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

Environmental management of groundwater from the Jandakot Mound groundwater resources

Triennial compliance assessment report July 2020 – June 2023

February 2024

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Disclaimer

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Summary

This report describes the Department of Water and Environmental Regulation's (the department) compliance with environmental conditions and commitments in *Ministerial Statement no. 688 – Jandakot Mound groundwater resources [including Jandakot Groundwater Scheme Stage 2]* (Government of Western Australia 2005a) for the period 1 July 2020 to 30 June 2023, under Part IV of the *Environmental Protection Act 1986* (EP Act).

The report also outlines the environmental monitoring, management, research and consultation undertaken by the department to manage groundwater use from the Jandakot groundwater system.

Under *Ministerial Statement no. 688*, the department must manage abstraction from the groundwater system to comply with water level criteria set at 23 groundwater-dependent wetland and terrestrial vegetation sites across the Jandakot Mound.[1]

Groundwater level trends across the Jandakot Mound, and compliance with water level criteria, are influenced by rainfall, groundwater abstraction and also changes in land use such as urbanisation.

The number of sites where water levels were non-compliant with absolute minimum water level criteria in 2022–23 was four – North Lake, Bibra Lake, Lake Forrestdale and Shirley Balla Swamp. The same four sites were non-compliant in 2021–22 and in 2020–21.

Although 'absolute minimum' water level criteria are the main indicators of compliance, some sites also have 'other' criteria, which include rules such as the timing or frequency of drying, minimum lake depth, rate of water level decline and 'preferred' water levels. Four sites were non-compliant with 'other' criteria, compared with three in 2021–22 and five in 2020–21. The lower number of non-compliant sites in 2021–22 was likely due to the higher winter rainfall received rather than changes in licensed entitlements, as licensed entitlements both for public supply and private self-supply remained steady across all years.

Rainfall at Bureau of Meteorology (BoM) Jandakot Aero station (no. 9172) was 822.8 mm in 2022–23. This was below the long-term (1945–2023) average of 834.9 mm and well above the 10-year average of 761.3 mm. In 2021–22 it was 839.0 mm due predominantly to an unusually large monthly rainfall of 315.0 mm in July 2021 – the highest July rainfall since 1946. In 2020–21 730.2 mm was recorded.

Public water supply entitlements for the Integrated Water Supply Scheme (IWSS) from the Superficial aquifer were 3.90 GL in all years of the reporting period (Table 1). The department continued to work with Water Corporation to distribute abstraction for public water supply in response to groundwater level trends and to

[1] Compliance with criteria over the triennial reporting period could not be assessed at terrestrial vegetation site JM8 because this bore could not be accessed for monitoring during the triennial reporting period. Compliance with criteria could not be assessed in 2022–23 at terrestrial site JM16 because the bore was damaged and needed to be replaced.

reduce the volume of groundwater pumped from production bores nearest to non-compliant sites.

Private licensed entitlements remained stable across the Jandakot Mound across the reporting period (Table 1).

The department is currently preparing a groundwater allocation plan for the Jandakot and Perth South groundwater areas. This will include a review of groundwater allocation limits for the Superficial and confined aquifer resources in these areas and an evaluation of existing water level criteria in the context of future climate projections. The department will undertake comprehensive stakeholder and public consultation and engagement in 2024–25 as part of the development of the plan.

Table 1 Rainfall, licensed entitlement totals from the Superficial aquifer and compliance summary

	2020–21	2021–22	2022–23
Rainfall[1]	730.2 mm	839.0 mm	822.8 mm
Public water supply entitlements[2]	3.90 GL	3.90 GL	3.90 GL
Private licensed entitlements	39.30 GL	40.72 GL	40.49 GL
Estimated stock and domestic garden bore use[3]	24.00 GL	24.00 GL	24.00 GL[2]
No. of non-compliant sites[4]	4 out of 23[5]	4 out of 23[5]	4 out of 23[6]

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

2 For detail on groundwater licensed for public water supply across all aquifers of the Jandakot system, including groundwater replenishment entitlements and abstraction, see Section 3.1 and Table 2.

3 Garden bore and stock and domestic use is from the Superficial aquifer only. It is estimated using data collected through surveys, data from the Australian Bureau of Statistics and records of household use from Water Corporation. See Section 3.3.

4 For full details of compliance with water level and other criteria see Table 4 and Appendix A.

5 Compliance was assessed against absolute minimum criteria at 22 sites because terrestrial vegetation site JM8 could not be monitored during the triennial reporting period.

6 Compliance was assessed against absolute minimum criteria at 21 sites because terrestrial sites JM8 and JM16 could not be monitoring during 2022–23.

2 This estimate will be updated to include consideration of the recent change to the domestic garden bore roster upon completion of the current Jandakot and Perth South groundwater allocation planning work. The new two-days-per-week roster (reduced from three-days-per-week) came into effect on 1 September 2022. Domestic garden bore users are now on the same sprinkler roster as scheme water users.

1 Background

1.1 Ministerial Statement no. 688

Ministerial Statement no. 688 – Jandakot Mound groundwater resources [including Jandakot Groundwater Scheme Stage 2] (Government of Western Australia 2005a) established the environmental conditions and commitments associated with the allocation of groundwater for public and private use. The department is the proponent and must comply with and report on the implementation conditions to the Environmental Protection Authority (EPA) each year.

The department was formed in July 2017 following the merger of the Office of the Environmental Protection Authority, the Department of Water and the Department of Environment Regulation. To ensure there is no possible apprehension of bias, the Director General of the department is not involved in monitoring compliance with *Ministerial Statement no. 688*. The Executive Director, Compliance and Enforcement has been formally delegated to exercise the compliance duties under the EP Act.

Some of the key conditions in *Ministerial Statement no. 688* are environmental water provisions, set as minimum water level criteria at 23 representative sites across the Jandakot Mound – ten wetland, nine terrestrial phreatophytic[3] vegetation and four rare flora sites across the Jandakot, Perth and Cockburn groundwater areas (Figure 1).

Implementation conditions associated with the Jandakot Mound proposal were first established in 1992 in *Ministerial Statement no. 253* (Government of Western Australia 1992) to ensure that the important groundwater-dependent values of the Jandakot Mound were protected from significant impacts from groundwater abstraction for public water supply and private licensed use. In 2005, the Minister for the Environment, on the advice of the EPA, revised the implementation conditions and commitments of the Jandakot Groundwater Scheme proposal. Water level criteria were removed from sites where environmental values had been lost due to causes other than abstraction (see Appendix C). These included sites that had been affected by land clearing for development and other land use changes. The 2005 revision resulted in the removal of criteria from 15 sites and the amendment of water level criteria at a further five sites.

The water level criteria at the current 23 sites have been developed to ensure that wetland surface water levels and groundwater levels in areas of phreatophytic vegetation stay within a range necessary to protect the stated environmental values of that site.

[3] Phreatophytic vegetation uses groundwater to meet at least part of its water needs. On the Swan Coastal Plain, native vegetation that occurs within 10.5 m depth to groundwater is considered to be phreatophytic.

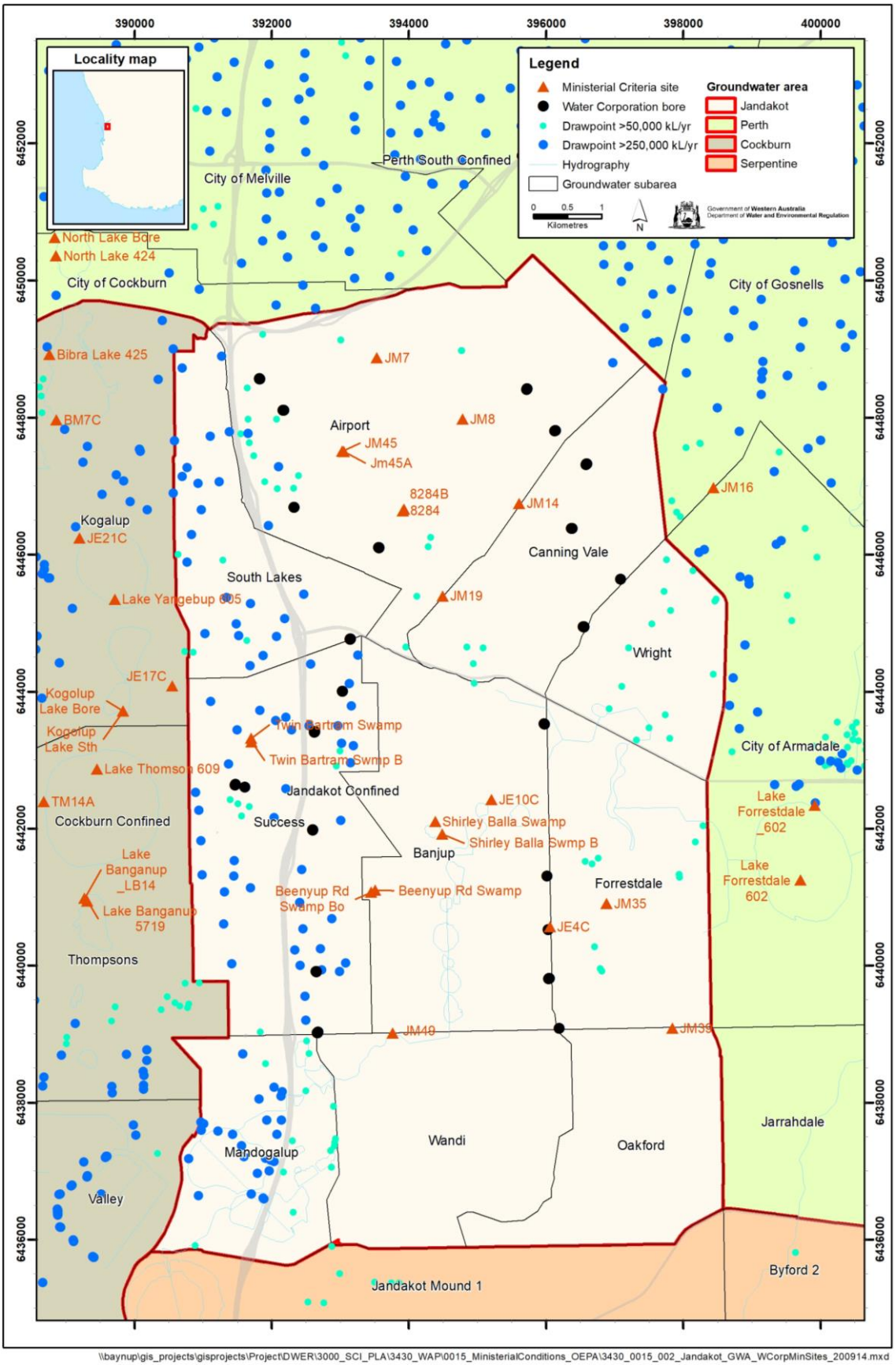

Figure 1 Location of Jandakot Ministerial sites, public water supply production bores and private licensed drawpoints with entitlements ≥50,000 kL/year

1.2 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 near the Darling Scarp in the east. The system comprises three main aquifers:

- the shallow, unconfined Superficial (watertable) aquifer, also referred to 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 (the Kardinya shale) that extends under all the sites with Ministerial water level criteria except Lake Forrestdale. This separation means that abstraction from the Superficial aquifer has a greater impact on Jandakot Mound wetlands and phreatophytic vegetation 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 that seen across the Gnangara Mound, north of the Swan River. In some areas of the Jandakot Mound, groundwater levels stabilised or improved since 2016 due to:

- higher annual rainfall since the extreme dry years of 2006, 2010 and 2015
- unusual summer rainfall events in 2017 and 2018
- increased recharge rates from clearing and urbanisation
- localised management of abstraction.

1.3 Allocation limits and licensing

The department uses allocation limits, groundwater licensing rules and conditions, and monitoring of water levels, water quality and ecological values 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 we account for that is exempt from licensing, including water used by domestic garden bores.

Water allocated to the environment is not included as part of the allocation limit. Rather, it is the water that is left in the groundwater system to support environmental, cultural and community values. The water level criteria set at high value wetland and bushland sites on the Jandakot groundwater system in *Ministerial Statement no. 688* serve to restrict the amount of water that can be allocated from the system without causing the watertable to drop below environmental thresholds, helping to ensure sufficient water remains to meet environmental needs. If the criteria are not met it is

an indication that there could be a risk of impact to ecological values. Breaches, or impending breaches of water level criteria trigger management actions, such as shifting public water supply abstraction away from drawpoints in more sensitive areas, or instigating further investigations into the causes, or, ultimately, broader changes to groundwater allocation limits or groundwater management.

Allocation limits are set following comprehensive assessments of the state of the groundwater resource, hydrogeological capacity of the system and risks of abstraction to the resource, existing users and the environment. The department applies climate science, hydrogeological modelling and environmental assessments when setting and reviewing allocation limits. Groundwater licences are issued within the allocation limits and consider licensing policies.

Although domestic garden bores are exempt from licensing, they are still accounted for in setting allocation limits. They are managed through constraints on their use (such as the winter sprinkler ban and two-days-per-week sprinkler roster) and through groundwater awareness and water use efficiency messaging targeted at domestic garden bore owners.

2 Rainfall

Groundwater is recharged by rainfall. How much groundwater levels rise and fall each year is affected by the volume of rain that falls in the catchment, but also by how it falls (timing, pattern and intensity). Recharge is also affected by temperature – warmer weather increases evaporation so that less rainfall recharge reaches the aquifer.

The climate across Western Australia is changing. Average temperatures across the whole of the state have risen 1.3°C since 1910, and in the south-west, there has been a general trend of declining annual rainfall since the mid-1970s.

National climate projections data provided through the *Climate Change in Australia* website, project that Western Australia will continue to get hotter into the future, the south-west of the state will continue to become drier, and by mid-century, under a high emissions scenario, the climate of Perth will be more like the current climate of Jurien (CSIRO and Bureau of Meteorology 2021).

Rainfall at Bureau of Meteorology (BoM) Jandakot Aero station (no. 9172) was 822.8 mm in 2022–23. This was below the long-term (1945–2023) average of 834.9 mm and well above the 10-year average of 761.3 mm. In 2021–22 it was 839.0 mm due predominantly to an unusually large monthly rainfall of 315.0 mm in July 2021 – the highest July rainfall since 1946. In 2020–21 730.2 mm was recorded.

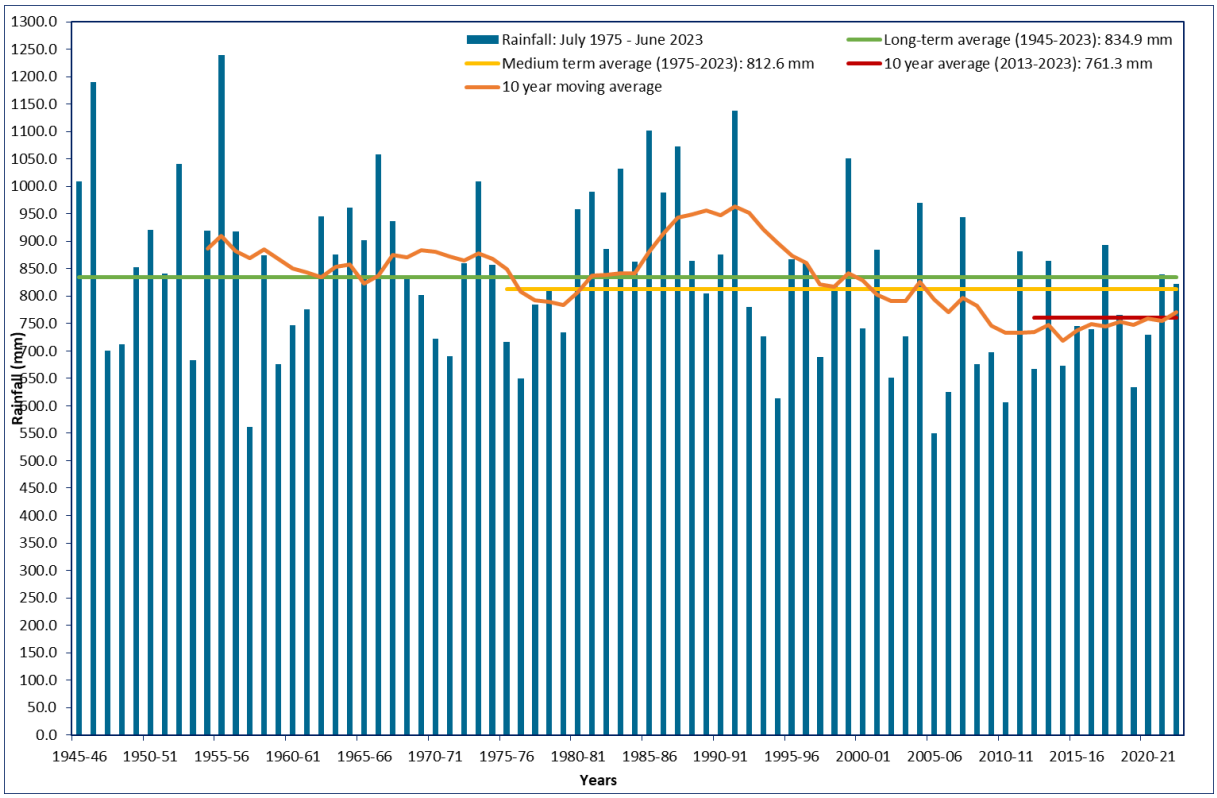

Figure 2 Annual and average water-year (July-June) rainfall at BoM Jandakot Aero station (no. 9172)

3 Groundwater use

The Jandakot groundwater system is a source of accessible, low-cost good-quality water. It provides water for public open space, agriculture and industry, contributes to Perth's public water supply and supplies water for domestic garden bores.

This section of the report summarises allocation limits, licensed entitlements and estimates of use exempt from licensing in groundwater subareas where abstraction may affect environmental sites with statutory water level criteria.

Most of the sites that have water level criteria under *Ministerial Statement no. 688* are located in the Jandakot groundwater area, and the remainder are found in the Cockburn and the Perth South groundwater areas (Figure 1). Local abstraction has the greatest effect on water levels at criteria sites, but because groundwater flows from the Jandakot groundwater area outwards into the Cockburn and Perth South groundwater areas, abstraction from the Jandakot groundwater area may still affect criteria sites in the Cockburn and Perth South groundwater areas.

3.1 Public water supply

The department licenses 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). The volume of water licensed for public supply from all aquifers of the Jandakot system (Table 2) was 17.01 GL in 2022–23. This was a slight decrease compared with 17.13 GL in 2021–22 and a slight increase from 16.08 GL in 2020–21.[4] Public water supply entitlements for the IWSS (licensed to Water Corporation) from the Superficial aquifer was 3.90 GL in all three years of the reporting period.

The volume licensed from the Superficial aquifer in each year during the reporting period included an additional 1 GL allocated as part of a trial to assess the sustainability of the additional volume. Water Corporation's licensed entitlements from the Jandakot groundwater system, including the trial volume, are being considered as part of the allocation limit review for the Jandakot groundwater area being completed under *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 2* (Government of Western Australia 2022).

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 sites where levels are non-compliant with water level criteria in *Ministerial Statement no. 688*.

See Table 2 for the distribution of licences by all aquifers and Table 3 for the distribution of licences across the Superficial aquifer subareas.

[4] There was slightly more water licensed from the Yarragadee aquifer for the IWSS in 2021–22 compared to the other years in the reporting period.

Groundwater replenishment scheme

Over the reporting period, a very small volume of water was licensed to be abstracted from the Jandakot groundwater system as part of Water Corporation's groundwater replenishment (GWR) scheme (Table 2)[5]. In 2020–21, 1.00 GL was licensed (0.70 GL from the Leederville aquifer and 0.30 GL from the Yarragadee aquifer) but only 0.31 GL was abstracted from the Leederville aquifer. In 2021–22 and 2022–23, 0.10 GL was licensed from the Yarragadee aquifer. 0.10 GL was abstracted in 2021–22 and 0.09 GL was abstracted in 2022–23. From 2023–24 onwards no water will be licensed for GWR against bores outside of the Gnangara groundwater allocation plan area.

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

Aquifer	IWSS licence entitlement (GL)			Groundwater replenishment (GWR) (GL)					
				Entitlements			Abstracted[2]		
	2020–21	2021–22	2022–23	2020–21	2021–22	2022–23	2020–21	2021–22	2022–23
Superficial	3.90	3.90	3.90	-	-	-	-	-	-
Leederville	6.45	6.45	6.73	0.70	-	-	0.31	-	-
Yarragadee[1]	5.73	6.78	6.38	0.30	0.10	0.10	0.00	0.10	0.09
Total	**16.08**	**17.13**	**17.01**	**1.00**	**0.10**	**0.10**	**0.31**	**0.10**	**0.09**

1 Licence entitlement includes groundwater licensed from the Yarragadee bore in the Jandakot groundwater area (4.95 GL in 2020–21, 6.00 GL in 2021–22 and 5.60 GL in 2022–23) and volumes licensed to bore MR17 in the Perth South groundwater area (0.78 GL in all years of the reporting period).

2 1.00 GL was licensed for groundwater replenishment in 2020–21. Of this, 0.31 GL was abstracted from Leederville bores located in the Jandakot groundwater area. No water was abstracted from bore MR17 located in the Perth-South groundwater area. 0.10 GL was licensed against bore MR17 in 2021–22. This volume was also abstracted. 0.10 GL was licensed against bore MR17 in 2022–23. 0.09 GL was abstracted.

3.2 Private licensed use

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

Over the reporting period private licensed entitlements from the Superficial aquifer remained steady in the Jandakot, Perth South and Cockburn groundwater areas. Table 3 shows private licensed entitlements for the groundwater subareas related to the sites with water level criteria set in *Ministerial Statement no. 688*.

5 GWR is a form of managed aquifer recharge. At Beenyup Wastewater Treatment Plant in Craigie, water is treated to drinking-water standard and up to 28 GL/year is recharged/injected into the Leederville and Yarragadee aquifers. An equivalent amount is then abstracted by Water Corporation from aquifers for public water supply purposes, subject to a groundwater licence. Almost all of this is licensed to be abstracted from Gnangara groundwater resources.

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.

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?	Public water supply entitlements[4] GL			Private licensed entitlements[5] GL		
			2020–21	2021–22	2022–23	2020–21	2021–22	2022–23
Jandakot[1]	Airport	Yes	1.59	1.64	1.64	1.05	1.17	1.16
	Banjup	Yes	0.20	0.17	0.17	0.52	0.47	0.45
	Canning Vale	No	0.94	0.94	0.94	0.28	0.37	0.37
	Forrestdale	Yes	0.15	0.18	0.18	0.91	0.91	0.86
	Mandogalup	No	-			2.21	2.17	1.83
	Oakford	Yes	-			0.09	0.09	0.11
	South Lakes	No	-			0.97	0.63	0.58
	Success	Yes	1.03	0.98	0.98	1.06	1.08	1.08
	Wandi	No	-			0.30	0.30	0.29
	Wright	No	-			0.79	0.77	1.10
Total for Jandakot groundwater area			**3.90**	**3.90**	**3.90**	**8.17**	**7.95**	**7.84**
Perth[2]	City of Armadale	Yes	-	-	-	4.63	4.09	4.23
	City of Canning	No	-	-	-	2.95	3.74	3.74
	City of Cockburn	Yes	-	-	-	0.65	0.65	0.65
	City of Gosnells	No	-	-	-	3.60	4.37	4.45
	City of Melville	No	-	-	-	4.28	5.02	4.75
Total for Perth South groundwater area			**0.00**	**0.00**	**0.00**	**16.11**	**17.85**	**17.83**
Cockburn[3]	Kogalup	Yes	-	-	-	9.84	9.84	9.88
	Thompsons	Yes	-	-	-	5.17	5.08	4.94
Total for Cockburn groundwater area			**0.00**	**0.00**	**0.00**	**15.01**	**14.91**	**14.82**
Total[6]			**3.90**	**3.90**	**3.90**	**39.30**	**40.72**	**40.49**

1 Allocation limits for the Jandakot groundwater area were updated in October 2014. They are currently being reviewed under Action 20 in *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 2* (Government of Western Australia 2022).

2 Allocation limits for subareas in the Perth South groundwater area, to the south of the Swan River, were last reviewed in 2007 and are currently being reviewed under Action 20 in *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 2* (Government of Western Australia 2022).

3 Allocation limits for the Cockburn groundwater area are from the *Cockburn groundwater allocation plan* released in January 2021 (DWER 2021).

4 Public water supply information is extracted from the department's COMPASS (water licensing and assessment) system and from annual reports submitted to the department by Water Corporation under licence conditions. The figures shown are what was allocated to Water Corporation for public water supply as of 30 June in each of the reporting years.

5 The 2020–21 allocation report was run on 1 July 2021. The 2021–22 report on 1 July 2022. The 2022–23 report was run on 1 July 2023. All information was extracted from the department's water licence and assessment system, COMPASS.

6 The total is from subareas in the Jandakot, Perth South or Cockburn groundwater areas where a Ministerial criteria site is present, or where groundwater use from that subarea could affect Ministerial criteria sites in other subareas.

Up-to-date information about water availability can be found on the Water Register on the department's website or through Swan Avon or Kwinana Peel regional offices.

Figures are rounded to two decimal places. Numbers may not add up to the total due to rounding.

1 GL = 1 000 000 kL.

3.3 Use that is exempt from licensing

The department estimates and accounts for groundwater that is exempt from licensing. The main types of exempt water use from the Jandakot Mound are garden bores used in urban areas and stock and domestic bores used in rural areas where there is no scheme water connection. We estimate that a total of 2.39 GL/year is abstracted from garden bores and stock and domestic bores across the Jandakot groundwater area. This is about 10 per cent of the total estimated 24 GL/year of exempt use across subareas listed in Table 3.

As exempt uses are not subject to metering regulations, we use other methods, such as surveys to estimate use volumes. Estimates are updated over time as we obtain better information on the rates of instalment and average water use by garden bores in urban and rural areas.

Average water use per bore was estimated as part of our domestic bore metering project, which operated from 2009–2012. Average water use per bore decreased from about 800 kL/year to 430 kL/year in urban areas after the three-day-per-week sprinkler roster and the winter sprinkler ban were introduced in 2010.

The existing estimate of use exempt from licensing will be updated to include consideration of the recent change to the domestic garden bore roster upon completion of the current Jandakot and Perth South groundwater allocation planning work. The new two-days-per-week roster (reduced from three-days-per-week) came into effect on 1 September 2022. Domestic garden bore users are now on the same sprinkler roster as scheme water users.

Further information on the management of garden bores is contained in Section 5.2.

4 Compliance

The conditions and commitments in *Ministerial Statement no. 688: Jandakot Mound groundwater resources* (Government of Western Australia 2005a) that the department is required to comply with under Part IV of the EP Act are detailed in Appendices A and B (the 'audit tables').

4.1 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 therefore 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, time/frequency of drying and minimum lake depth – these are also referred to as 'other' water level criteria in this report.

In all years of the reporting period, four of the 23 sites were non-compliant with absolute minimum water level criteria (Table 4). In 2022–23 four sites were non-compliant with 'other' criteria. This is compared with three in 2021–22 and five in 2020–21 (Table 4). The slight improvement since 2020–21 is likely due to the higher rainfall in 2021–22 and 2022–23 rather than changes in licensed entitlements, as these were similar across all years.

Compliance with absolute minimum and other criteria could not be assessed during the triennial reporting period at terrestrial vegetation site JM8 because this bore could not be accessed for monitoring during the triennial reporting period. The department is investigating whether access can be reinstated or if a new bore can be installed to replace JM8 in an accessible location. A replacement bore would need to fulfil the purpose of monitoring groundwater levels in proximity to a rare orchid population within phreatophytic vegetation at Jandakot Airport (Bush Forever Site 388). The department will provide an update on these investigations in the next annual compliance report.

Compliance with absolute minimum and other criteria could not be assessed during 2022–23 at terrestrial vegetation site JM16 because the bore was destroyed by roadworks in August 2022. A replacement bore, JM16A (AWRC ref. 61612151) was drilled adjacent to JM16 during 2022–23 and is currently being surveyed so it can be used to assess compliance in future years.

The management and mitigation actions we implement in response to non-compliance are described in Section 5. Details for individual sites can be found in the 'audit tables' in Appendix A.

Table 4 Summary of non-compliance with water level criteria for Jandakot groundwater resources for the reporting period

Non-compliant sites[1]					
Absolute minimum water level criteria			**Other water level criteria**		
Wetlands	**Terrestrial vegetation and rare flora**	**Total non-compliant**	**Wetlands**	**Terrestrial vegetation and rare flora**	**Total non-compliant**
2020–21					
North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	4 out of 23[2]	North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	JM7	5 out of 12[2]
2021–22					
North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	4 out of 23[2]	Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	3 out of 12[2]
2022–23					
North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	4 out of 23[3]	North Lake Bibra Lake Lake Forrestdale Shirley Balla Swamp	None	4 out of 12[3]

1 In the event that a site is non-compliant with more than one type of 'other' criterion at a single site (for example minimum peak water depth and timing of drying) within the same year, it is only counted as a single incidence of non-compliance i.e. the site is not double counted. See also Appendix A.

2 Compliance was assessed against absolute minimum criteria at 22 sites and other water level criteria at 11 sites because terrestrial vegetation site JM8 could not be monitored during the triennial reporting period.

3 Compliance was assessed against absolute minimum criteria at 21 sites and other water level criteria at 10 sites because terrestrial vegetation sites JM8 and JM16 could not be monitoring during 2022–23.

5 Environmental monitoring, management, research and consultation

5.1 Environmental monitoring

Expert environmental consultants undertake environmental monitoring for the department in line with the commitments in *Ministerial Statement no. 688* (Government of Western Australia 2005a). This long-term monitoring program provides a representative indication of changes in the overall health of the Jandakot groundwater system and includes:

- wetland vegetation
- terrestrial (phreatophytic) vegetation
- wetland macroinvertebrates
- wetland water quality.

The ecological condition of groundwater-dependent ecosystems is affected by several factors, of which the water regime is just one. Other factors include fire, insect attack, disease, weed invasion, pollution and disturbance from changing land use. 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 land use changes such as urbanisation.

The department uses the results of environmental monitoring, carried out each spring in the reporting period, to continually improve its understanding of the relationship between water levels and ecological condition. The information is also used to manage public water supply abstraction at priority locations, by reducing abstraction from production bores near environmental features where monitoring indicates there have been adverse changes in ecological condition (and water stress is a likely contributing factor).

The department is required to update the monitoring program every six years and submit it to the EPA. This is in line with commitment 14.3 in *Ministerial Statement no. 688* (Government of Western Australia 2005a). The department reviewed its environmental monitoring program in 2009 and 2013 (see Appendix D) to improve cost-effectiveness and efficiency. An updated environmental monitoring program was submitted to the EPA Services branch of the Department of Water and Environmental Regulation in April 2021. The next review of the environmental monitoring program is due to be completed and submitted with the next triennial report in 2027.

Wetland vegetation

Over the triennial reporting period the condition of wetland vegetation was monitored in spring at the sites listed in Table 5. Wetland vegetation monitoring was carried out by Edith Cowan University during the 2020–21 reporting period.

Table 5 Sites where wetland vegetation monitoring occurred over the 2020–2023 triennial reporting period

	2020–21	2021–22	2022–23
Ministerial criteria sites	North Lake Thomsons Lake Banganup Lake Twin Bartram Swamp Beenyup Road Swamp Shirley Balla Swamp Forrestdale Lake	None	None
Other sites	None	None	None
Reference	Buller et al. 2021	-	-

Wetland vegetation monitoring of North Lake, Thomsons Lake, Forrestdale Lake, Banganup Lake, Shirley Balla Swamp and Beenyup Road Swamp did not occur in 2021–22 or 2022–23 which is a departure from the annual monitoring frequency set out in the 2021 environmental monitoring program. The department has been undertaking transect maintenance and planning for a new consultant to take over the monitoring program. Transect maintenance involved updating transect coordinates, re-staking transects and plots and tagging/re-tagging overstorey species. The department plans to recommence the annual spring wetland vegetation monitoring program in 2024–25.

Wetland vegetation monitoring of The Spectacles did not occur during the 2020–2023 triennial reporting period which is a departure from the triennial monitoring frequency set out in the 2021 environmental monitoring program. The Spectacles transect was last monitored during spring of the 2018–19 annual period. The department will assess risks of future water level declines at The Spectacles as part of the current Jandakot and Perth South groundwater allocation planning work. This will inform the need for future wetland vegetation monitoring at the site.

In 2020–21, minor changes in the condition and composition of vegetation since the 2019–20 survey were recorded across most wetlands previously monitored in that year. These changes are likely to be largely associated with the natural inter-annual variability in seasonal conditions and groundwater levels, as well as continued regeneration at sites previously affected by fire.

Canopy condition declines since 2019–20 were recorded at four of the six sites surveyed in 2019–20 and 2020–21 (Thomsons Lake, Beenyup Road Swamp, Shirley Balla Swamp and Forrestdale Lake). Thomsons Lake recorded the largest decline in canopy condition since 2019–20. North Lake and Banganup Lake recorded minor canopy condition improvements since 2019–20. A minor decline in canopy condition was recorded at Twin Bartram Swamp since the previous survey in 2014–15.

Over the long term, canopy condition has declined at all sites except Banganup Lake. The largest long-term decline in canopy condition has occurred at Thomsons Lake where insect damage continued to affect *Eucalyptus rudis* in 2020–21.

The monitoring in 2020–21 showed Banganup Lake had a healthy overstorey due to post-fire regeneration and growth of *E. rudis*. However, the vegetation remains at risk of a threshold response in ecohydrological state. A threshold response is where particular 'groups' of species that prefer wetter conditions may be lost from the ecosystem due to excessive drying. The native sedges, *Baumea articulata* and *B. juncea*, which were present in moderate to high abundance before 2008 are now absent from the transect, despite some recent improvement in groundwater levels at the lake.

Spread of exotic species continues to be a significant driver of floristic change at Jandakot wetlands. Most sites monitored recorded moderate to large increases in exotic cover-abundance since baseline monitoring, possibly due to increased urbanisation and other local factors (such as fire at Banganup Lake). In 2020–21, the invasive species *Zantedeschia aethiopica* (arum lily) remained a dominant understorey species at North Lake and Lake Forrestdale and increased in density at Thomsons Lake. This exotic species is likely having a negative impact on species richness, cover-abundance and recruitment of native species in these locations. Forrestdale Lake recorded the largest increase in exotic cover-abundance since 2019–20, likely due in part to the lack of inundation of the transect in 2020–21. Twin Bartram Swamp recorded a notable decrease in exotic cover-abundance compared to the previous survey in 2014–15 and 2000 baseline, possibly attributable to inundation of the transect in 2020–21 and council weed management.

Terrestrial vegetation

Terrestrial vegetation monitoring of five transects was last conducted in November 2019. Terrestrial vegetation monitoring did not occur during the 2020–23 triennial reporting period which is a departure from the triennial monitoring frequency set out in the 2021 environmental monitoring program. The department plans to undertake the next round of terrestrial vegetation monitoring in Spring 2025–26.

Groundwater level monitoring at Superficial aquifer bores associated with the terrestrial vegetation transects was undertaken during the reporting period at the bores shown in Table 6 (levels at JM8 could not be accessed for monitoring during the triennial reporting period). Minimum groundwater levels at the bores have been relatively stable since monitoring was last undertaken in 2019 and levels have remained compliant with absolute water level criteria at JE4C and JM14.

Table 6 Monitoring bores associated with terrestrial vegetation transects on the Jandakot groundwater system

Site	Bore	Water level criteria (mAHD)
Liddelow	JE4A	-
	JE4C	23.5
Thomsons Lake	T10C	-
	TM13C	-
Airport	JM14	23.89
	JM8	23.38
Modong West	T150 (O)	-
	T150 (I)	-
Modong East	T201 (O)	-
	T210 (I)	-

Wetland macroinvertebrates and water quality

Over the triennial reporting period macroinvertebrates and water quality were monitored in spring at the sites listed in Table 7.

Table 7 Sites where wetland macroinvertebrate and water quality monitoring occurred over the 2020–2023 triennial reporting period

	2020–21	2021–22	2022–23
Ministerial criteria sites	North Lake Thomsons Lake Kogolup Lake (South) Forrestdale Lake	North Lake Thomsons Lake Kogolup Lake (South) Forrestdale Lake Shirley Balla Swamp	North Lake Thomsons Lake Kogolup Lake (South) Forrestdale Lake
Reference	Bennelongia 2021	Bennelongia 2022	Lateral Environmental 2023

2022-23

Monitoring was not undertaken at Shirley Balla Swamp as it was already dry when monitoring occurred in November 2022. The department intends to target Shirley Balla Swamp earlier in spring in future years to carry out sampling before the lake dries. Monitoring at other sites found:

- Peak water levels at the four monitored wetlands were lower than the previous year.
- North Lake continues to have high nutrient, chlorophyll *a,* iron and turbidity levels and low dissolved oxygen and pH compared to most other sites. Total phosphorus, total nitrogen and ammonium concentrations in North Lake in 2022–23 were higher than historical results which indicates that localised eutrophication across the area may be increasing.

- Most of the tested parameters at Thomsons Lake were within historical ranges and the limits of acceptable change[6] (LAC) for the site. Exceptions include electrical conductivity and total nitrogen which were above the LAC and turbidity which was higher than the historical range. Chlorophyll *a* and dissolved oxygen both improved compared to 2021–22.
- Total oxidised nitrogen, ammonium and pH were higher than usual at Kogolup Lake (South). Iron concentrations reduced compared to 2021–22 but remained higher than usual which may be related to low dissolved oxygen levels or drying.
- Total nitrogen at Lake Forrestdale was above the LAC and total oxidised nitrogen was higher than the historical range. Other water quality parameters were generally within the LAC and historical range.
- Wetland conditions were still supporting healthy macroinvertebrate assemblages. Total family richness at the monitored wetlands was similar to previous years. The family richness at Thomsons Lake and Lake Forrestdale were within the LAC. Lower family richness at North Lake may reflect suboptimal habitat and environmental conditions compared to other wetland sites.

2021-22

Monitoring was undertaken at all five wetlands. The monitoring found:

- Peak water levels at all wetlands were higher than the previous three years.
- North Lake had high nutrient concentrations compared with the other wetlands monitored. Chlorophyll *a* was high and dissolved oxygen low, indicating the presence of an algal bloom during sampling. Other parameters were within historical ranges.
- Most of the tested parameters at Thomsons Lake were within historical ranges and the LAC for the site (Maher & Davis 2009). Nitrogen exceeded the LAC. Conductivity was the highest recorded since 2010 but was within historical ranges. Chlorophyll *a* and dissolved oxygen exceeded the LAC and were indicative of an algal bloom at the time of sampling.
- There was little variation in water quality at Kogolup Lake (South), with all tested parameters, except for dissolved oxygen, within historical ranges.
- Shirley Balla Swamp is a naturally acidic wetland. Water quality measures were within historical ranges.

[6] Limits of acceptable change are defined as the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland without indicating change in ecological character which may lead to a reduction or loss of the values for which the site was Ramsar listed (Phillips (2006) in Maher and Davis (2009)).

- Water quality parameters at Lake Forrestdale were within historical ranges. Dissolved oxygen, salinity, total nitrogen and chlorophyll *a* were outside the LAC for the site. All other parameters were within the LAC.
- Wetland conditions were still supporting healthy macroinvertebrate assemblages. Total species richness across the five wetlands sampled was higher than the past three years, likely due to higher water levels.

2020-21

Monitoring was not undertaken at Shirley Balla Swamp as it was dry. The monitoring found:

- High nutrient concentrations and low dissolved oxygen levels at North Lake compared with the other wetlands monitored.
- Most of the tested parameters at Thomsons Lake were within historical ranges and the LAC for the site (Maher & Davis 2009). Nitrogen exceeded the LAC. Conductivity was the highest recorded since 2010 but was within historical ranges. Chlorophyll *a* and dissolved oxygen exceeded the LAC and were indicative of an algal bloom at the time of sampling.
- There was little variation in water quality at Kogolup Lake (South), with all tested parameters, except for dissolved oxygen, within historical ranges.
- Water quality parameters at Lake Forrestdale were similar to previous years and within historical ranges. However, dissolved oxygen, salinity, nitrogen and chlorophyll *a* were outside the LAC for the site. All other parameters were within the LAC.
- Wetland conditions are able to support healthy macroinvertebrate assemblages. Species richness declined slightly at all sites in 2020–21 compared with 2019–20. Abundance remained similar to previous years.

5.2 Management actions

Managing public water supply

Every year the department works with Water Corporation to optimise the distribution of abstraction for the IWSS, including from the Jandakot borefield (Figure 1), by considering groundwater level trends and the results of ecological monitoring. The department uses a bore sensitivity classification system to help limit abstraction in sensitive locations, such as from production bores close to sites that are non-compliant with water level criteria set in *Ministerial Statement no. 688*.

Managing local government and other private licensed use

The department monitors private licensed use through on-ground compliance inspections, meter audits, water use surveys and standard checks as part of the licence renewal process. Through this work the department verifies that groundwater use is within licensed entitlements and that site activities are authorised.

We also work 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 evaluate potential alternative water supply options.

Under the *Rights in Water and Irrigation Amendment Regulations 2018* all bores with a licensed entitlement greater than 10 000 kL/year were required to have a meter fitted by the end of 2020. The 2018 regulations support improved water resource management over previous requirements, which only mandated metering for entitlements of 500 000 kL/year or greater. Licence holders must adhere to their licence conditions and provide metered information annually to the department.

The department's response to non-compliance, including failure to install a meter and exceedance of annual water entitlements, can range from educational letters and warning notices to statutory direction and infringement notices, and, in some cases, prosecution.

Managing groundwater use exempt from licensing

The use of domestic garden bores is managed under the provisions of the *Water Agencies (Water Use) By-Laws 2010*. Permanent water efficiency measures are in place across the Jandakot Mound. They include:

- a total winter sprinkler switch-off between 1 June and 31 August each year (unless amended by the Minister due to low rainfall).
- a daytime sprinkler ban between the hours of 9am and 6pm.
- watering day rosters for scheme and domestic garden bore sprinkler use.

From 1 September 2022, the sprinkler roster for domestic garden bore use changed from three days to two-days-per-week – the same roster as for scheme water users. The State Government is supporting garden bore users to adopt waterwise practices through a variety of means including through the Be Groundwater Wise community education initiative (see below). The Water Corporation also offers rebates for waterwise products such as smart irrigation controllers, provides advice on waterwise plant selections for homeowners and endorses waterwise specialists such as garden designers, landscapers, irrigators and nurseries that homeowners can utilise to improve their waterwise practices.

Compliance and enforcement of garden bore watering restrictions is undertaken in collaboration with Water Corporation.

Waterwise Perth action plan

The *Waterwise Perth action plan* was released in October 2019 to help transition Perth to a leading waterwise city by 2030 (Government of Western Australia 2019). The 2019 action plan involved eight government agencies coordinating on 38 actions with the aim of creating waterwise communities and helping Perth to stay beautiful, cool and liveable in the face of reducing water resources and rising temperatures as a result of climate change. The plan aims to achieve responsible and sustainable use of water from all sources, including groundwater, and well-designed private and public green spaces to make the most of the Perth and Peel region's limited water resources.

The second two-year plan, *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan* 2, was launched in October 2022 (Government of Western Australia 2022) and has broadened to include 11 agencies and 41 actions. The department continues to work with local government, industry and the broader community to fulfil (amongst others) the following action plan commitments:

- reduce Perth and Peel groundwater use by 10 per cent by 2030
- Waterwise Gold status achieved by all Perth and Peel councils
- best practice waterwise policies integrated into all state urban water policies, guidelines and technical advice notes
- 100 per cent of irrigated open space audited and adopting waterwise management practices.

The *Cockburn groundwater allocation plan* was released in January 2021 (DWER 2021) as a deliverable under Action 20[7] of *Kep Katitjin – Gabi Kaadadjan*. Also under Action 20, the department is currently reviewing allocation limits for the Jandakot and Perth South groundwater areas and the Serpentine groundwater area. See Figure 1 for the location of these groundwater areas in relation to sites with water level criteria set in *Ministerial Statement no. 688.*

Be Groundwater Wise

The Be Groundwater Wise community education initiative was part of the 2019 *Waterwise Perth action plan* and continues in *Kep Katitjin – Gabi Kaadadjan*. In collaboration with Water Corporation, the department has developed the Be Groundwater Wise website that provides a central location for the community to learn about the importance of groundwater and how to use groundwater wisely, such as through developing waterwise gardens and through waterwise use of garden bores.

The initiative also includes regular social media campaigns at key points in the year, such as in spring when homeowners begin to switch on their irrigation systems after winter and plant out new gardens.

[7] Action 20 of *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan* 2 is "Review allocation limits across the Boorloo and Bindjareb (Perth and Peel) region to manage groundwater levels for its sustainable use in line with the impacts of climate change."

5.3 Research initiatives

The department continues to undertake research to better understand and manage water resources on the Jandakot groundwater system. This includes updating the Perth Regional Aquifer Modelling System for use in the allocation limit reviews for the Jandakot and Perth South groundwater areas.

Projects currently underway that will contribute to the understanding and management of the Jandakot resources include:

- Development of updated climate science guidance using model projections from the Coupled Model Intercomparison Project Phase 5 (CMIP5) suite of global climate models.
- Testing of PRAMS version 3.6 through application of the updated climate science guidance.
- State telemetry program:
    - Approximately half of the department's total monitoring bore network will undergo installation of telemetry systems between 2023–24 and 2026–27, including many of the monitoring bores relevant to the Jandakot Mound groundwater resources proposal. This will provide a wealth of monitoring information that will be very useful for ongoing management of the groundwater resources, including groundwater model development and evaluation, assessment of groundwater licence applications, monitoring the effects of groundwater abstraction, rainfall and land use changes on the groundwater resource, and for improving the understanding of connectivity between aquifers.

5.4 Consultation

The department holds annual meetings with the Jandakot Community Consultative Committee (JCCC), in line with the commitment in *Ministerial Statement no. 688.* The committee is chaired by Professor Philip Jennings from Murdoch University, and includes representatives from the cities of Cockburn and Armadale, the Department of Biodiversity, Conservation and Attractions (DBCA), the Wetlands Centre Cockburn, Perth NRM, Friends of Forrestdale, Banjup Residents Group, South East Regional Centre for Urban Landcare, the Waterbird Conservation Group, and the Water Corporation. The department provides an update to the committee on the preceding year's management of Jandakot groundwater resources, including its compliance with water level criteria, allocation and the outcomes of ecological monitoring.

During the reporting period, the department sponsored the annual WA Wetlands Conference, hosted by the Wetlands Centre Cockburn each February. Staff attended a DWER booth over the two- to three-day period of the conference, liaising with stakeholders and responding to any questions or concerns raised by members of the public. As the conference venue is located adjacent to Bibra Lake, it attracts many

interested community members from the local Jandakot Mound area, and department staff regularly respond to questions and concerns around environmental management of Jandakot wetlands, and around issues related to the use of groundwater for public and private supply.

More broadly, the department provides 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 that environmental and resource restrictions are properly considered.

Over the reporting period, the department worked closely with the Department of Planning, Lands and Heritage (DPLH) to incorporate relevant water-related guidance into the Western Australian Planning Commission's (WAPC) review of the state's water planning policy framework. The WAPC released the *Draft State Planning Policy 2.9 Planning for Water (SPP 2.9)* (WAPC 2021a) and *Planning for Water Guidelines* (WAPC 2021b) for public comment at the end of 2021 and is currently reviewing the submissions received on those documents.

Once gazetted, SPP 2.9 and Guidelines will replace water-related policies including *State Planning Policy 2.9 Water Resources* (Government of Western Australia 2006), and *Better urban water management* (WAPC 2008). The new framework will set out how water resources should be considered at each planning stage by identifying the actions and investigations required to support decisions at each level of planning.

The department is currently preparing a groundwater allocation plan for the Jandakot and Perth South groundwater areas, which will involve considerable stakeholder and public consultation and engagement during the 2024–25 reporting period.

Appendices

Appendix A — Water level monitoring results for Ministerial sites on the Jandakot Mound for 2013–2023

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)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
North Lake	Staff 424 6142521	13.29	12.68	Peak water levels should not decline at rate greater than 0.1 m/year. Monitor staff gauge.	Max	13.01	13.11	**12.79**	12.95	13.03	13.38	**12.98**	**12.62**	13.22	**13.08**	Compliance and trends: **Non-compliant with absolute minimum criterion.** The lake has been non-compliant with the absolute minimum criterion at both the staff gauge and the bore since 2006–07. The lake dried at 12.30 mAHD in January 2021, in April 2022 and in March 2023. Water levels in the North Lake bore declined about one metre between the start of monitoring in 1997 until around 2013 but have been relatively stable from 2014 onwards. Peak surface water levels at the lake increased by about 0.75 m between 2010 and 2018 and have declined about 0.25 m since then. **Non-compliant with other criterion.** Peak water levels improved in 2021–22 after declining by more than 0.1 m/year in 2019–20 and 2020–21. They declined by more than 0.1 m/year again in 2022–23. Overall, peak water levels rose 0.1 m over the triennial reporting period. Ecological condition: Minor increases in canopy condition were recorded in 2020 compared to 2019. 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 understanding of the lake's hydrogeology in relation to its ecological health (Bourke et al. 2013). In 2014–15, the department updated the Superficial aquifer allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological health at the lake. The lower allocation limits reduced the risk of future increases in abstraction impacting on lake levels.
					Min	**12.30**	**12.30**	**12.00**	**12.30**	**12.30**	**12.30**	**12.43**	**12.30**	**12.30**	**12.30**	
	Bore 61410726				Max	12.87	12.85	**12.49**	12.58	12.65	12.98	**12.64**	**12.16**	12.94	**12.72**	
					Min	**11.52**	**11.61**	**11.87**	**11.66**	**11.81**	**11.80**	**11.60**	**11.59**	**11.60**	**11.78**	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
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 Either Bibra or Yangebup Lake must contain 0.3 m water, preferably 0.5 m	Max	14.3	14.3	14.0	14.1	14.3	14.5	14.3	14.0	14.3	14.3	Compliance and trends: **Non-compliant with absolute minimum criterion.** The lake is consistently non-compliant with the absolute minimum criterion and has been non-compliant since 2006–07. Annual peak levels at the lake rose by about 0.75 m over the period 2010–2018 and have declined slightly since then. **Non-compliant with other criterion.** The lake is non-compliant with the other criterion as it has dried more than two times in three years. Both Bibra and Yangebup Lake contained more than 0.3 m of water when peak water levels occurred during the triennial period. When water levels were at their lowest during each autumn of the triennial period, Bibra Lake was dry, but Yangebup Lake contained more than 0.3 m of water. Ecological condition: The Bibra Lake transect was not monitored during the triennial reporting period and was last surveyed in 2017. Long-term monitoring of this transect from 1997 to 2017 showed declines in canopy condition, changes in species composition to more terrestrial species and increases in abundance of exotic species. Due to the change in vegetation condition, this transect has been removed from the wetland vegetation monitoring. Management and mitigation: In 2014–15, the department updated the Superficial aquifer allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological health at the lake. The revised allocation limits reduced the risk of future increases in abstraction impacting on lake levels.
					Min	**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**	**13.5**	**13.5 dry 04/02**	**13.5 dry 09/02**	**13.5 dry 09/02**	**13.5 dry 02/03**	
	Bore BM7C 61410177				Max				13.9	14.0	14.2	14.1	13.7	14.0	14.0	
					Min			**13.0**	**13.2**	**13.2**	**13.2**	**12.8**	**12.9**	**13.1**	**13.1**	
Kogolup Lake (South)	Staff 6142522	13.1–14.0 <14.8 peak	13.1		Max	15.1	15.2	14.6	14.9	15.1	15.3	16.1	14.5	15.3	15.2	Compliance: **Compliant with absolute minimum criterion.** Maximum lake levels recorded in 2020–21 were the lowest recorded since 2010–11. Absolute minimum surface water levels in 2022–23 were the highest recorded since 2017–18. Additional information: Water Corporation monitors surface water levels at this site.
					Min	14.1	14.4	13.8	13.9	14.1	13.8	13.8	13.8	13.8	14.0	
	Bore 6015 61410727				Max	15.1	15.2	14.6	14.7	15.0	15.3	15.2	14.4	15.3	15.1	
					Min	14.0	14.0	13.6	13.8	14.0	14.0	13.5	13.5	14.0	13.8	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
Thomsons Lake	Staff 609 6142517	11.3–11.8	10.8	For 30% of time water levels meet the following criteria: • >11.8 mAHD (“wet” year – 10 %). • 11.3–11.8 mAHD (“medium” year – 80 %). • 10.8–11.3 mAHD (“dry” year – 10 %).	Max	12.5	12.4	12.2	12.6	12.6	12.8	12.6	12.3	13.2	12.9	Compliance and trends: **Compliant with absolute minimum and other criteria.** The lake staff gauge dries at 11.5 mAHD so compliance is measured at the bore. Maximum surface water levels recorded in 2021–22 were the highest recorded since at least 2005–06. Minimum and maximum groundwater levels have risen since 2011. The other criteria are based on calendar year rainfall, not water year. 2020 was classed as a “dry” year with 664.8 mm of rainfall received at Jandakot Airport (BoM station no. 9172). 2020–21 water levels were above the water levels of 10.8–11.3 mAHD set for “dry” years. 2021 and 2022 were classed as “medium” years with 922.6 mm and 757.0 mm of rainfall received respectively. 2021–22 and 2022–23 water levels were above the water levels of 11.3–11.8 mAHD set for “medium” years. Minimum water levels met the applicable criteria based on effective rainfall during eight of the past ten years which means the minimum compliance rate of 30% was achieved over this period. Ecological condition: Monitoring in 2020 identified declines in the canopy condition of *Eucalyptus rudis* since 2019. Understorey vegetation in 2020 was once again dominated by high abundances of exotic species. There are stands of *Baumea articulata* and *Melaleuca rhaphiophylla* downgradient of the transect. Additional information: The Department of Biodiversity, Conservation and Attractions implements an annual supplementation and sampling analysis plan that it developed in 2004–05. The lake is supplemented over the winter months to ensure it contains sufficient water in late spring and early summer to support migratory and resident bird populations. It is also intended to allow cygnets more time to mature enough to fly over the vermin-proof fence surrounding the lake. Water Corporation monitors surface water levels at this site.
					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	
	Bore TM14A 61410367				Max	12.1	12.1	11.8	12.0	12.2	12.4	12.3	12.0	12.4	12.6	
					Min	**11.2**	**11.2**	11.1	11.3	11.4	11.5	11.3	11.3	11.4	11.7	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
Lake Forrestdale	Staff 6162557	21.2–21.6	21.1	Preferred earliest drying by: • April (“wet” year) • February to March (“medium” year) • January (“dry” year) Peak lake levels must be at least 0.9 m deep (22.6 mAHD).	Max	**22.0**	**21.9**	**21.8**	**22.0**	**22.0**	**22.1**	**21.9**	**21.8**	**22.3**	**22.2**	Compliance and trends: **Non-compliant with absolute minimum criterion.** The lake staff gauge dries at 21.5 mAHD so compliance is measured at the bore. The site was last compliant with the absolute minimum criterion in 2016–17 and 2017–18. Water levels in the bore have been relatively stable since monitoring began in the mid-1990s. The minimum groundwater level in 2022–23 was below the absolute criterion before being rounded to one decimal place. **Non-compliant with other criteria.** Peak levels at the lake in 2021–22 were the highest they had been since 2005–06, and about 0.5 m higher than they were the previous year. However, the lake still did not achieve a minimum depth of 0.9 m (22.6 mAHD) over the reporting period. The lake is consistently non-compliant with this criterion. The other criteria are based on calendar year, not water year. 2020 was classed as a “dry” year with 664.8 mm of rainfall received at Jandakot Airport (BoM station no. 9172). During 2020–21, the lake dried before the “dry” year preferred month of January. 2021 and 2022 were classed as “medium” years with 922.6 mm and 757.0 mm of rainfall received respectively. In 2021–22 and 2022–23 the lake likely dried in February, coinciding with the preferred “medium” year months of February to March. Ecological condition: The health and abundance of *M. rhaphiophylla* declined in 2020, with new deaths recorded. The condition of mature *E. rudis* also deteriorated in 2020. Overall canopy condition declined from 2017 to 2020 after previously showing some improvement since 2009. Monitoring in 2020 identified that there continues to be an increase in abundance of exotic species which are the dominant cover along the transect. Management and mitigation: In 2014–15, the department updated the Superficial aquifer allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological health at the lake.
					Min	dry 04/01	dry 13/01	dry 11/01	dry 21/02	**dry 04/12**	dry 08/01	**dry 02/12**	**dry 04/12**	dry 01/02	dry 07/02	
	Bore 602 61410714				Max	23.2	23.1	23.0	23.1	23.1	23.1	23.1	22.8	23.3	23.2	
					Min	**20.8**	**20.8**	**20.6**	21.4	21.1	**20.9**	**20.7**	**20.7**	**20.9**	**21.1**	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
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	17.1	16.9	16.4	16.8	16.4	16.7	16.6	16.6	16.9	16.9	Compliance: **Compliant with absolute minimum and other criteria.** In 2021–22 and 2022–23 peak water levels were the highest recorded since 2014–15. Both Bibra and Yangebup Lake contained more than 0.3 m of water when peak water levels occurred during the triennial period. When water levels were at their lowest during each autumn of the triennial period, Bibra Lake was dry, but Yangebup Lake contained more than 0.3 m of water. Additional information: As part of the Jandakot Drainage Scheme, Water Corporation monitors surface water levels at this site and lowers water levels if the peak is exceeded.
					Min	15.6	15.5	14.9	15.2	15.3	15.4	15.0	15.3	15.3	15.5	
	Bore JE21C 61419707				Max	16.2	16.2	15.8	16.0	15.8	16.1	16.0	15.7	16.3	15.9	
					Min	15.0	15.0	14.9	15.1	15.4	14.8	14.7	15.0	15.1	15.2	
Banganup Lake	Staff 5719 6142516		11.5		Max	12.7	12.7	12.7	12.7	12.6	12.6	12.9	12.6	13.0	12.8	Compliance and trends: **Compliant with absolute minimum criterion.** Minimum groundwater levels have partially recovered and stabilised at this site in recent years, despite lower rainfall in 2020. Ecological condition: Since the 2015 fire, there has been regeneration, and an improvement in canopy condition and health of both *E. rudis* and *Melaleuca preissiana*. Despite a stabilisation in water levels *Baumea spp*. remained absent from the transect in 2020.
					Min	12.7	12.7	12.7	12.7	12.6	12.6	12.6	12.6	12.6	12.6	
	Bore LB14 61419614				Max	12.4	12.2	12.3	12.3	12.4	12.7	12.8	12.3	12.8	12.8	
					Min	**11.4**	11.6	**11.3**	**11.4**	11.5	11.8	11.6	11.7	11.7	11.8	
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	24.7	24.6	24.3	24.4	24.6	24.3	24.7	24.4	24.8	24.3	Compliance and trends: **Compliant with absolute minimum and other criteria.** Minimum surface and groundwater levels have remained relatively stable over the past few years. The lake has not dried before the end of January since 2010–11. Water levels have been above the preferred minimum level since 2010–11. Ecological condition: The health of mature *M. rhaphiophylla* has declined only very slightly over the long-term monitoring period and 2020 monitoring results were consistent with this trend. Since 1997, most trees have been in average to good health and in 2020 three mature *Banksia spp.* were in excellent health. Recruitment of *M. rhaphiophylla* and *Banksia menziesii* was recorded in 2020. Native species richness and cover abundance has been slowly increasing at the site since 2000 and significant improvements were observed in both parameters in 2020 compared to the previous survey in 2014. Monitoring in 2020 identified that exotic richness was only slightly greater than in 2000 and exotic cover-abundance had reduced since 2000. The observed exotic decline is possibly due to inundation of the lower part of the transect; density of native mid- and understorey vegetation in the mid part of the transect; and weed management in the upper part of the transect.
					Min	23.4	23.5	23.3	23.7	23.8	23.6	23.5	23.5	23.5	23.4	
	Bore JE6C 61410715				Max	24.7	24.6	24.3	24.4	24.6	24.8	24.6	24.4	24.9	24.5	
					Min	23.4	23.6	23.3	23.7	23.9	23.7	23.5	23.6	23.5	23.6	

Wetland	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
Shirley Balla Swamp	Staff 6142576		23.1 m AHD or 0.5 m below lake base, whichever is higher	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	25.2	25.5	**25.3**	25.2	25.2	25.4	**25.1**	25.0	25.3	25.2	Compliance and trends: **Non-compliant with absolute minimum criterion.** The lake staff gauge dries at 25 mAHD so compliance is measured at the bore. Minimum water levels have consistently been below the absolute minimum criterion, except for the 2014–15 reporting period. **Non-compliant with other criterion.** The wetland has dried before the end of January every year. Peak surface water levels and minimum groundwater levels did not decline by more than 0.1 m/year during the triennial reporting period. The peak groundwater level declined by more than 0.1 m/year in 2022–2023. Overall, peak surface water levels rose 0.1 m over the triennial reporting period and peak groundwater levels declined by 0.1 m over the triennial reporting period. Ecological condition: Recruitment of *Melaleuca rhaphiophylla* and *M. preissiana* has continued across the transect since a fire in 2014. Canopy condition has generally been recovering since the 2014 fire but declined from 2019 to 2020, possibly because of the dry winter and lower water levels recorded in 2020. Management and mitigation: In 2014–15, the department updated the Superficial aquifer allocation limits in the Jandakot groundwater area based on a review that considered compliance, water level trends and ecological health at the lake. The revised allocation limits reduced 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-years criterion cannot be applied. Further review of criteria is required and will be undertaken as part of the groundwater allocation limit review currently in progress.
					Min	**dry 02/12**	**dry 02/02**	**dry 01/12**	**dry 01/12**	**dry 04/12**	**dry 03/12**	**dry 08/01**	**dry 02/11**	**dry 01/12**	**dry 01/11**	
	Bore 61410713				Max	25.3	25.6	**25.4**	**25.2**	25.2	25.5	**25.2**	25.1	25.3	**25.1**	
					Min	**24.4**	24.7	**24.2**	**24.2**	**24.3**	**24.2**	**23.9**	**23.8**	**24.0**	**23.9**	
Beenyup Road Swamp	Staff 6142547	24.0	23.6	Bore must be above preferred minimum 4 in every 6 years.	Max	25.3	25.3	24.9	25.1	25.3	25.5	25.3	24.9	25.6	25.4	Compliance: **Compliant with absolute minimum and other criteria.** The lake staff gauge dries at 24.6 mAHD so compliance is measured at the bore. Water levels have been above the preferred minimum since 2003–04. Ecological condition: Health of *M. rhaphiophylla* remained good in 2020, and there was continued recruitment of this species. *Baumea articulata* distribution and abundance on the transect in 2020 remained similar to previous years, but its health had declined since 2018 and 2019.
					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	
	Bore 61410711				Max	25.4	25.3	24.9	25.2	25.3	25.6	25.4	25.0	25.6	25.5	
					Min	24.4	24.4	24.1	24.5	24.6	24.4	24.2	24.3	24.5	24.5	
The Spectacles	Staff 6142528	No water level criteria			Monthly water monitoring data available on Water Information Reporting website.											The 2021 environmental monitoring program specified monthly water level monitoring at The Spectacles which was undertaken during the triennial reporting period. *Ministerial Statement no. 688* does not include water level criteria for The Spectacles.
	Bore SP1_1D 61419854				Monthly water monitoring data available on Water Information Reporting website.											

Table A2 Phreatophytic vegetation or rare flora sites

Monitoring bore	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
Vegetation sites																
JM14	61610247	24.39	23.89		Max	25.67	25.91	25.26	25.58	25.67	26.13	25.48	25.04	25.71	25.64	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.61	24.78	24.35	24.68	24.75	24.75	24.47	24.34	24.51	24.52	
JM16/ JM16A	61610445/ 61612151	23.90	23.40		Max	25.53	25.56	25.13	25.30	25.51	25.71	25.36	24.86	25.41		Compliance: **Unavailable.** JM16 was destroyed by roadworks in August 2022. A replacement bore, JM16A (AWRC ref. 61612151) was drilled adjacent to JM16 during 2022–23 and is currently being surveyed. We will measure compliance with water level criteria at the new bore once it is surveyed in early 2024.
					Min	24.31	24.39	24.19	24.49	24.57	24.40	24.22	24.11	24.31		
JM19	61610177	25.26	24.76		Max	26.06	26.18	25.72	26.41	26.82	27.27	27.05	26.71	27.23	27.45	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.90	25.26	24.84	25.28	25.90	26.22	26.10	26.07	26.42	26.46	
JM35	61610333	21.25	20.75		Max	25.76	26.06	25.02	23.39	24.13	25.18	24.75	24.00	25.28	24.99	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.08	21.76	20.91	21.45	21.86	22.56	22.15	21.98	22.94	23.20	
JM39	61410142	21.20	20.70		Max	23.80	23.71	22.46	22.76	23.56	24.39	23.61	22.82	24.43	24.00	Compliance: **Compliant with absolute minimum criterion.**
					Min	21.52	21.37	20.76	21.08	21.59	21.85	21.42	21.49	21.47	21.92	
JM49	61410111	22.34	21.84		Max	23.89	23.98	23.67	23.86	24.02	24.23	24.11	23.60	24.10	24.03	Compliance: **Compliant with absolute minimum criterion.**
					Min	23.04	23.01	22.93	23.08	23.19	23.20	22.92	22.86	23.11	23.11	
8284/ 8284B	61610178/ 61611864	24.82	24.32		Max	25.79	25.99	25.68	25.78	26.16	26.56	26.26	25.77	26.35	26.65	Compliance: **Compliant with absolute minimum criterion.** Additional information: Bore 8284 was decommissioned due to the bore collapsing while it was being airlifted. The department now uses 8284B (AWRC ref. 61611864), located adjacent to 8284, to measure water level criteria.
					Min	25.07	25.29	24.99	25.11	25.38	25.52	24.34	25.17	25.15	25.86	
JE4C	61610234	24.00	23.50		Max	25.81	25.95	25.45	25.72	26.07	26.46	26.08	25.69	26.33	26.19	Compliance: **Compliant with absolute minimum criterion.**
					Min	24.59	24.71	24.43	24.79	25.06	25.13	24.79	24.79	24.75	24.96	
JE10C	61410250	21.80	21.30		Max	25.72	25.98	26.04	25.48	25.96	26.44	26.19	25.80	26.44	26.27	Compliance: **Compliant with absolute minimum criterion.**
					Min	23.31	23.94	23.01	23.62	23.98	24.19	23.66	23.90	24.67	24.44	

Monitoring bore	AWRC reference number	Water level criteria (mAHD)		Other criteria	Water level (mAHD)										Status and comments on compliance during the 2020–23 triennial reporting period
		Pref.	Abs.			2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	
Rare flora sites																
JM7	61610180		22.06	Absolute summer minimum water levels should not decline at rate greater than 0.1 m/year	Max	24.48	24.61	24.35	24.41	24.74	25.17	24.87	24.25	24.90	24.94	Compliance: **Compliant with absolute minimum criterion.** **Non-compliant with other criterion.** After water level declines of more than 0.1 m/year in 2019–20 and 2020–21, absolute minimum water levels have shown some recovery in 2021–22 and 2022–23. Overall, absolute minimum water levels rose about 0.3 m over the triennial reporting period. Additional information: Bushland around JM7 has been progressively cleared since 2005 and the closest remnant native bushland is now about 500 m north-east of the monitoring bore.
					Min	23.59	23.77	**23.56**	23.81	24.00	24.05	**23.63**	**23.52**	23.92	23.95	
JM8	61610248		23.38	Absolute summer minimum water levels should not decline at rate greater than 0.1 m/year	Max	25.29	25.58									Compliance: **Unavailable.** Monitoring of water levels stopped in September 2014 due to access issues. The department is unable to determine compliance with absolute summer minimum or other water level criteria. The department is investigating whether access to JM8 can be reinstated or if a new bore can be installed to replace JM8 and will provide an update on this in the next annual report.
					Min	24.42										
JM45/ JM45A	61610179/ 61618756		22.71	Absolute summer minimum water levels should not decline at rate greater than 0.1 m/year	Max	24.45	24.76	24.39	24.59	24.85	25.16	24.96	24.46	25.04	25.35	Compliance: **Compliant with absolute minimum and other criteria.** After water level declines of more than 0.1 m/year in 2019–20, absolute minimum water levels recovered by about 0.4 m over the triennial reporting period. Additional information: JM45 was decommissioned in 2016–17 due to urban development in the area. The department now uses JM45A (AWRC ref. 61618756) to measure compliance with water level criteria.
					Min	23.72	23.97	**23.69**	23.82	24.09	24.09	**23.93**	23.84	24.07	24.35	
JE17C	61419703		16.35	Absolute summer minimum water levels should not decline at rate greater than 0.1 m/year	Max	18.16	18.27	18.13	18.18	18.18	18.24	18.20	18.12	18.21	18.25	Compliance: **Compliant with absolute minimum and other criteria.** After water level declines of more than 0.1 m/year in 2019–20, absolute minimum water levels have been stable over the triennial reporting period.
					Min	17.55	**17.39**	17.45	17.76	17.76	17.69	**17.58**	17.61	17.57	17.61	

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

Proponent: Department of Water and Environmental Regulation

Period: 1 July 2020 to 30 June 2023

Note: *Ministerial Statement no. 688* refers to Department of Water and Environmental Regulation (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	Requirement of:	On advice from	Phase	When/Where	Status and further information for the 2020–23 triennial reporting period
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		**Non-compliant.** Under the Waterwise Perth Action Plan (Government of Western Australia 2019 and 2022), the department is working toward a target of a 10 per cent reduction in groundwater use across the greater Perth area by 2030. The *Cockburn groundwater allocation plan* (DWER 2021) was released in 2021 and a review of allocation limits in the Jandakot and Perth South groundwater areas is currently under way. Refer also to the status of other conditions in this table and Table B2 for further information on groundwater management strategies the department is undertaking.
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		**Non-compliant.** Over the triennial reporting period, the same four sites (North Lake, Bibra Lake, Lake Forrestdale and Shirly Balla Swamp) were non-compliant each year with the absolute minimum water level criteria identified in Schedule 1 of *Ministerial Statement no. 688*.
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		**Not required at this time.** No change to proponent was made during the reporting period.
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	**Not required at this time.** No change to proponent was made during the reporting period.

Audit code	Subject	Action	How	Evidence	Requirement of:	On advice from	Phase	When/Where	Status and further information for the 2020–23 triennial reporting period
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	**Completed.** The 'status of implementation of the proposals' is 'completed' because the Water Corporation's 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	**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 4 and 5, and Appendix A and B of this report.
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 4 and 5 and Appendix A and B of this report.
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.** Condition met by submission of this report by 1 February 2024.
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.** Condition met by submission of this report to the EPA by 1 February 2024 (refer to Table B2 in Appendix B for objectives).

Audit code	Subject	Action	How	Evidence	Requirement of:	On advice from	Phase	When/Where	Status and further information for the 2020–23 triennial reporting period
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.** Condition met by submission of this report by 1 February 2024. The Jandakot Community Consultative Committee (JCCC) met annually over the triennial reporting period on: • 14 October 2020 • 20 October 2021 • 25 October 2022 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.** Condition met by submission of this report by 1 February 2024. The department submitted a revised environmental management program to the EPA on 9 April 2021. The department is continuing to review and refine its environmental management of Jandakot groundwater resources using results from environmental monitoring (see Section 5) and hydrogeological investigations and modelling (such as the update of the PRAMS groundwater model and assessment of scenario outputs). The department has begun preparation of a groundwater allocation plan for the Jandakot and Perth South groundwater areas, which will include environmental objectives and management actions to meet those objectives. The draft plan is scheduled to be released for public comment by December 2024.
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.** Jandakot annual and triennial compliance reports are available on the department's website.
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	Requirement of:	On advice from	Phase	When/Where	Status and further information for the 2020–23 triennial reporting period
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		**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 several 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 • 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. Compliance reports are published on the department's website. Information about the availability of groundwater for licensing can also be accessed on the department's Water Register. The department's recent management focus has been an allocation limit review for the Jandakot and Perth South groundwater areas. This is due to be released as a draft for public comment by December 2024. The *Cockburn groundwater allocation plan* (DWER 2021) was published in 2021 and is available on the department's website: *Cockburn groundwater allocation plan (www.wa.gov.au)*
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 5.2 outlines the management actions the department is taking to encourage further reduction in public and private water demand. Many of these strategies fall under the 2030 targets detailed in *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022). The department has recently updated its water efficiency policy for licensees: *Water conservation/efficiency plan – Achieving water use efficiency gains through water licensing* (DWER 2022a). This policy requires all licensees who must prepare an operating strategy as part of their groundwater licence conditions to include a water conservation/efficiency plan (WCEP) as part of that strategy. Licensees in high demand areas who aren't required to prepare an operating strategy may still be required to develop a WCEP.
688: M Proced-ure 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		**Not required at this stage.**
688: M Proced-ure 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		**Not required at this stage.**

Audit code	Subject	Action	How	Evidence	Requirement of:	On advice from	Phase	When/Where	Status and further information for the 2020–23 triennial reporting period
688: M Proced-ure 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 complianc e 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 and further information for the 2020–23 triennial reporting period
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 Environ-ment		Overall	**Non-compliant.** Groundwater abstraction has not satisfied all of the environmental criteria presented in Appendix A. Four sites were non-compliant with water level criteria over the 2020–23 triennial reporting period: North Lake, Bibra Lake, Lake Forrestdale and Shirley Balla Swamp. These sites have been 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 *Cockburn groundwater allocation plan* (DWER 2021) and is currently reviewing allocation limits in the Jandakot and Perth South groundwater areas. The department also considers non-compliance at these sites in its annual reviews of the distribution of public supply abstraction and in its licensing decisions for private use. A target of 10 per cent less groundwater use across Perth and Peel by 2030 was set under the *Waterwise Perth Action Plan* (Government of Western Australia 2019) and continues under *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022). Achieving this target will help protect groundwater-dependent ecosystems from declining groundwater levels and improve their resilience in the face of climate change.
688: P 2 1	Environmental management and monitoring	To minimise environmental and/or significant impact.	If 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 projects, based on water level trends, whether sites are likely to be non-compliant with water level criteria during the coming summer and if necessary, adjusts 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	**Non-compliant.** Water levels at several Ministerial sites (including North Lake, Bibra Lake, Lake Forestdale and Shirley Balla Swamp) are consistently non-compliant with water level and other criteria. However, water levels at each of those sites have been stable for the last decade or more with no long-term declining trends apparent. 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. A target of 10 per cent less groundwater use across Perth and Peel by 2030 was set under the *Waterwise Perth Action Plan* (Government of Western Australia 2019) and continues under *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022). Achieving this target will help protect groundwater-dependent ecosystems from declining groundwater levels and improve their resilience in the face of climate change.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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 reviews the distribution of public water supply abstraction from Water Corporation borefields on an annual basis. Wherever possible the department moves abstraction away from public supply bores that are most likely to affect Ministerial sites and other groundwater-dependent ecosystems at risk of impact from low water levels. See also status for **688 P 2 2**.
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, about 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 has reviewed allocation limits for the *Cockburn groundwater allocation plan* (DWER 2021) and is currently reviewing allocation limits in the Jandakot and Perth South groundwater areas. A target of 10 per cent less groundwater use across Perth and Peel by 2030 was set under the *Waterwise Perth Action Plan* (Government of Western Australia 2019) and continues under *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022). Fifteen of the 41 actions in *Kep-Katitjin* are directly contributing to this target. Achieving this reduction in use will help protect groundwater-dependent ecosystems from declining groundwater levels and improve their resilience in the face of climate change.
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 has reviewed allocation limits for the *Cockburn groundwater allocation plan* (DWER 2021) and is currently reviewing allocation limits in the Jandakot and Perth South groundwater areas. In the Cockburn groundwater area, the allocation limits set require the recouping of long-term unused water entitlements to achieve them. Improving water use efficiency, changes in land use over time, and localised recouping of long-term unused water entitlements will ensure that water use remains climate resilient. Licensed entitlements are within the allocation limits for the Jandakot groundwater area.
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 has reviewed allocation limits for the *Cockburn groundwater allocation plan* (DWER 2021) and is currently reviewing allocation limits in the Jandakot and Perth South groundwater areas. This work uses contemporary methods for determining sustainable limits for use in the decision-making process for the new allocation limits. The department uses a sophisticated numerical model, the Perth Regional Aquifer Modelling System (PRAMS) to run a range of groundwater use scenarios and assesses the results against management objectives. The PRAMS model has recently been updated and incorporates future climate projections that are based on current global climate science.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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			**Not required at this stage.** No groundwater-related environmental protection policies are currently in preparation. The department has been heavily involved in developing the draft State Planning Policy 2.9 Planning for Water (SPP2.9) and Planning for Water Guidelines. The aim of SPP2.9 and Guidelines is to streamline and simplify the current water policy framework as part of planning reform. Public comment closed on 15 November 2021 and the Department of Planning, Lands and Heritage is currently reviewing submissions and finalising the policy.
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* (BUWM) (WAPC 2008), a framework for land use planning assessments. BUWM has now been incorporated into the draft SPP2.9 Planning for Water Guidelines (see more information in the status column of **688: P 6**). The department also produced the *Jandakot drainage and water management plan* (DoW 2009), which aims to assist land developers and local government to better manage groundwater quantity and quality in the area. In 2018 the department provided updated 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. In 2020 and 2021 the department provided advice to the Department of Planning, Lands and Heritage (DPLH) and the WA Planning Commission on the water issues and constraints associated with potential development of the Jandakot-Treeby Planning Investigation Area. Under Actions 19 (alternative water supplies) and 29 (deliver integrated water planning for priority areas) of the *Waterwise Perth Action Plan* (Government of Western Australia 2019), the department worked with Water Corporation and DPLH on improving the integration of land and water planning to achieve optimal water and planning outcomes for water-constrained areas across Perth and Peel. *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022) includes two actions led by DPLH and the department to improve and then implement water-related policies, guidelines and processes to strengthen waterwise outcomes at all levels of land use planning.
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.** See the status of **688: P 7**.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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 5.2 outlines the actions the department is taking to manage supply and demand and support water conservation.
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 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 Water Corporation. See also the status of **688: P 7**.
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.** The department recently published the *Cockburn groundwater allocation plan* (DWER 2021) and is currently reviewing allocation limits in the Jandakot and Perth South groundwater areas. A target of 10 per cent less groundwater use across Perth and Peel by 2030 was set under the *Waterwise Perth Action Plan* (Government of Western Australia 2019) and continues under *Kep-Katitjin – Gabi Kaadadjan: Waterwise Perth action plan 2* (Government of Western Australia 2022).
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, Kogolup, 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. The department submitted a revised environmental monitoring program to the EPA on 9 April 2021 (DWERA-001176) (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: • groundwater levels in all relevant aquifer systems • relevant wetland water levels and water quality • condition of vegetation and fauna associated with groundwater-dependent ecosystems. An 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 2007). The EPA's audit of the 2006–07 compliance report agreed that the commitment could be 'cleared' upon confirmation from the then Department of Environment and Conservation (DEC). The department reviewed the environmental monitoring program in June 2009 with the monitoring ecologists (see Appendix D). Several amendments were made. A letter was sent to the Director General of the DEC in December 2009, seeking advice and input on the amendments. The department submitted a revised environmental monitoring program to the EPA on 9 April 2021 (DWERA-001176).

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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)		**Potentially non-compliant.** Water level monitoring, macroinvertebrate and water quality monitoring generally occurred in accordance with the 2021 environmental monitoring program during the triennial reporting period, except for the following minor departures: • Water levels at JM8 were not monitored monthly during the triennial period as the bore was not accessible to monitoring personnel. Further information is provided in Section 4.1. • Water levels at JM16 were not monitored in 2022–23 because the bore was destroyed by roadworks in August 2022. A replacement bore, JM16A (AWRC ref. 61612151) was drilled adjacent to JM16 during 2022–23 and is currently being surveyed so it can be used to assess compliance in future years. • Annual macroinvertebrate and water quality monitoring could not occur at Shirley Balla Swamp in 2020–21 and 2022–23 because the lake was dry in 2020–21 and dried before the spring monitoring event in 2022–23. The department intends to target Shirley Balla Swamp earlier in spring in future years to carry out sampling before the lake dries. The following departures from the vegetation monitoring set out in the 2021 environmental monitoring program occurred during the triennial reporting period: • Wetland vegetation monitoring at North Lake, Thomsons Lake, Forrestdale Lake, Banganup Lake, Shirley Balla Swamp and Beenyup Road Swamp transects occurred once during the triennial period rather than annually as set out in the program. Further information is provided in Section 5.1. • Wetland vegetation monitoring at The Spectacles did not occur during the triennial period but was scheduled to occur on a triennial basis in the program. Further information is provided in Section 5.1. • Terrestrial vegetation monitoring at Jandakot Airport, Liddelow, Modong West, Modong East and Thomsons Lake transects did not occur during the triennial period but was planned to occur triennially in the program. Further information is provided in Section 5.1. • Annual rapid visual inspections of vegetation condition during the end of summer period did not occur at wetland sites or specified terrestrial vegetation sites (JM19 and JM39) during the triennial period. The department is planning to update the environmental monitoring program so that these inspections are only carried as needed (i.e. following extremely hot and dry summers). A summary of the results of the environmental monitoring over the reporting period is reported in Sections 4.1 and 5.1. 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 monitoring ecologists (see Appendix D). Several 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. The department submitted a revised environmental management program to the EPA on 9 April 2021 (DWERA-001176).

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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, Kogolup, 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)	**Non-compliant.** The department has not used aerial photographs over the triennial reporting period to detect habitat shifts at North Lake, Yangebup, Kogolup, Thomsons and Forrestdale lakes. It was recognised that there may be limited value using aerial photos solely as a diagnostic tool. As a result, the commitment was modified in Bulletin 1155. The department conducts monitoring at established transects annually at each of these wetland sites. This monitoring identifies shifts in habitat. The department commissioned Dr Bea Sommer and Professor Ray Froend of Edith Cowan University to develop a model for determining ecological risk to groundwater-dependent vegetation in a drying climate (Sommer & Froend 2010). The model is based on 30 years of ecological and hydrological monitoring data. The department uses the model to assess risks 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.** The Jandakot Community Consultative Committee (JCCC) met annually over the triennial reporting period on: • 14 October 2020 • 20 October 2021 • 25 October 2022 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 of current water issues and community concerns. The department's staff are involved in conferences, meetings and workshops that include community group representation (for example JCCC meetings), and regularly respond to questions and concerns coming through various communication channels from the general public, including from social media. The department released the *Cockburn groundwater allocation plan* as a draft for public comment in 2018 and responded to submissions received through the *Cockburn groundwater allocation plan: Statement of response* in 2021. See: *Cockburn groundwater allocation plan (www.wa.gov.au)* The department will continue to consult with community and stakeholders as part of its review of allocation limits for Jandakot and Perth South groundwater areas.
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 & Paton 2010) as part of the Perth shallow groundwater systems investigation. The investigation at the lake found that it acts as a drainage basin that captures local groundwater discharge and drainage. The department has also installed telemetry monitoring sites at Lake Forrestdale and at Gibbs Road Swamp as part of works to investigate increasing flow of water from James Drain to Lake Forrestdale to support the lake's surface water levels.

Audit code	Subject	Objective	Action	How	Evidence	Require-ment of	On advice from	When/ Where	Status and further information for the 2020–23 triennial reporting period
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 public water supply 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 3**) in December 2005. A revised monitoring program was also submitted to the EPA in 2021 (DWERA-001176).
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.
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, because 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 EP Act. 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 2008). 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 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 culminated in the *Gnangara groundwater allocation plan*, which was finalised in June 2022 (DWER 2022b). The EPA is currently inquiring into the proposed changes to implementation conditions that were put forward in the Gnangara plan. For Jandakot and Perth South groundwater areas, the department is reviewing allocation limits as part of the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 2* (Government of Western Australia 2019

and 2022). The Jandakot and Perth South groundwater allocation plan is scheduled to be released as a draft for public comment by December 2024.

Appendix D – Review of the environmental monitoring program (688: P 14 1 and 688: P 14 3)

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.

The environmental monitoring program was reviewed in 2021 and submitted to the EPA on 9 April 2021 (DWERA-001176). Under the *Kep Katitjin – Gabi Kaadadjan – Waterwise Perth action plan 2* (Government of Western Australia 2022) the department is reviewing allocation limits and our environmental management program for the Perth South and Jandakot groundwater areas.

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