related to the Jandakot Ministerial sites.

4.3 Use that is exempt from licensing

In reviewing allocation limits, we estimate and account for groundwater that is exempt from licensing. This volume is estimated using:

- water use surveys
- local government plans and land zoning to estimate the number of properties likely to have domestic bores
- information on the subdivision potential of the properties (current and future) to gauge likely future numbers of garden bores
- water use and future requirements of Commonwealth government agencies such as the defence forces, which are exempt from licensing.

Our current estimate for stock and domestic use on semi-rural and rural blocks in the Jandakot groundwater area is 2.39 GL/year. The exempt stock and domestic garden bores use in the area is around 10 per cent of the total estimated 24 GL/year used across the whole of the Jandakot Mound.

Table 3 Licensed entitlements for public water supply and private use from the Superficial aquifer in the subareas that impact on Ministerial sites

Groundwater area	Subarea	Ministerial criteria site present?	Allocation limit GL/year	Public water supply entitlements[4] GL		Private licensed entitlements[5] GL	
				2016–17	2017–18	2016–17	2017–18
Jandakot[1]	Airport	Yes	2.64	1.26	1.26	0.99	0.99
	Banjup	Yes	2.00	0.30	0.30	0.41	0.46
	Canning Vale	No	1.10	0.89	0.89	0.07	0.07
	Forrestdale	Yes	1.30	0.15	0.15	0.87	0.97
	Mandogalup	No	2.05			1.85	1.87
	Oakford	Yes	0.55			0.08	0.08
	South Lakes	No	0.82			0.53	0.53
	Success	Yes	3.91	1.30	1.30	1.02	1.08
	Wandi	No	0.88			0.31	0.31
	Wright	No	0.96			0.89	0.99
Total for Jandakot groundwater area			**16.21**	**3.90**	**3.90**	**7.03**	**7.34**
Perth[2]	City of Armadale	Yes	4.00			3.93	4.34
	City of Canning	No	3.50			2.58	2.75
	City of Cockburn	Yes	1.00			0.54	0.54
	City of Gosnells	No	5.50			3.32	3.43
	City of Melville	No	5.50			4.07	4.28
Total for Perth South groundwater area			**19.50**	**0.00**	**0.00**	**14.44**	**15.34**
Cockburn[3]	Kogalup	Yes	9.00			9.84	9.88
	Thompsons	Yes	4.50			6.06	5.62
Total for Cockburn groundwater area			**13.50**	**0.00**	**0.00**	**15.90**	**15.50**
Total for Jandakot subareas that affect Ministerial criteria sites			**47.93**	**3.90**	**3.90**	**37.37**	**38.17**

1 Allocation limits for the Jandakot groundwater area were updated in October 2014.

2 Allocation limits for subareas in the Perth South groundwater area, to the south of the Swan River, were reviewed in 2007.

3 The new Cockburn groundwater allocation plan is being finalised following a 3-month public comment period in ending in September 2018. The allocation limits for the Cockburn groundwater area represent the new allocation limits in the plan.

4 Public water supply information is from both the department's Water Resources Licensing System (2016–17) and COMPASS (2017–18) as well as and annual reports submitted to the department as a condition of the Water Corporation's licences. The figures shown are what was allocated to Water Corporation for public water supply as at 30 June 2018.

5 2016–17: allocation reports are normally captured at 30 June, however, as a result of upgrades to the licensing and reporting, allocation statuses were captured at 1 June 2017). The 2017–18 report was run on 1 July 2018 using COMPASS.

Also note:

- Up-to-date figures on water availability are available from the department's Swan–Avon or Kwinana Peel regional offices.
- Figures are rounded to two decimal places.
- 1 GL = 1 000 000 kL.

5 Compliance

The conditions and commitments that the Department of Water and Environmental Regulation is required to comply with from *Ministerial statement no. 688: Jandakot Mound groundwater resources* (Government of Western Australia 2005a) are shown in Appendices A and B (the 'audit tables').

5.1 Compliance with water level criteria

Ministerial statement no. 688 sets water level criteria at 23 sites across the Jandakot Mound (Figure 1). There are 10 wetland sites, nine terrestrial (phreatophytic) vegetation monitoring sites, and four rare flora sites. Some criteria sites have more than one water level criterion and can be non-compliant with multiple criteria. Water level criteria include:

- absolute minimum levels – these are used as the main indicator for compliance from year to year
- levels allowed to fall between a preferred minimum and the absolute minimum in two out of six years to replicate natural drying cycles – these are referred to as 'other' water level criteria in this report and provide information on water level trends
- rate of decline and time of drying – these are also referred to as 'other' water level criteria in this report.

In 2017–18 three of the 23 sites were non-compliant with absolute minimum water level criteria (Table 4), one less than the previous year. Minimum levels at Banganup Lake were compliant for the first time since 2014–15. Three sites were non-compliant with 'other' criteria across the reporting period (Table 4).

The management and mitigation actions we implement in response to non-compliance are described in Section 6. Details for individual sites can be found in Appendix A.

Table 4 Summary of Jandakot Mound sites non-compliant with Ministerial criteria

Absolute minimum water level criteria			Other water level criterion		
Wetlands	**Terrestrial vegetation and rare flora**	**Total non-compliant**	**Wetlands**	**Terrestrial vegetation and rare flora**	**Total non-compliant**
2016–17					
North Lake Bibra Lake Banganup Lake Shirley Balla Swamp	None	4 out of 23	North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	4 out of 12
2017–18					
North Lake Bibra Lake Shirley Balla Swamp	None	3 out of 23	Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	3 out of 12

6 Environmental monitoring, management, research and consultation

6.1 Environmental monitoring

Expert environmental consultants undertake environmental monitoring for the department in line with the commitments in *Ministerial statement no. 688: Jandakot Mound groundwater resources* (Government of Western Australia 2005a).

The department reviewed the environmental monitoring program in 2009 and 2013 (see Appendix D) to improve cost effectiveness and efficiency. Over the reporting period the program included monitoring of:

- wetland vegetation
- wetland macroinvertebrates
- wetland water quality.

Ecological condition of groundwater-dependent ecosystems is affected by a range of factors, of which the water regime is just one. Other factors include fire, insect attack, clearing, weed invasion, pollution and disturbance. Similarly, groundwater abstraction is just one of the factors that can affect the water regime of an ecosystem. Others include changes in rainfall patterns, fire, and other land use changes including urbanisation. We use the results of environmental monitoring to continually improve our understanding of the relationship between water levels and ecological condition. The information is also used to manage abstraction at priority locations, reducing abstraction where it is likely to improve ecological condition.

Wetland vegetation

Over the reporting period the condition of wetland vegetation was monitored in spring at Banganup Lake, North Lake, Bibra Lake, Beenyup Road Swamp, Shirley Balla Swamp and Lake Forrestdale by Buller et al. (2018). Minor improvements in mean canopy condition from 2016 were recorded at most sites, including the non-compliant North Lake and Shirley Balla Swamp sites. These improvements coincided with slightly higher groundwater levels at most sites. At the third non-compliant site, Bibra Lake which was last surveyed in 2014, there was a slight decrease in mean canopy condition despite a minor increase in groundwater levels.

Banganup Lake remains at potential risk of a threshold response in ecohydrological state, despite slightly increased groundwater levels which resulted in the site's compliance during the reporting period. The native sedge, *Baumea articulata*, which was present in moderate to high abundance prior to 2008, has declined rapidly since and was absent from the transect for the first time in 2017.

Spread of exotic species continues to be a significant driver of floristic change at Jandakot wetlands with all sites monitored in 2017 recording moderate to large increases in exotic cover-abundance since baseline monitoring.

Wetland macroinvertebrates and water quality

Over the reporting period macroinvertebrates and water quality were monitored in spring at Bibra Lake, Forrestdale Lake, Thomsons Lake and Kogalup South Lake (water quality only) by Bennelongia Environmental Consultants (2018). Monitoring was planned at Shirley Balla Swamp, but the wetland dried before it could be sampled.

The water quality monitoring found that:

- oxygenation improved at Bibra Lake but nutrient concentrations (total nitrogen and total phosphorus) remained high
- conditions were similar to previous years at Lake Forrestdale except reduced total phosphorus and a spike in conductivity that was likely due to drying of the lake before sampling
- pH at Thomsons Lake returned to a normal level for the lake (8.29) after the slightly acidic conditions recorded in 2016 and total phosphorus concentrations reduced significantly
- all tested parameters at Kogalup Lake South were within ranges from previous sampling.

The monitoring found that conditions at Forrestdale, Thomsons and Bibra lakes are able to support healthy macroinvertebrate assemblages, with species richness remaining relatively constant at Lake Forrestdale and Thomsons Lake and increasing at Bibra Lake.

6.2 Management actions

New Cockburn groundwater area water management plan

The department is developing a new Cockburn groundwater allocation plan which will be finalised in 2019. The plan was released for a three month public comment period in May 2018. A key objective of the updated plan is to meet Ministerial criteria at Bibra Lake, Lake Yangebup, Kogalup Lake, Thomsons Lake and Lake Banganup under projected climate change to 2030.

As part of this water allocation planning process we reduced the allocation limits in the Superficial aquifer in January 2017. Allocation limits in the Kogalup and Thompsons subareas were reduced from 11.46 GL to 9 GL and 8.7 GL to 4.5 GL respectively. As licensed entitlements in these subareas exceed the revised allocation limits, recoup and retirement of long-term unused entitlements has been triggered. In line with this strategy, licensed entitlements were reduced by 0.4 GL in Thompsons subarea over the reporting period. This strategy is outlined in the plan and we are working with all affected stakeholders on its implementation.

The Cockburn plan aligns with, and will support any future implementation of, the Western Trade Coast Heavy Industry Water Supply Strategy (DoW 2016a). The supply strategy outlines the cost and benefit of all water supply options for industrial growth in the area. These options include managed aquifer recharge, non-potable scheme supply such as wastewater reuse, and more efficient use of existing groundwater abstraction across the plan area.

Managing public water supply

Before the start of each new water year, we work with Water Corporation to optimise the distribution of abstraction for the Integrated Water Supply Scheme by considering groundwater level trends. This work uses a bore sensitivity classification system and aims to move abstraction away from more sensitive bores, such as those closer to non-compliant Ministerial sites.

Managing private licensed use

Private licensed use is monitored through on-ground compliance inspections, meter audits, water use surveys and the licence renewal process. Through this work we check that groundwater use is within licence entitlements and that site activities are authorised.

The department has prioritised its licence compliance and enforcement activities to consider the conditions and commitments in *Ministerial statement no. 688*. This included expanding the scope of our licensing compliance plan to focus on areas potentially affecting Ministerial sites.

We also manage the use of groundwater by private licensees in other ways. This includes working with local governments, urban developers and other licensees that

use large volumes, to improve water use efficiency, reduce demand for groundwater, assess water needs for future public open space and assess water supply options.

The Rights in Water and Irrigation Amendment Regulations, which came in to effect in 2018, outline a staggered program to have meters fitted to all bores with a licenced entitlement greater than 10 000 kL by the end of 2020. Licence holders will be required to adhere to their licence conditions and provide metered information to the department.

Managing groundwater use exempt from licensing

Domestic garden bores are generally supported (where suitable and used efficiently) because they reduce demand on scheme water with minimal local impact. To help manage this abstraction, we provide a garden bore use guideline that emphasises water conservation and efficiency. Further information on garden bore suitability can be found on the Perth Groundwater Map on the department's website.

Garden bores are not encouraged in areas where there is a risk of acid sulfate soils, poor water quality or low yields. These areas are identified as unsuitable in the bore suitability map.

To help preserve water resources and encourage water use efficiency by the community, restrictions on the use of garden bores were initiated in 2007 under the *Rights in Water and Irrigation Act Exemption (Section 26C) Order 2007*. In 2010 the total winter sprinkler ban also came into effect under the *Water Agencies (Water Use) By-laws 2010*. These by-laws restrict the use of domestic garden bores to a roster of three days a week, with a total ban during winter.

The annual winter sprinkler ban is now in its eighth year and has become an accepted part of the community's water use calendar.

6.3 Research initiatives

The department continues to undertake research to better understand and manage water resources on the Jandakot Mound. Prior to the reporting period, this has included updating the Perth Regional Aquifer Modelling System, developing a tool that generates local climate projections for planning, and completing the Perth Regional Confined Aquifer Capacity Project. This has given us a much better understanding of the Leederville and Yarragadee aquifers.

Lake Forrestdale

Over the reporting period Urbaqua consulting partnered with state government (including the Department of Water and Environmental Regulation), local government (City of Armadale), the Water Corporation, and other community stakeholders (Perth NRM, Friends of Forrestdale) to identify and prioritise options to increase water levels in Lake Forrestdale with the objective of restoring its Ramsar values.

A number of options were analysed, modelled and discussed with stakeholders over two sets of workshops run by Urbaqua in April and September 2017. The study's findings:

- identified a strong correlation between lake levels and local Superficial aquifer levels
- recommended the peak water level criteria be revised to consider the lake's current hydrological status and values
- recognised stormwater drainage design with reduced on-site retention requirements in the proposed new industrial area to the southeast of Forrestdale Lake could contribute to the lake's water balance.

6.4 Consultation

We regularly engage with the community through public seminars, conferences, workshops and community meetings, and present annually to the Jandakot Community Consultative Committee (JCCC) as per its commitment in *Ministerial statement no. 688: Jandakot Mound groundwater resources*. In this reporting period we met with the JCCC on 12 October 2017.

We provide advice to local and state government agencies to ensure that water availability and supply options for irrigation of public open space, or for development proposals are considered as early as possible in the planning phase, and environmental and resource restrictions are properly taken into account.

Through the framework described in *Better urban water management* (WAPC 2008), we also provide advice to local governments and land development agencies on water management in urban areas to minimise the effects of drainage and stormwater on shallow groundwater in the Jandakot area. The framework sets out how water resources should be considered at each planning stage by identifying the

various actions and investigations required to support decisions at each level of planning.

Appendices

Appendix A — Water level monitoring results for Ministerial sites on the Jandakot Mound for 2007–2018

Bold text refers to compliance with water level criteria and other criteria. **Black bold text** indicates sites compliant with water level and other criteria. **Red bold text** indicates sites non-compliant with water level criteria. **Blue bold text** indicates sites non-compliant with other criteria.

Table A1 Wetland sites

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)											Comments on compliance during the 2017–18 reporting period
		Preferred	Absolute			2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	
North Lake	Staff 424 6142521	13.29	12.68	<0.1 m decline per year	Max	13.07	13.22	12.93	12.68	12.93	12.71	13.01	13.11	12.79	12.95	13.03	Compliance and trends: **Non-compliant with absolute minimum criterion.** The lake has been non-compliant with the absolute minimum criteria since 2006–07. **Compliant with other criterion.** Minimum levels increased by 0.15 m from 2016–17 to 2017–18. Ecological condition: Long-term monitoring has shown declines in canopy condition, changes in species composition to more terrestrial species, increases in abundance of exotic species and insect damage. Management and mitigation: A shallow groundwater investigation finalised in 2014–15 improved our understanding of the lake's hydrogeology in relation to its ecological health. In 2014–15, the department updated the allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological heath at the lake. The lower allocation limits reduce the risk of future increases in abstraction impacting on lake levels.
					Min	**12.38**	**12.38**	**12.38**	**12.38**	**12.27**	**12.30**	**12.30**	**12.30**	**12.00**	**12.30**	**12.30**	
	Bore 61410726				Min	**11.81**	**11.74**	**11.59**	**11.48**	**11.60**	**11.45**	**11.52**	**11.61**	**11.87**	**11.66**	**11.81**	
Bibra Lake	Staff 6142520	13.6–14.2 <15.0 peak	13.6	Dry no more than 2 in 3 years, and preferably less than 1 in 3 years	Max	14.3	14.3	14.2	13.7	14.0	13.9	14.3	14.3	14.0	14.1	14.3	Compliance and trends: **Non-compliant with absolute minimum criterion.** **Non-compliant with other criterion.** The lake has been non-compliant with the absolute minimum criterion and has dried every summer since 2006–07. Ecological condition: Long-term monitoring has shown declines in canopy condition, changes in species composition to more terrestrial species and increases in abundance of exotic species. Management and mitigation: In 2014–15, the department updated the allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological heath at the lake. The revised allocation limits reduce the risk of future increases in abstraction impacting on lake levels.
					Min	**13.5 dry 19/03**	**13.5 dry 12/03**	**13.5 dry 19/02**	**13.5 dry 07/12**	**13.5 dry 01/02**	**13.5 dry 05/03**	**13.5 dry 01/04**	**13.5 dry 04/05**	**13.5 dry 01/03**	**13.5 dry 03/04**	**13.5 dry 04/04**	
	Bore BM7C 61410177	<15.0 peak			Min									**13.0**	**13.2**	**13.2**	
Kogalup Lake (South)	Staff 6142522	13.1–14.0 <14.8 peak	13.1	N/A	Max			15.2	14.5	14.8	14.6	15.1	15.2	14.6	14.9	15.1	Compliance: **Compliant with absolute minimum criterion.** Groundwater levels in 2014–15 were the highest recorded since 2009–10 and levels remained relatively stable over the reporting period.
					Min			14.0	14.0	14.0	13.8	14.1	14.4	13.8	13.9	14.1	
	Bore 6015 61410727				Max	14.5	14.9	14.5	14.5	14.8	14.6	15.1	15.2	14.6	14.7	15.0	
					Min	13.6	13.8	14.0	13.6	13.9	13.6	14.0	14.0	13.6	13.8	14.0	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria		Water level (mAHD)											Comments on compliance during the 2017–18 reporting period
		Preferred	Absolute			2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	
Thomsons Lake	Staff 609 6142517	11.3–11.8	10.8	For 30% of time water levels > 11.8 mAHD (wet year – 10 %) 11.3-11.8 mAHD (medium year – 80 %) 10.8-11.3 mAHD (dry year – 10 %)	Max	12.4	12.7	12.7	12.1	12.3	12.2	12.5	12.4	12.2	12.6	12.6	Compliance and trends: **Compliant with absolute minimum and other criteria.** 2017–18 was classed as a “medium year” with 894.4 mm of rainfall received at Jandakot Airport (BoM station no. 9172) and 765.6 mm at Perth Airport (BoM station no. 9021). Levels were above 11.3-11.8 mAHD set for “medium years”. The lake dries at 11.5 mAHD. Absolute minimum water levels are measured at the bore. Additional information: As part of the Jandakot Drainage Scheme, the Water Corporation monitors water levels at this site. The Department of Biodiversity, Conservation and Attractions (formerly the Department of Parks and Wildlife) implements a supplementation and sampling analysis plan that it developed in 2004–05.
					Min	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	11.5 dry	
	Bore TM14A 61410367				Max	12.0	12.2	12.2	11.8	12.1	11.8	12.1	12.1	11.8	12.0	12.2	
					Min	11.3	11.2	11.3	11.0	11.2	11.4	11.2	11.2	11.1	11.3	11.4	
Lake Forrestdale	Staff 6162557	21.2–21.6	21.1	Preferred earliest drying by April (wet year), February to March (medium year) or January (dry year) Lake levels must be at least 0.9 m deep (22.6 mAHD)	Max	**21.9**	**22.1**	**22.0**	**21.7**	**21.9**	**21.7**	**22.0**	**21.9**	**21.8**	**22.0**	**22.0**	Compliance and trends: **Compliant with absolute minimum criterion.** 2016–17 is the first time the site has been compliant since 2010–11. **Non-compliant with other criterion.** The lake did not achieve a minimum depth of 0.9 m (22.6 mAHD) over the compliance period. 2017–18 was classed as a “medium year” with 894.4 mm of rainfall received at Jandakot Airport (BoM station no. 9172) and 765.6 mm at Perth Airport (BoM station no. 9021). The lake dried before the “medium year” preferred months of February-March). Ecological condition: Long-term monitoring has shown declines in canopy condition, changes in species composition to more terrestrial species and increases in abundance of exotic species. Management and mitigation: In 2014–15, the department updated the allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological heath at the lake.
					Min	**dry 05/12**	dry 13/01	**dry 09/12**	**dry 07/12**	dry 11/01	dry 04/02	dry 04/01	dry 13/01	dry 11/01	dry 21/02	**dry 04/12**	
	Bore 602 61410714				Max	23.2	23.2	23.2	23.0	23.2	22.9	23.2	23.1	23.0	23.1	23.1	
					Min	21.2	**21.0**	21.2	**20.6**	**21.0**	**20.9**	**20.8**	**20.8**	**20.6**	21.4	21.1	
Yangebup Lake	Staff 605 6142523	13.9–15.5 <16.5 peak	13.8	Either Bibra or Yangebup Lake must contain 0.3 m water, preferably 0.5 m	Max	16.0	16.6	16.6	15.9	15.9	15.9	17.1	16.9	16.4	16.8	16.4	Compliance: **Compliant with absolute minimum and other criteria.** Additional information: As part of the Jandakot Drainage Scheme, the Water Corporation monitors water levels at the site and lowers water levels if the peak is exceeded.
					Min	15.0	15.6	15.4	14.5	15.1	15.2	15.6	15.5	14.9	15.2	15.3	
	Bore JE21C 61419707				Max	15.9	15.9	16.1	15.3	15.3	15.3	16.2	16.2	15.8	16.0	15.8	
					Min	14.8	15.1	15.0	14.1	14.6	14.6	15.0	15.0	14.9	15.1	15.4	
Banganup Lake	Staff 5719 6142516	N/A	11.5	N/A	Max	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.6	Compliance and trends: **Compliant with absolute minimum criterion** 2017–18 was the first year groundwater levels at the lake have been compliant with the absolute minimum criteria since 2014–15.
					Min	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.6	
	Bore LB14 61419614				Max	12.6	12.6	12.5	12.0	12.3	12.1	12.4	12.2	12.3	12.3	12.4	
					Min	11.7	11.5	11.6	**11.2**	**11.4**	**11.4**	**11.4**	11.6	**11.3**	**11.4**	11.5	
Twin Bartram Swamp	Staff JE7C 6142544	22.8	22.5	No drying before end of January. Must be above preferred minimum 4 in every 6 years.	Max	23.8	24.4	24.4	23.7	23.8	24.3	24.7	24.6	24.3	24.4	24.6	Compliance and trends: **Compliant with absolute minimum and other criteria.** In 2014–15, the peak surface water level was the second highest on record and the minimum level was the highest recorded since 2009–10. Levels remained relatively stable over the reporting period.
					Min	23.0 **dry 09/01**	23.5	23.2	23.0 **dry 04/01**	23.1	23.2	23.4	23.5	23.3	23.7	23.8	
	Bore JE6C 61410715				Max	24.4	24.5	24.5	23.8	23.9	24.3	24.7	24.6	24.3	24.4	24.6	
					Min	23.1	23.5	23.4	22.7	23.1	23.3	23.4	23.6	23.3	23.7	23.9	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)											Comments on compliance during the 2017–18 reporting period
		Preferred	Absolute			2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	
Shirley Balla Swamp	Staff 6142576	N/A	23.1 mAHD or 0.5 m below lake base, whichever is higher 24.5	No drying before end of January. Must be above preferred minimum 4 in every 6 years. Water levels should not decline at rate greater than 0.1 m/year. Monitor staff gauge.	Max	25.0	25.0	25.0	25.1	25.1	25.0	25.2	25.5	25.3	25.2	25.2	Compliance and trends: **Non-compliant with absolute minimum criterion.** Although minimum levels were slightly improved over 2016–17, they were still 0.2m below the absolute minimum. **Non-compliant with other criterion.** The wetland dries every year. Ecological condition: Long-term monitoring has shown declines in canopy condition, changes in species composition to more terrestrial species and increases in abundance of exotic species. Management and mitigation: In 2014–15, the department updated the allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological heath at the lake. The revised allocation limits reduce the risk of future increases in abstraction impacting on lake levels. Additional information: A preferred minimum has not been established so the 4 in 6 year criteria cannot be applied. Further review of criteria is required.
					Min	**dry**	**dry**	**dry**	**dry 01/09**	**dry 01/12**	**dry 05/11**	**dry 02/12**	**dry 02/02**	**dry 01/12**	**dry 01/12**	**dry 04/12**	
	Bore 61410713				Max	25.0	25.4	25.3	24.6	24.6	25.1	25.3	25.6	25.4	25.2	25.2	
					Min	**24.3**	**24.2**	**24.2**	**23.8**	**24.3**	**24.1**	**24.4**	24.7	**24.2**	**24.2**	**24.3**	
Beenyup Road Swamp	Staff 6142547	24.0	23.6	Bore must be above preferred minimum 4 in every 6 years.	Max	24.7	25.1	25.1	24.7	25.1	25.1	25.3	25.3	24.9	25.1	25.3	Compliance: **Compliant with absolute minimum and other criteria.**
					Min	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	24.6 dry	
	Bore 61410711				Max	24.9	25.1	25.2	24.7	25.2	25.1	25.4	25.3	24.9	25.2	25.3	
					Min	24.1	24.2	24.2	23.9	24.3	24.3	24.4	24.4	24.1	24.5	24.6	

Table A2 Phreatophytic vegetation or rare flora sites

Monitoring bore	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)												Comments on compliance during the 2017–18 reporting period
		Preferred	Absolute			2007–08	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–16	2016–17	2017–18	
JM14	61610247	24.39	23.89		Max	25.08	25.65	25.64	25.08	25.30	25.16	25.67	25.91	25.26	25.58	25.67	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.39	24.63	24.64	**23.82**	24.59	24.34	24.61	24.78	24.35	24.68	24.75	
JM16	61610445	23.90	23.40		Max	25.19	25.51	25.50	24.95	25.27	24.94	25.53	25.56	25.13	25.30	25.51	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.30	24.26	24.38	23.98	24.31	24.17	24.31	24.39	24.19	24.49	24.57	
JM19	61610177	25.26	24.76		Max	25.68	26.51	26.27	25.59	25.90	25.65	26.06	26.18	25.72	26.41	26.82	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.90	25.16	25.26	**24.29**	25.12	24.86	24.90	25.26	24.84	25.28	25.90	
JM35	61610333	21.25	20.75		Max	25.64	25.95	25.82	24.33	25.68	25.44	25.76	26.06	25.02	23.39	24.13	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.63	23.60	23.11	21.22	21.74	23.42	24.08	21.76	20.91	21.45	21.86	
JM39	61410142	21.20	20.70		Max	23.12	23.87	24.27	22.66	23.86	23.46	23.80	23.71	22.46	22.76	23.56	Compliance: **Compliant with absolute minimum criterion.**
					Min	21.56	21.56	21.62	21.16	21.86	21.88	21.52	21.37	20.76	21.08	21.59	
JM49	61410111	22.34	21.84		Max	23.76	23.80	23.81	23.49	23.86	23.73	23.89	23.98	23.67	23.86	24.02	Compliance: **Compliant with absolute minimum criterion.**
					Min	23.15	23.12	23.19	22.75	23.25	22.98	23.04	23.01	22.93	23.08	23.19	
8284 8284B	61610178/ 61611864	24.82	24.32		Max	25.80	25.80	25.70	25.35	25.62	25.38	25.79	25.99	25.68	25.78	26.16	Compliance: **Compliant with absolute minimum criterion.** Additional information: 8284 has been decommissioned due to the bore collapsing while it was being airlifted. The department is now using 8284B (AWRC ref. 61611864), located adjacent to 8284, to measure water level criteria.
					Min	25.00	25.00	25.00	25.00	25.03	25.00	25.07	25.29	24.99	25.11	25.38	
JE4C	61610234	24.00	23.50		Max	25.18	25.85	25.70	24.83	25.63	23.85	25.81	25.95	25.45	25.72	26.07	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.41	24.49	24.43	24.00	24.78	23.30	24.59	24.71	24.43	24.79	25.06	
JE10C	61410250	21.80	21.30		Max	25.39	25.79	25.98	24.86	25.28	25.06	25.72	25.98	26.04	25.48	25.96	Compliance: **Compliant with absolute minimum criterion.**
					Min	23.70	23.46	23.25	22.46	23.81	23.26	23.31	23.94	23.01	23.62	23.98	
JM7	61610180		22.06	< 0.1 m decline per year	Max	23.38	23.86	23.84	23.27	23.84	23.85	24.48	24.61	24.35	24.41	24.74	Compliance: **Compliant with absolute minimum criterion.**
					Min	22.82	22.90	22.97	22.30	23.13	23.06	23.59	23.77	23.56	23.81	24.00	
JM8	61610248		23.38	< 0.1 m decline per year	Max	24.57	25.00	25.12	24.49	24.88	24.66	25.29	25.58				Unavailable. Monitoring of water levels stopped in September 2014 due to access issues so the department is unable to determine compliance with absolute summer minimum water level criteria.
					Min	24.02	24.09	24.19	23.67	24.15	23.96	24.42					
JM45 JM45A	61610179/ 61618756		22.71	< 0.1 m decline per year	Max	23.57	24.12	24.12	23.62	23.91	23.85	24.45	24.76	24.39	24.59	24.85	Compliance: **Compliant with absolute minimum criterion.** Additional information: JM45 has been decommissioned due to urban development in the area. The department now uses JM45A (AWRC ref. 61618756) to measure water level criteria.
					Min	23.17	23.38	23.38	22.71	23.45	23.30	23.72	23.97	23.69	23.82	24.09	
JE17C	61419703		16.35	< 0.1 m decline per year	Max	18.12	18.15	18.13	18.06	18.05	18.06	18.16	18.27	18.13	18.18	18.18	Compliance: **Compliant with absolute minimum criterion.**
					Min	17.46	17.53	17.68	16.97	17.48	17.36	17.55	17.39	17.45	17.76	17.76	

Appendix B — Audit tables: Environmental conditions, procedures and commitments for the Jandakot Mound

Proponent: Department of Water and Environmental Regulation

Period: 1 July 2017 to 30 June 2018

Note: *Ministerial statement no. 688* refers to the Department of Water and Environmental Regulation's (formerly Water and Rivers Commission and Department of Water) responsibilities to the EPA. In some cases, although referred to below as EPA, some responsibilities now lie with DBCA.

Table B1 Ministerial conditions and procedures

Audit code	Subject	Action	How	Evidence	Require-ment of:	On advice from	Phase	When/Where	Status for 2017–18
688: M 1-1	Implementation	The proponent shall implement the proposals as documented in *Section 46 Review of Environmental Conditions on Management of the Gnangara and Jandakot Mounds – Stage 1 Proposal for Changes to Conditions* (August 2004), as modified and documented in *Environmental Protection Authority Bulletin 1155*.	Implement proposals (conditions, procedures) given in EPA Bulletin 1155 and *Ministerial statement no. 688*.	Compliance report.	Minister for the Environment		Overall		**Partly compliant.** Compliant with most Ministerial conditions – refer to the status column of this table.
688: M 2-1	Proponent commitments	The proponent shall implement the environmental management commitments, as revised in December 2004, and documented in schedule 1 of *Ministerial statement 688*, to the requirements of the Minister for the Environment on advice of the EPA.	Implement environmental management commitments given in EPA Bulletin 1155 and *Ministerial statement no. 688*.	Compliance report	Minister for the Environment	EPA	Overall		**Partly compliant.** Compliant with most proponent commitments – refer to the status column of this Appendix.
688: M 3-1	Proponent nomination & contact details	The proponent nominated by the Minister for the Environment under section 38 (6) or (7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal, until such time as the Minister for the Environment has exercised the Minister's power under section 38 (7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.	Adhere to conditions, procedures and commitments given in EPA Bulletin 1155 and *Ministerial statement no. 688*.	Letter notifying the Chief Executive Officer of any change in proponent details.	Minister for the Environment	EPA	Overall		**Compliant.** The Department of Water and Environmental Regulation was established by the Government of Western Australia on 1 July 2017. It is a result of the amalgamation of the Department of Environment Regulation, Department of Water and the Office of the Environmental Protection Authority.
688: M 3-2	Proponent nomination & contact details	If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.	Follow procedure given in 'action'.	Letter notifying the Chief Executive Officer of any change in proponent details.	Minister for the Environment		Overall		**Compliant.** The Department of Water and Environmental Regulation was established by the Government of Western Australia on 1 July 2017. It is a result of the amalgamation of the Department of Environment Regulation, Department of Water and the Office of the Environmental Protection Authority.
688: M 3-3	Proponent nomination & contact details	The nominated proponent shall notify the EPA of any change of contact name and address within 60 days of such change.	Follow procedure given in 'action'.	Letter notifying the Chief Executive Officer of the EPA of any change in proponent details.	CEO of DWER or their delegate		Overall	60 days of change	**Partly compliant.** The Department of Water and Environmental Regulation was established by the Government of Western Australia on 1 July 2017. It is a result of the amalgamation of the Department of Environment Regulation, Department of Water and the Office of the Environmental Protection Authority.

Audit code	Subject	Action	How	Evidence	Require-ment of:	On advice from	Phase	When/Where	Status for 2017–18
688: M 4-1	Commencement and time limit of approval	The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposals have been substantially commenced or the approvals granted in the statements of 8 March 1988 and 17 February 1999 shall lapse and be void.	Provide evidence in annual/triennial reports.	Compliance report.			Overall	Condition complete	**Complaint/Completed** The 'status of implementation of the proposals' is 'completed' because Jandakot scheme stages 1 and 2 are fully commissioned.
688: M 5-1 1	Compliance audit and performance review	The proponent shall prepare an audit program and submit compliance reports to the EPA which address: 1. the status of implementation of the proposals	Detail in annual/triennial reports. Compliance report will include: 1. the status of implementation of the proposals	Compliance report.	CEO		Overall	Condition complete	**Compliant/Completed.** An audit program (see 688: P 14) was submitted to the EPA on 25 November 2005. The 'status of implementation of the proposals' is 'completed' as Jandakot scheme stage 1 and 2 are fully commissioned.
688: M 5-1 2	Compliance audit and performance review	The proponent shall prepare an audit program and submit compliance reports to the EPA which address: 2. evidence of compliance with the conditions and commitments	Detail in annual/triennial reports. Compliance report will include: 2. evidence of compliance with the conditions and commitments	Compliance report.	CEO			Annually	**Compliant.** Detailed in sections 6 and 7 of this report and status column of this Appendix.
688: M 5-1 3	Compliance audit and performance review	The proponent shall prepare an audit program and submit compliance reports to the EPA which address: 3. the performance of the environmental management plans and programs. Note: Under delegation No. 54 issued on 18 June 2004 and section 48 (1) of the *Environmental Protection Act 1986*, the EPA is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement.	Detail in annual/triennial reports. Compliance report will include: 3. the performance of the environmental management plans and programs.	Compliance report.	CEO			Annually	**Compliant.** Detailed in sections 6 and 7 of this report and status column of this Appendix. Also refer to the results in Appendix A and Table 4 (Section 6).
688: M 5-2 1	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the EPA, which address: 1. compliance with the conditions	The performance review will address: 1. compliance with the conditions	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	**Compliant.** Detailed in sections 6 and 7 of this report and status column of this Appendix. Also refer to the results in Appendix A and Table 4 (Section 6).
688: M 5-2 2	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the EPA, which address: 2. the achievement of environmental objectives set for the proposal	The performance review will address: 2. the achievement of environmental objectives set for the proposal	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	**Compliant.** This report provides the required performance review and evidence of whether the environmental objectives (refer to Table 2 in the Appendix B for objectives) are being met.

Audit code	Subject	Action	How	Evidence	Require-ment of:	On advice from	Phase	When/Where	Status for 2017–18
688: M 5-2 3	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the EPA, which address: 3. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed	The performance review will address: 3. stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed. Comply with commitments in Ministerial statement 688: P 7, 9, 10, 11, 16, and 17.	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	**Compliant.** Detailed in this report. The Jandakot Community Consultative Committee (JCCC) met in: • August 2014 • October 2015 • September 2016 • 12 October 2017 and discussed the environmental management of abstraction from the Jandakot groundwater system.
688: M 5-2 4	Compliance audit and performance review	The proponent shall submit a performance review report by 1 December each year and more detailed reports by 1 February every three years, to the requirements of the EPA, which address: 4. proposed environmental management over the next three years to comply with conditions and environmental objectives set for the proposal.	The performance review will address: 4. proposed environmental management over the next three years to comply with conditions and environmental objectives set for the proposal.	Compliance report.	CEO		Overall	By 1 December each year and more detailed reports by 1 February every three years.	**Compliant.** The department is continuing to review and refine its environmental management of Jandakot groundwater resources using results from environmental monitoring (see Section 6.1) and hydrogeological investigations.
688: M 5-3	Compliance audit and performance review	The proponent shall make the reports required by condition 5-2 publicly available, to the requirements of the EPA.	Available on Department of Water and Environmental Regulation's website:	Reports made available on the Department of Water and Environmental Regulation website: <www.dwer.wa.gov.au>	CEO		Overall	After OEPA acknowledgement letter being received. Department of Water and Environmental Regulation's website.	**Compliant.** The following Jandakot compliance reports can be found on the department's website: • 2006–07 annual (DoW 2007b) • 2005–08 triennial (DoW 2008a) • 2008–09 annual (DoW 2009a) • 2009–10 annual (DoW 2010) • 2008–11 triennial (DoW 2012a) • 2011–12 annual (DoW 2012b) • 2012–13 annual (DoW 2013) • 2011–14 triennial (DoW 2014) • 2014–15 annual (DoW 2015b) • 2015–16 annual (DoW 2016b) • 2014–17 triennial (DWER 2018).
688: M 5-4	Compliance audit and performance review	The proponent shall report any breach or anticipated breach of the environmental criteria set out in tables 1 and 2 (attached to *Ministerial statement 688*) or environmental objectives to the OEPA immediately it becomes evident to the proponent.	Report in regular summaries sent to the Chief Executive Officer of the EPA.	Letter to the Chief Executive Officer of the EPA reporting non compliances with water level and other criteria as required. Compliance report.	CEO		Overall	Immediately as it becomes evident.	**Compliant.** The department informs the EPA of non-compliance with criteria water levels and other criteria in annual and triennial compliance reports.

Audit code	Subject	Action	How	Evidence	Require-ment of:	On advice from	Phase	When/Where	Status for 2017–18
688: M 6-1	Management plan	The proponent shall implement the Environmental Management Plan prepared by the Water Authority of Western Australia (1992) to the requirements of the EPA.	Comply with environmental objectives and criteria listed in WAWA EMP (1992).	Compliance report	EPA		Overall		**Compliant/Completed** The condition to implement the requirements set out in the Environmental Management Plan is met by following and meeting the commitments in *Ministerial statement no. 688*. The Environmental Management Plan was submitted to the former Department of Environment and Conservation (now DBCA) in 1992 and since then there have been a number of amendments to Ministerial conditions relating to the plan. The department considers the implementation of the Environmental Management Plan an ongoing commitment. From 2005 onwards the former Department of Environment and Department of Water, now Department of Water and Environmental Regulation is demonstrating its implementation through the annual/triennial compliance reports to the EPA. Implementation is reported as: • compliance with water level and other criteria • predictions of non-compliance with water level criteria • reporting on proponent and Ministerial conditions/commitments (audit tables) • implementation of the environmental monitoring program (required under other conditions).
688: M 7-1	Groundwater allocations	The proponent shall inform the EPA immediately of any proposed changes to allocations, abstraction limits and licence or allocation periods.	Detail limits on availability on the Department of Water and Environmental Regulation's website. Detailed in annual/triennial reports.	Reports made available on the Department of Water and Environmental Regulation's website: <www.dwer.wa.gov.au>	Minister for the Environment		Overall		**Compliant.** Changes to allocations, abstraction limits and licensing is documented in annual and triennial compliance reports. There has been limited change (mostly reductions in abstraction) over the last five years. The department's recent management focus has been an allocation limit review for the Jandakot groundwater area (see Section 6.2.1). The EPA will be consulted regarding changes that have resulted from the review.
688: M 8-1	Water conservation	The proponent shall actively encourage further reduction in public and private water demand in accordance with the State Water Strategy (2003) and other water conservation initiatives.	Engage in activity that supports water conservation.	Compliance reports	Minister for the Environment		Overall		**Compliant.** Section 6 outlines the management actions the department is taking to encourage further reduction in public and private water demand. Following extensive consultation with the irrigation industry as well as local government, the Department of Water developed and implements *Operational policy no. 1.2 – Policy on water conservation/efficiency plans* (DoW 2009b). The department's Water Recycling and Efficiency staff undertake projects to reduce water demand and achieve water conservation initiatives (see Section 6.2.3). This includes implementing the above policy and the permanent winter sprinkler ban.
688: M Procedure 1		Where a condition states 'to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority', the EPA will prepare the written notice to the proponent.	The EPA to provide written notice to the proponent (Department of Water) and Environmental Regulation.		Minister for the Environment		Overall		**No action required by the Department of Water and Environmental Regulation.**
688: M Procedure 2		The EPA may seek advice from other agencies or organisations, as required, in order to provide its advice.	The EPA to seek advice as required.		EPA	Other agencies as required	Overall		**No action required by the Department of Water and Environmental Regulation.**

Audit code	Subject	Action	How	Evidence	Require-ment of:	On advice from	Phase	When/Where	Status for 2017–18
688: **M Procedure 3**		Where a condition lists advisory bodies, it is expected that the proponent will obtain the advice of those listed as part of its compliance reporting to the EPA.	Department of Water liaises with advisory body as required.	Liaison with advisory body in compliance report	EPA	Agencies listed as part of compliance reporting	Overall		**Compliant.**

Table B2 The proponent's (Department of Water and Environmental Regulation's) environmental management conditions

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status
688: P 1	Groundwater-dependent ecosystems	To protect significant environmental values.	Ensure that groundwater abstraction satisfies the environmental criteria presented in tables 1 and 2 (*Ministerial statement no. 688*).	Meet objectives and Environmental Water Provisions criteria presented in Tables 1 and 2 (*Ministerial statement no. 688*).	Compliance report	Minister for the Environment		Overall	**Partly compliant.** Detailed in section 6 and in Appendix A of this report.
688: P 2 1	Environmental management and monitoring	To minimise environmental and/or significant impact.	In the event that monitoring indicates that there will be significant impacts of a nature not predicted or indicates that a breach of the specified criteria has occurred or is likely to occur, then one or more of the following actions will be undertaken: 1. demonstrate to the satisfaction of the EPA that the breach of criteria is not a result of groundwater abstraction; or	Review of monitoring results, advice from expert hydrogeologists, groundwater modelling.	Compliance report See Condition 688: M 5-4	EPA		Overall	**Compliant.** The department annually predicts whether sites are likely to be non-compliant with water level criteria during the coming summer and reviews public water supply abstraction to limit impacts at potentially non-compliant sites.
688: P 2 2	Environmental management and monitoring	To minimise environmental and/or significant impact.	2. satisfy the EPA that the breach of a criterion is transient and not of permanent significance; or	Review of similar occurrence in the past and consequences from environmental monitoring results Advice from expert hydrogeologists.	Compliance report	EPA		Overall	**Partly compliant.** Water levels at a number of Ministerial sites (including North Lake and Bibra Lake) are consistently non-compliant with water level and other criteria. The department considered non-compliance and ecological condition at these sites in its review of allocation limits for the Jandakot and Cockburn groundwater areas. The department also considers non-compliance at these sites in distributing public supply abstraction and in licensing decisions for private use.
688: P 2 3	Environmental management and monitoring	To minimise environmental and/or significant impact.	3. take the following actions: a. modify pumping from any bore where such changes can have a measurable effect (say raise water levels 1 centimetre or more), except in extenuating circumstances such as where significant economic hardship would occur, or DBCA (formerly CALM) declare that the low water levels would be beneficial b. in the case of a wetland, artificially maintain the 'action minima' water level c. implement a short-term detailed monitoring program to establish the condition of agreed species in the affected area.	Implement actions as outlined.	Compliance report	EPA		Overall	**Compliant.** No new actions were required in the reporting period. As described in previous compliance reports, the department restricts Water Corporation abstraction from bores that impact on Ministerial sites and other groundwater-dependent ecosystems.
688: P 3	Water allocation	To minimise environmental and/or significant impact and manage the resource sustainability.	Regularly review the bulk allocations for private abstraction, as part of the total water abstraction allocation for the Jandakot PWSA, with regard to the sustainable yield of the superficial aquifer, including consideration of the environmental impacts of that abstraction.	Make part of Department of Water and Environmental Regulation's water allocation planning program.	Compliance report	EPA		Overall	**Compliant.** The department's recent management focus was refining the allocation limits in the Jandakot and Cockburn groundwater areas . This work considered licensed entitlements for both private and public abstraction. The Cockburn allocation plan for public comment was released in May 2018.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status
688: P 4	Water allocation	To minimise environmental and/or significant impact and manage the groundwater resource sustainability.	Restrict the issuing of licences for private abstraction to the limits set by the bulk allocations for both the Jandakot PWSA in its entirety and the licensing subareas.	Set sub-area groundwater allocation limits to values equal to or less than those set for the Jandakot PWSA.	Compliance report	EPA			**Compliant.** The department's recent management focus was refining the allocation limits in the Jandakot and Cockburn groundwater areas.
688: P 5	Water allocation	Provide up-to-date mechanisms for groundwater allocation.	Investigate and implement efficient mechanisms for groundwater allocation.	Incorporate in regular Department of Water and Environmental Regulations' allocation work program.	Compliance report	EPA			**Compliant.** The department's recent management focus was refining the allocation limits in the Jandakot and Cockburn groundwater areas. This work used contemporary methods for determining sustainable limits for use in the decision-making process for the new allocation limits.
688: P 6	Groundwater protection	To minimise environmental and/or significant impact and manage the groundwater resource sustainability.	Assist the EPA in the development of environmental protection policies to protect groundwater.	Liaise with the EPA as required	Compliance report	EPA			**N/A at this time.**
688: P 7	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Participate in the review of regional plans proposed by the Department of Planning, Lands and Heritage (formerly Department for Planning and Infrastructure), local government town planning schemes, and rezoning and development applications.	Liaise with local government, the Department for Planning, Lands and Heritage, and other relevant land-use planning agencies.	Compliance report	EPA			**Compliant.** The department assesses land use proposals with potential water resource issues referred from local and state government agencies. In partnership with the then Department of Planning (and other agencies), the department helped develop *Better urban water management* (WAPC 2008), a framework for land use planning assessments. The department also produced the *Jandakot drainage and water management plan* (DoW 2009c), which aims to assist land developers and local government to better manage groundwater quantity and quality in the area. The department recently provided advice on the *Southern Metropolitan and Peel sub-regional structure plan – Regional water management strategy*, which identifies water related constraints and opportunities associated with proposed urban and industrial areas.
688: P 8	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Participate in the review of development submissions to the EPA.	Provide advice to the EPA as requested.	Compliance report See 688: P 7	EPA			**Compliant.** See the status of 688: P 7.
688: P 9	Groundwater protection	Integrated land and water resource planning to minimise environmental and/or significant impact.	Work with the Department of Planning, Lands and Heritage (formerly Department for Planning and Infrastructure), to prepare an integrated Land Use and Water Management Strategy for the Jandakot Mound.	Liaise with the Department of Planning, Lands and Heritage to prepare an integrated Land Use and Water Management Strategy for the Jandakot Mound.	Compliance report	EPA			**Compliant.** The department produced the *Jandakot drainage and water management plan* (DoW 2009c), which aims to assist land developers and local government to better manage groundwater quantity and quality in the area. With the then Department of Planning (and other agencies) the department has produced the *Better urban water management* publication (WAPC 2008). The department recently provided advice on the *Southern Metropolitan and Peel sub-regional structure plan – Regional water management strategy*, which identifies water related constraints and opportunities associated with proposed urban and industrial areas.
688: P 10	Water conservation	Water conservation.	Actively pursue programs in both supply and demand management. This includes ongoing public information programs and, where appropriate, regulation for design changes and regular reviews of pricing to conserve water. Improvements in the Water Corporation's supply system will also be pursued.	Engage in activity that supports water conservation. Development of a policy on water conservation plans.	Compliance report	EPA			**Compliant.** Section 6.2 outlines the actions the department is taking to manage supply and demand and support water conservation.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status
688: P 11	Groundwater protection	Integrated land and water resource management to minimise environmental and/or significant impact.	Actively participate in integrated management of the Jandakot catchment.	Liaise with other water and land-use agencies.	Compliance report	EPA			**Compliant.** The department liaises with other water and land-use agencies to integrate management of the Jandakot catchment, including the Water Corporation, EPA and the Western Australian Planning Commission. For example, the department prepared the *Jandakot drainage and water management plan* for the WAPC Jandakot structure plan area (see 688: P 9) with some modelling assistance from the Water Corporation.
688: P 12	Environmental management and monitoring	Environmental management of groundwater abstraction is based on best available scientific knowledge.	Review and revise the management criteria and strategies, with the agreement of the EPA, as knowledge of the Jandakot environment and its interaction with groundwater improves.	Stage 1 and 2 Section 46 review supported by scientific research results.	Compliance report	EPA	EPA		**Compliant.** *Stage I Section 46* (DoE 2005) is complete and a number of changes were supported by the EPA (refer Bulletin 1155). Stage II Section 46 work has concentrated on the Gnangara Mound area due to priorities. The department's recent management focus was refining the allocation limits in the Jandakot and Cockburn groundwater areas .
688: P 13	Environmental management and monitoring	Monitor compliance with Ministerial water level criteria. Management of groundwater levels to protect environmental values of select wetlands.	Monitor water levels in groundwater monitoring bores and North, Bibra, Yangebup, Kogalup, Thomsons and Forrestdale lakes, and The Spectacles and Twin Bartram Swamp, as well as some other small wetlands.	Include in Department of Water regional groundwater monitoring program.	Compliance report Hydrographs available on the Department of Water and Environmental Regulation's website: <www.dwer.wa.gov.au> See 688: P 14	EPA			**Compliant.** Detailed in this report, refer to the results given in Appendix A. Wetlands were included in the department's Jandakot Environmental Monitoring Program referred to the EPA in December 2005 (see 688: P 14). Hydrographs of Ministerial wetland and terrestrial vegetation sites are available on the department's website.
688: P 14 1	Environmental management and monitoring	Provide a means for the assessment of compliance with Ministerial environmental criteria for the Jandakot Mound.	1. Prepare an environmental monitoring program for submission to the EPA for review and subsequent finalisation of the program to the satisfaction of the EPA. The monitoring program will include: • monitoring of groundwater levels in all relevant aquifer systems • relevant wetland water levels and water quality • condition of vegetation and fauna associated with groundwater-dependent ecosystems.	Prepare an environmental monitoring program.	Submit monitoring program to the EPA for approval Compliance report	EPA	DBCA (formerly DEC)	Within four months of a revised statement being issued following the 2004 Stage 1 section 46 review	**Compliant.** The department's monitoring program includes: • monitoring of groundwater levels in all relevant aquifer systems • relevant wetland water levels and water quality • condition of vegetation and fauna associated with groundwater-dependent ecosystems. The previous environmental monitoring program was submitted to the EPA on 21 December 2005. It was detailed in Appendix 7 of the Gnangara triennial report for 2003–06 (DoW 2007c). The EPA's audit of the 2006–07 compliance report agreed that the commitment could be 'cleared' upon confirmation from the then DEC. The department reviewed the environmental monitoring program in June 2009 with the ecologists that do the monitoring (see Appendix D). A number of amendments were made. A letter was sent to the Director General of the then DEC in December 2009, seeking advice and input on the amendments.
688: P 14 2	Environmental management and monitoring	To enable assessment of compliance with Ministerial environmental criteria for the Jandakot Mound.	2. Implement the approved environmental monitoring plan	Make part of annual departmental work program	Compliance report	EPA	DBCA (formerly DEC)		**Compliant.** A summary of the results of the environmental monitoring over the reporting period (2014–17) is reported in Section 6.1. The department used these results to distribute public supply abstraction to limit environmental impacts and inform licensing decisions for private use. The department has also considered the results in its review of allocation limits in the Jandakot and Cockburn groundwater areas.
688: P 14 3	Environmental management and monitoring	Monitoring program is a reflection of the best available knowledge of groundwater/environment interaction.	3. Review and revise the program every six years (coinciding with triennial reports), to the satisfaction of the EPA.	Incorporate review in triennial reporting in 6 year intervals.	Triennial compliance report	EPA	DBCA (formerly DEC)	Every six years (coincides with triennial report)	**Compliant.** The department reviewed the environmental monitoring program in June 2009 with the ecologists that do the monitoring (see Appendix D). A number of amendments were made. A letter was sent to the Director General of the then DEC in December 2009, seeking advice and input on the amendments.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status
688: P 15	Environmental management and monitoring	Monitor habitat shifts in conjunction with the assessment of potential impacts on environmental values from groundwater abstraction on the Jandakot Mound.	Use aerial photographs or equivalent on a triennial basis to detect habitat shifts in North Lake, Yangebup, Kogalup, Thomsons and Forrestdale lakes.	Aerial photographs not an effective method. Instead the department focuses on field surveys of vegetation transects.	Triennial compliance report	EPA		Every three years (coincides with triennial report)	**Partly-compliant.** There may be limited value using aerial photos solely as a diagnostic tool. This was recognised and the commitment was modified in Bulletin 1155. The department does monitoring at established transects annually at each of these wetland sites. This monitoring identifies shifts in habitat. The department commissioned Edith Cowan University to develop a model for determining ecological risk to groundwater-dependent vegetation in a drying climate. The model is based on 30 years of ecological and hydrological monitoring data. It will be an important management tool for assessing risk to groundwater-dependent vegetation (including likely habitat shifts) under different climate and abstraction regimes.
688: P 16	Community consultation	Inform major stakeholders of Department of Water and the Water Corporation activities on the Jandakot Mound. Provide mechanism for feed-back.	Hold meetings at least annually with the Jandakot Community Consultative Committee (JCCC) established in consultation with the EPA. This committee will be informed on the groundwater scheme's operation and will provide feed-back to the proponent.	Department of Water to organise JCCC meetings.	Compliance report	EPA			**Compliant.** Detailed in this report. The Jandakot Community Consultative Committee (JCCC) met in: • August 2014 • October 2015 • September 2016 • October 2017. and discussed the environmental management of abstraction from the Jandakot groundwater system.
688: P 17	Community information	Maintain good public image and up-to-date knowledge of community concerns of water resource issues.	Continue to monitor community response to relevant water resource issues as reported by the media and maintain the current practice of public accessibility of WRC staff. Upon request and adequate notice, staff will address community groups on issues associated with groundwater management.	Monitor media for relevant issues. Address community groups as requested.	Compliance report	EPA			**Compliant.** The department subscribes to the 'Media Portal' which forwards water related newspaper articles to department employees so they are kept informed. The department's staff are involved in conferences, meetings and workshops that include community group representation (for example JCCC meetings).
688: P 18	Environmental management and monitoring	Improved environmental monitoring facility at this significant wetland.	Install monitoring wells and improved wetland water level monitoring facilities for Forrestdale Lake, and evaluate monitoring data to determine groundwater/wetland water level relationship. Subject to DBCA/DWER (formerly CALM/WRC) installing permanent vegetation monitoring transect and undertaking flora and fauna studies to establish environmental values, the proponent will review available information to propose revised management criteria, if appropriate.	Addressed as part of the Department of Water and Environmental Regulation's completed project – 'Perth shallow groundwater systems investigation'.	Compliance report	EPA			**Compliant.** The department installed groundwater monitoring bores at Lake Forrestdale (Bourke 2008) and North Lake (Searle 2009) as part of the Perth shallow groundwater systems investigation. The Spectacles and Thomsons Lake were also included (Searle 2009) with sampling done at existing bores. The department is evaluating monitoring data at these wetlands to determine the groundwater–wetland water level relationship.
688: P 19	Environmental management and monitoring	Enable good water resource management including environmental protection on the Jandakot Mound.	1. Prepare a Management and Monitoring Program. 2. Implement the Management and Monitoring Program.	Prepare Management and Monitoring Program and submit to EPA.		EPA		Completed	**Completed.** This commitment was required prior to commissioning the Stage 2 scheme. Stage 2 was in operation for over 10 years and the implementation of the management and monitoring program is described in numerous annual and triennial compliance reports. In addition, following publication of *Ministerial statement no. 688*, a revised monitoring program was developed and submitted to EPA (refer Commitment 688: P 14) in December 2005.
688: P 20	Environmental management and monitoring	Improve understanding of groundwater/wetland ecology relationships	Continue to fund the research projects 10.6.3 listed in Appendix 2 of the EPA Bulletin 587 for the duration of the studies.	Include research projects in annual business planning.		EPA		Completed	**Completed.** Auditor's comments in the 2003–04 annual report state that the commitment can be 'cleared'. Research projects given in Appendix C (Table A12.2) of EPA *Bulletin 587* refer to commitments given in numbers 21, 22, and 23 below.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status
688: P 21	Environmental management and monitoring	Improve understanding of aquatic fauna of the select Jandakot wetlands.	Develop a fauna monitoring program which will focus on: 1. waterbird species diversity and breeding success 2. the number of families of aquatic invertebrate and, at infrequent intervals, species richness.	Develop a fauna monitoring program.		EPA	DBCA (formerly CALM)	Completed	**Completed.** Auditor's comments in the 2003–04 annual report agreed such a program had been developed and implemented prior to commissioning the Stage 2 scheme and that the commitment can be 'cleared'. A fauna monitoring program was developed and implemented. The results are presented in numerous annual and triennial reports to date.
688: P 22	Environmental management and monitoring	Improve understanding of the environmental significance of this wetland and means of protecting values.	Undertake study of Banganup Lake, in conjunction with DBCA (formerly CALM) and The University of WA to establish management criteria and consider effectiveness of artificial maintenance of water levels.	Undertake a study of Banganup Lake as described.		EPA	CALM	Completed	**Completed.** The study was completed and Auditor comments in 2003–04 annual report states that Commitment can be 'cleared'.
688: P 23	Environmental management and monitoring	Improve understanding of the environmental significance of this wetland and means of protecting values.	Undertake a study of Twin Bartram Swamp to consider the feasibility and effectiveness of artificial maintenance of water levels.	Undertake a study of Twin Bartram Swamp as described.		EPA	CALM	Completed	**Completed.** The study was completed and Auditor's comments in 2003–04 annual report state that the commitment can be 'cleared'.

Appendix C – History of Ministerial statements for the Jandakot Mound

In 1988, the former Water Authority of Western Australia (WAWA) referred plans for the construction of Stage 2 of the Jandakot groundwater scheme to the Environmental Protection Agency (EPA). The EPA completed a Public Environmental Review (PER) level of assessment of the proposal. In 1992, the Minister for the Environment issued a statement (EPA Bulletin 587, *Ministerial statement no. 253 – Assessment 196),* advising that the proposal could be implemented subject to conditions and commitments imposed on the WAWA. Most of the conditions and commitments related to ensuring that groundwater and surface water levels across the Jandakot Mound are maintained at acceptable levels.

A key element of *Ministerial statement no. 253* was that it confirmed environmental water provisions to maintain environmental values on the Jandakot Mound. These were set in the form of water level criteria to be achieved in key wetlands and other groundwater-dependent ecosystems, such as areas of phreatophytic vegetation.

In 2001, as a consequence of changes in land use and lower rainfall, the EPA endorsed a two-stage approach to review the Ministerial conditions and commitments for the Gnangara and Jandakot mounds under section 46 of the *Environmental Protection Act 1986*. The first stage of the section 46 review was for the department (then the Department of Environment) to review Ministerial conditions and commitments on Gnangara and Jandakot based on existing knowledge (DoE 2005). This review led to *Ministerial statement no. 687* for Gnangara (Government of Western Australia 2005b) and *Ministerial statement no. 688* for Jandakot (Government of Western Australia 2005a).

The department further reviewed Ministerial conditions and commitments on Gnangara in 2007 (DoW 2008b). The purpose of this review was to refine Ministerial criteria sites to those with significant ecological value and those where abstraction is the main factor influencing groundwater levels. This review led to the *EPA Bulletin 1324* in May 2009, which recommended changes to the Minister for Environment. *Ministerial statement no.819* for Gnangara (Government of Western Australia 2009) was released later that year including the consolidated and refined conditions and commitments.

The second stage of the section 46 review was proposed as a more comprehensive review to improve how the department manages public and private abstraction and to incorporate ecological information using the results of work underway at the time. This stage was later improved by more recent investigations into the shallow groundwater systems and ecological responses to climate.

For Gnangara, the second stage review will occur as part of the work associated with the next Gnangara groundwater allocation plan, due for release as a draft for public comment in late 2018. For Jandakot, the department will use the analysis of recent

work to focus management efforts in the areas that will most benefit from changes to abstraction.

Appendix D – Review of the environmental monitoring program (688: P 14 1)

In mid-2009, the department started a series of workshops to review the current environmental monitoring with the ecologists contracted to do the work. The workshops aimed to improve both the effectiveness and efficiency of the environmental monitoring program.

The initial review of the environmental monitoring program:

- refocused the program on the relationships between groundwater levels, ecological condition and abstraction
- improved efficiency by reducing the monitoring frequency from annually to every three years, unless annual monitoring is warranted on a management or information-needs basis
- improved the presentation and communication of monitoring data.

The second review workshop, held in late April 2010, considered two key issues:

- how monitoring results could be presented spatially so that it represents short-term and long-term trends across an entire groundwater management area
- how modelling results could be used to ensure the monitoring effort is focussed on the correct areas in the long-term.

There were three main outcomes and recommendations from this second workshop:

- Future monitoring programs should include sites where ecological health and compliance can be improved through managing abstraction (based on modelling).
- The department can make a difference to important areas on the Jandakot Mound by managing abstraction – even minor benefits to groundwater levels can be significant for certain groundwater-dependent ecosystems.
- Where possible, abstraction should be reduced in areas where it would benefit wetlands that still retain some of their key environmental values.

Another review workshop was held in 2013 to further refine the frequency of the monitoring program.

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Department of Water and Environmental Regulation
Prime House 8 Davidson Terrace
Joondalup WA 6027

Phone: 08 6364 7000
Fax: 08 6364 7001
National Relay Service 13 36 77
dwer.wa.gov.au