Great Artesian Basin Wellfields Report

Olympic Dam

1 July 2023 – 30 June 2024

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Table of Contents

List of Figures

List of Tables

1 EXECUTIVE SUMMARY

The Wellfields Report is prepared annually in accordance with the conditions of the *Roxby Downs (Indenture Ratification) Act 1982*, and the Olympic Dam and Stuart Shelf Indenture (Indenture) ratified by that Act. This report presents data that relates to the operation of the BHP Olympic Dam (OD) Great Artesian Basin (GAB) water supply from Wellfields A and B for the FY24 period (1 July 2023 to 30 June 2024).

1.1 Abstraction

The average abstraction during FY24 was 33.3 Megalitres per day (ML/d) comprising 4.4 ML/d from Wellfield A and 28.9 ML/d from Wellfield B, representing a 3% increase for Wellfield A and a 1.7 % increase for Wellfield B compared with FY23, in alignment with normal processing rates.

Monthly total abstraction rates were variable, ranging from 26.7 to 38.5 ML/d, with the lowest total abstraction in July 2023 and the highest in November 2023.

Average total daily abstraction from the wellfields area in FY24, which includes the OD wells and pastoral wells, is estimated at 49.4 ML/d.

1.2 Wellfield A

Drawdowns remained consistent with 5-year averages and in alignment with normal production rates. The average drawdown within the Wellfield Sub-Basin and the North East Sub-Basin (NESB) remains consistent with the 5-year average. Drawdowns decreased in the Extension and Open GAB area, with a small increase in drawdown in the South West Hydrogeological Zones.

In FY24, average drawdown between sites GAB8 and HH2 was 1.5 metres (m), within the 4 m compliance criteria in the Environmental Management Program (EMP) (BHP 2022a).

The hydraulic gradient between NESB bores and HH2 remained above or equal to the leading indicator gradient of 0.0009 (metres per metre (m/m)) during FY24.

1.3 Wellfield B

For Wellfield B, the drawdown pattern in FY24 is similar to that of previous reports, consistent with the predicted confined aquifer response to a wellfield that has operated for some 28 years. The area contained within the 10 m drawdown footprint for Wellfield B is 4,004 square kilometres (km^2), within the 4,450 km^2 compliance criteria in the EMP but above the 4,000 km^2 leading indicator.

The average drawdown at monitoring bores S1/S1_New and S2 (dedicated monitoring wells closest to key GAB springs) is 1.7 m, which is less than the maximum 4 m drawdown compliance criteria in the EMP (BHP 2022b). In general, drawdown and percentage wellhead pressure loss at pastoral bores remained less than the predicted long-term impact (as presented in the Environmental Impact Statement (EIS) (Kinhill Engineers 1997, updated Golder Associates 2016), with the exception of three locations (see Section 6.5).

1.4 Spring Flow

During FY24 the monitoring results indicated that the spring flows increased in all hydrogeological management zones except the Wellfield A hydrogeological zone, which remained stable. All GAB spring flows remained within the predicted long-term impact (as presented in the EIS (Kinhill Engineers 1997, updated Golder Associates 2016)). Spring electrical conductivity data indicates no significant change from previously identified trends.

1.5 Monitoring Data

Monitoring of GAB bores and springs was conducted as per the Monitoring Program – Great Artesian Basin (GAB) 2022 (BHP 2022a). A summary of compliance to monitoring plan is presented in Appendix 1.

2 INTRODUCTION

2.1 Scope

This report is produced in accordance with the conditions of *the Roxby Downs (Indenture Ratification) Act 1982* (SA), and the Olympic Dam and Stuart Shelf Indenture (Indenture) ratified by that Act, the Environmental Management Program (EMP) (BHP 2022a) and the Monitoring Program - Great Artesian Basin (BHP 2022a).

The Indenture states that an annual hydrogeological report shall be prepared by a competent hydrogeologist and define the following:

- Aquifer response to wellfields operation.
- Ability of the resource to maintain the supply.
- Strategy for future abstraction and management.
- Requirements for further exploration or development.

Data presented relates to the operation of the BHP Olympic Dam Corporation Pty Ltd (ODC) Great Artesian Basin (GAB) water supply Wellfields A and B, for FY24. The objectives are to:

- Meet the requirements of Clause 13 of the Indenture.
- Report total abstraction and individual well abstraction on a monthly basis.
- Report water pressure and levels in monitoring and production wells and at the boundary of Designated Areas.
- Report water quality at monitoring and production wells on a quarterly basis.
- Compare actual impacts to predictions in the Environmental Impact Statement (EIS) by Kinhill Engineers, 1997 (updated by Golder Associates in 2016). Ensure that impacts are within predictions and expectations.
- Evaluate drawdown response of the aquifer to ODC abstraction, particularly within the Designated Areas of both wellfields.
- Delineate the drawdown induced by the wellfields, and particularly the impact on pastoral water supplies and environmental flows.
- Identify possible changes in water chemistry that may occur.
- Assess compliance with legal requirements for the operation of the GAB water supply.

2.2 Background

Water used at OD and the Roxby Downs Township is pumped from two wellfields located within the GAB. Wellfield A is located 100 kilometres (km) north of the operation at the southwest margin of the GAB. Wellfield B is located an additional 80 km to the northeast of Wellfield A, further into the basin.

The local hydrogeology has been previously described by Western Mining Corporation (WMC) during investigations for the establishment of Wellfield B (WMC 1995). Wellfield A is located at the margin of the GAB, where there is a relatively complicated basin architecture and strong influence of aquifer boundary conditions. There are separate hydrogeological domains with distinctively different responses to the Wellfield A abstraction. The distribution of the aquifer is strongly influenced by both the depositional setting of the aquifer sediments and post-depositional faulting, which has formed sub-basins that are hydraulically separated. Wellfield B is located further into the basin where the aquifer is much thicker and extensive, aquifer zonation is less marked and the effects of faulting greatly reduced. As a result, the drawdown around Wellfield B is more radially symmetrical than from Wellfield A.

A detailed description of the physical environment of the wellfields is contained in the Draft EIS (Kinhill-Stearns Roger 1982) and the Survey and Assessment Report (Kinhill Engineers 1995). Wellfield construction details are contained in 'Wellfield A Construction' (AGC 1987) and 'Borefield B Development' (WMC 1997) and related documents. The most recent hydrogeological conceptualisation was included in the GAB groundwater model developed in 2020 (Groundwater Logic et al 2020).

This report has been prepared and reviewed by a competent hydrogeologist.

3 MONITORING PROGRAM

A full and detailed description of monitoring sites, frequency, priorities and methodologies is maintained in the Great Artesian Basin Monitoring Program (BHP 2022b).

4 ABSTRACTION

4.1 Development History

Trends in long-term abstraction are summarised in Flow rate from 29 important pastoral bores in the wellfields area, where variation in flow rate could produce short-term impacts on regional monitoring, is estimated at the end of the review period. Pastoral abstractions from those 29 bores and those from Wellfields A and B are shown in Figure 4-2.

Total abstraction from the wellfields area, including ODC wellfields and the 29 pastoral bores rose from approximately 40 ML/d in 1995 to 60–70 ML/d in 2000–01 and subsequently declined to 45-50 ML/d since 2010 (Figure 4-2). Total abstraction from the wellfields area in FY24 is estimated at 49.4 ML/d.

Pastoral flows declined significantly in the period from 2000-2010 due to the bore closure program that ODC participated in during that time. Water savings of approximately 42 ML/d have been achieved through the sponsored closure of free-flowing pastoral wells in the ODC wellfield area. Third–party pastoral use was estimated during the reporting period.

Table 4-1 and Figure 4-2, with some additional commentary below:

- From FY11 until FY22 the annual average abstraction, from Wellfield A and Wellfield B combined, was between 32.1 and 33.3 Megalitres per day (ML/d) with the exceptions of FY15, FY18 FY19 and FY22. During these periods annual average abstraction reduced, due to various operational shutdowns, to between 26 to 28.8 ML/d.
- In FY23 and FY24 average abstraction was between 32 and 33 ML/d respectively, in line with recent historical norms.

4.2 Olympic Dam Abstraction During The Current Review Period

The average abstraction during FY24 was 33.3 ML/d comprising 4.4 ML/d from Wellfield A and 28.9 ML/d from Wellfield B, representing a 3% increase for Wellfield A and a 1.7 % increase for Wellfield B compared with FY23 (Table 4-1). These abstraction numbers align with processing rates with FY24 (with OD producing 10.84 million tonnes per annum (Mtpa)).

Monthly total abstraction rates were variable, ranging from 26.7 to 38.5 ML/d, with the lowest total abstraction in July 2023 and the highest in November 2023 (Table 4-2).

4.3 Total Abstraction

Flow rate from 29 important pastoral bores in the wellfields area, where variation in flow rate could produce short-term impacts on regional monitoring, is estimated at the end of the review period. Pastoral abstractions from those 29 bores and those from Wellfields A and B are shown in Figure 4-2.

Total abstraction from the wellfields area, including ODC wellfields and the 29 pastoral bores rose from approximately 40 ML/d in 1995 to 60–70 ML/d in 2000–01 and subsequently declined to 45-50 ML/d since 2010 (Figure 4-2). Total abstraction from the wellfields area in FY24 is estimated at 49.4 ML/d.

Pastoral flows declined significantly in the period from 2000-2010 due to the bore closure program that ODC participated in during that time. Water savings of approximately 42 ML/d have been achieved through the sponsored closure of free-flowing pastoral wells in the ODC wellfield area. Third–party pastoral use was estimated during the reporting period.

Table 4-1 Wellfields average annual daily abstraction rate in ML/d.

Year Ended	Wellfield A	Wellfield B	Total
30-Jun-1986	1.3	0.0	1.3
30-Jun-1987	2.2	0.0	2.2
30-Jun-1988	4.4	0.0	4.4
30-Jun-1989	8.9	0.0	8.9

Year Ended	Wellfield A	Wellfield B	Total
30-Jun-1990	10.0	0.0	10.0
30-Jun-1991	10.6	0.0	10.6
30-Jun-1992	11.6	0.0	11.6
30-Jun-1993	12.6	0.0	12.6
30-Jun-1994	12.1	0.0	12.1
30-Jun-1995	13.5	0.0	13.5
30-Jun-1996	15.1	0.0	15.1
30-Jun-1997	8.2	7.4	15.6
30-Jun-1998	5.3	12.3	17.6
30-Jun-1999	4.9	17.3	22.1
30-Jun-2000	5.2	26.2	31.4
30-Jun-2001	6.1	25.5	31.5
30-Jun-2002	6.0	24.7	30.7
30-Jun-2003	6.1	25.3	31.4
30-Jun-2004	5.4	26.0	31.4
30-Jun-2005	5.9	28.1	34.0
30-Jun-2006	4.9	29.4	34.3
30-Jun-2007	4.5	27.9	32.5
30-Jun-2008	4.3	29.1	33.5
30-Jun-2009	4.6	27.8	32.4
30-Jun-2010	2.3	19.6	21.9
30-Jun-2011	5.8	27.4	33.2
30-Jun-2012	4.1	28.2	32.3
30-Jun-2013	4.5	27.9	32.4
30-Jun-2014	5.2	27.8	33.0
30-Jun-2015	4.9	23.9	28.8
30-Jun-2016	4.5	26.9	31.4
30-Jun-2017	4.0	25.2	29.2
30-Jun-2018	4.0	23.7	27.7
30-Jun-2019	4.5	23.9	28.4
30-Jun-2020	5.3	28.0	33.3
30-Jun-2021	5.2	26.9	32.1
30-Jun-2022	3.7	22.3	26.0
30-Jun-2023*	4.3	28.4	32.7
30-Jun-2024	4.4	28.9	33.3

**Note: Data was reviewed, corrected and updated since FY23 report was published.*

Table 4-2 FY24 monthly average abstraction rate in ML/d.

	Wellfield A							Wellfield B				Wellfields
	GAB06	GAB12	GAB14	GAB15	GAB16	GAB18	Total	GAB51	GAB52	GAB53	Total	Total
Jul-23	0.58	0.00	0.00	0.00	1.87	2.24	4.68	8.26	6.24	7.46	21.97	26.65
Aug-23	0.58	0.00	0.00	0.00	1.95	2.11	4.64	9.99	7.52	8.76	26.27	30.91
Sep-23	0.60	0.00	0.00	0.00	2.01	2.21	4.82	9.92	7.38	8.60	25.89	30.72
Oct-23	0.58	0.00	0.00	0.00	2.04	2.26	4.88	11.72	8.74	10.13	30.59	35.47
Nov-23	0.60	0.00	0.00	0.00	2.10	2.21	4.91	12.88	9.62	11.10	33.60	38.51
Dec-23	0.55	0.00	0.00	0.00	1.72	1.89	4.16	11.82	8.82	10.22	30.85	35.01
Jan-24	0.58	0.00	0.00	0.00	1.44	1.58	3.60	10.60	7.83	9.18	27.61	31.21
Feb-24	0.62	0.00	0.00	0.00	1.89	2.02	4.54	12.65	9.29	10.95	32.88	37.42
Mar-24	0.56	0.00	0.00	0.00	1.06	1.19	2.82	10.72	7.94	9.34	28.01	30.83
Apr-24	0.60	0.00	0.00	0.00	1.99	2.12	4.70	12.62	9.33	10.92	32.86	37.56
May-24	0.32	0.00	0.00	0.00	2.19	2.25	4.76	11.45	8.54	9.96	29.95	34.71
Jun-24	0.60	0.00	0.00	0.00	2.02	2.12	4.74	10.31	7.72	8.79	26.82	31.56
Year Average (ML/d)	0.56	0.00	0.00	0.00	1.85	2.01	4.43	11.07	8.24	9.61	28.91	33.34
Year Total (ML)	206.5	0.0	0.0	0.0	678.4	737.5	1622.4	4050.0	3015.7	3515.8	10581.5	12203.9

Note: Sum of individual rows may not exactly match the totals due to rounding.

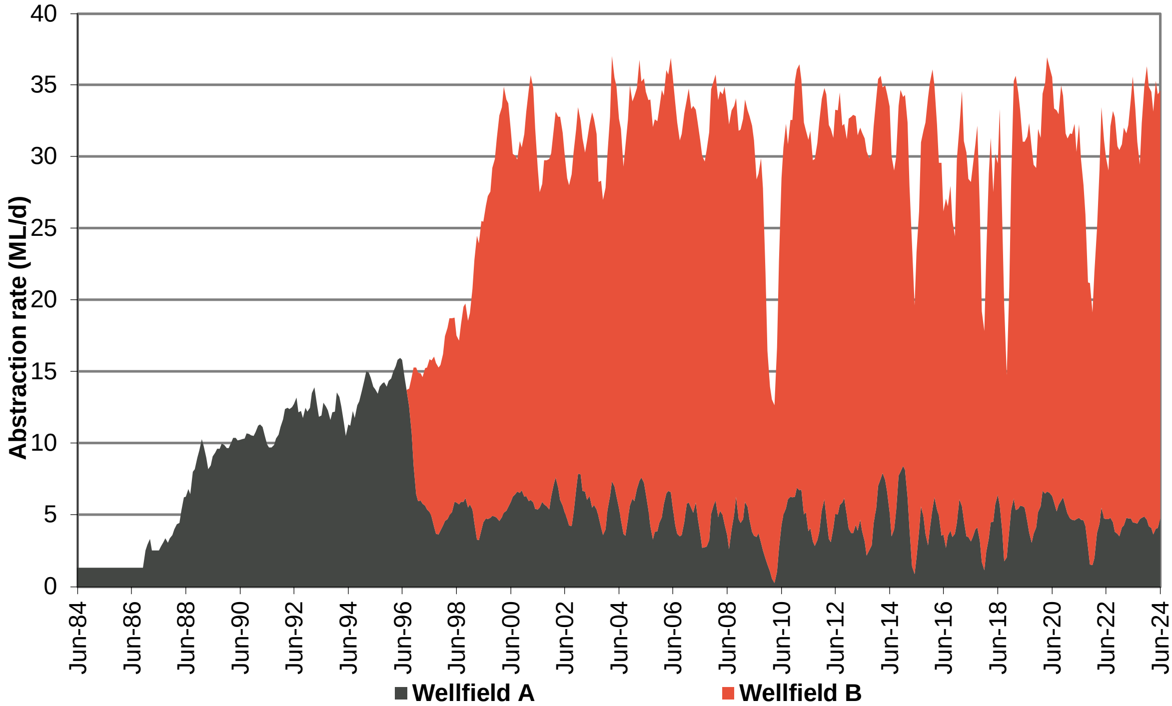


Figure 4-1 **Historical abstraction from Wellfields A and B – 3 month moving average.**

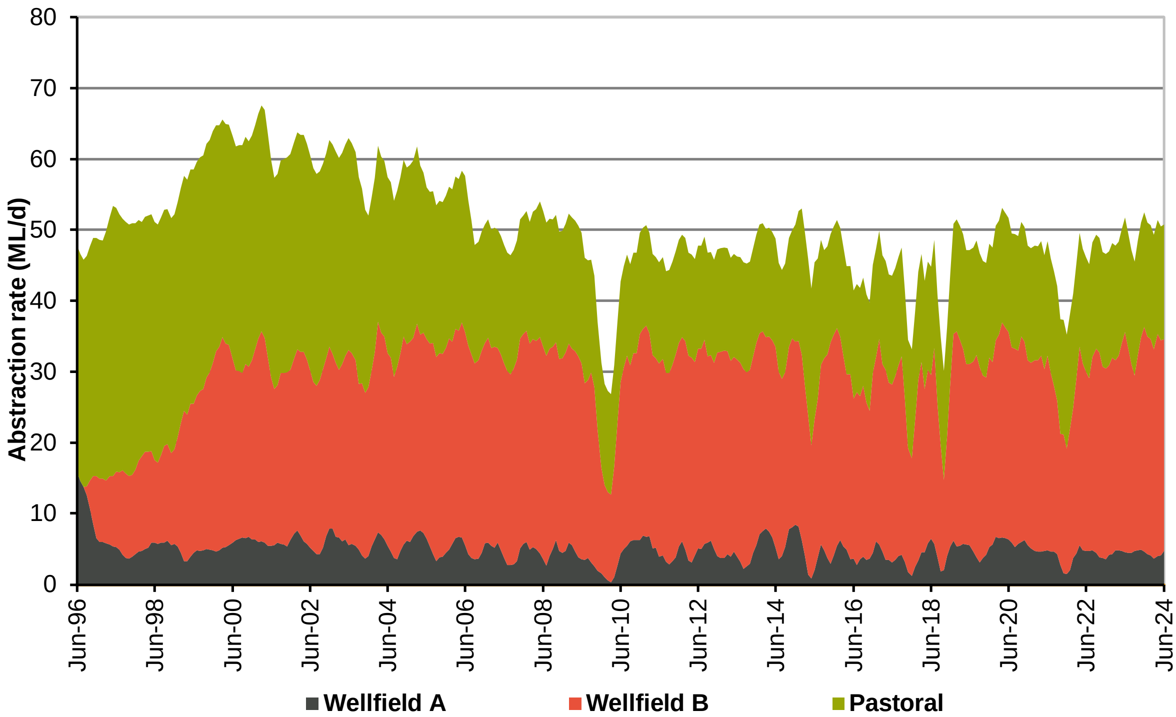


Figure 4-2 **Historical abstraction from the wellfields area – 3 month moving average.**

See Appendix 7 for list of pastoral bores used to estimate pastoral GAB abstraction.

5 WELLFIELD A AQUIFER PRESSURE RESPONSE

For the purposes of compliance and as agreed with the State Government, Wellfield A drawdown is measured in relation to reference heads established in May 1986 and, for monitoring bores MB1, MB5 and MB6, as a difference between contemporary and estimated 1996 Practical Reference Heads (PRHs) (BHP 2010).

5.1 Compliance Criteria

A 4 m drawdown limit at the point on the Designated Area for Wellfield A that is mid-way between GAB8 and HH2 based on the 12-month moving average (BHP 2022a).

5.2 Leading Indicators

A hydraulic gradient between wells in the NESB (North East Sub-Basin) and HH2 exceeding 0.0009 m/m, calculated as the six-monthly moving mean hydraulic gradient between HH2 and NESB wells GAB7, GAB8, GAB10, GAB11 and GAB19 (BHP 2022a).

5.3 Wellfield A Monitoring Program Requirements

5.3.1 Purpose

Quantify by routine and appropriate methods water pressures and water levels in all monitoring and production wells, and at the boundary of the Designated Areas, as approved by the State.

Measure or infer the magnitude of the drawdown according to the relevant compliance criteria for Wellfield A.

Provide data to support the leading indicator for GAB impacts, and alert management when levels approach the leading indicator value.

5.3.2 Deliverables

Records of artesian pressure and groundwater level data for assessment of drawdown. (GA 3.3) (BHP 2022b).

5.4 Groundwater Responses to Wellfield A

A summary of reference heads in m Australian Height Datum (AHD) is shown in Table 5-1. It is noted that some of these reference heads incorporate localised, prior drawdown effects due to the early operation of production bore GAB6. Average drawdown contours for FY24 are presented in Figure 5-1. The contour map for Wellfield A includes the geological boundaries and structures that are interpreted to influence the hydrogeology of the Wellfield A region and has been drawn using the kriging process for contouring as outlined for Wellfield B in the Great Artesian Basin Monitoring Program (BHP 2022b).

5.4.1 Wellfield A Hydrogeological Zone

Referred to as Wellfield Sub-Basin in Table 5-1. Monitoring shows that the average drawdown within the zone during FY24 remains consistent with the 5-year average. Wellfield A average monthly abstraction rates ranged from 2.8 ML/d in March 2024 up to 4.9 ML/d in November 2023 with a yearly average of 4.4 ML/d (Table 4-2).

Drawdown measured within the Wellfield A zone ranged from 18.8 m at GAB18A to 6.3 m at Venables Bore.

Drawdown propagation within the sub-basin is controlled by geological conditions, interpreted to be groundwater hydraulic barriers (grey shaded areas in Figure 5-1) causing asymmetrically and preferential drawdown to the northwest and southeast. The drawdown pattern for FY24 is shown in Figure 5-1.

5.4.2 North East Sub-Basin (NESB) Hydrogeological Zone

Average drawdowns within the zone have remained consistent during FY24 (Table 5-1) with GAB7, GAB8 and GAB10 all having the same average drawdown as FY23. Both GAB11 and GAB19 have slightly increased average drawdown compared to FY23. All monitoring locations in the NESB show groundwater pressures below the 5-year average (Table 5-1).

A slight decrease in drawdown was observed in HH2 but typically drawdown in HH2 was consistent over the reporting year. The decrease in drawdown is due to an elevated pressure recorded during recent scheduled monitoring. This will be reviewed at the next monitoring event to determine if the prior data is representative.

Groundwater pressure in the NESB was predicted to respond to a lesser extent to changes in abstraction from Wellfield A than the other monitoring locations in Wellfield A hydrogeological zones, due to the increased distance from Wellfield A production bores and the hydraulic boundary effects associated with structural faults and aquifer geometry. Drawdown has historically propagated from the Wellfield sub-basin firstly southeast and northwest; and subsequently to the NESB. As a result, groundwater pressure in the NESB is not expected to change as dynamically as observed in monitoring locations near Wellfield A production bore pumping.

The slight increase in drawdown in GAB11 and GAB19 may be in response to the resumption of historical production and abstraction rates following the smelter maintenance shutdown in FY22.

5.4.3 South Western Hydrogeological Zone

Average drawdowns within the south western zone have remained consistent during FY24, lower when compared to FY23 and are comparable with the 5-year average (Table 5-1).

5.4.4 Extension And Open GAB

Average drawdown at GAB 24 in the GAB extension zone has increased in FY24 compared to FY23 but is below the 5-year average. The mean drawdown for the Open GAB has increased during FY24, which may be due to drawdown influences from Wellfield B (Figure 6-1).

Table 5-1 Wellfield A – Summary of drawdown FY24.

Area	Well	Reference Elevation (m AHD)	Mean Drawdown FY24 (m)	Mean Drawdown FY23 (m)	FY19-23 Mean Drawdown (m)
Wellfield Sub-Basin	GAB1	22.4	9.0	8.7	8.8
	GAB2	22.8	8.6	8.2	8.3
	GAB5A	27.7	7.0	6.8	7.3
	GAB6A	22.2	10.1	10.1	10.0
	GAB12A	27.2	14.6	14.7	15.1
	GAB13A	30.4	14.9	14.2	15.4
	GAB14A	30.1	14.7	13.7	16.9
	GAB16A	24.5	14.1	13.8	13.9
	GAB17	28.4	15.0	14.7	7.2
	GAB18A	28.8	18.8	19.2	17.4
	GAB21	25.4	13.2	13.1	13.0
	GAB22	24.7	12.6	12.5	12.7
	GAB23	27.7	15.3	14.6	6.8

Area	Well	Reference Elevation (m AHD)	Mean Drawdown FY24 (m)	Mean Drawdown FY23 (m)	FY19-23 Mean Drawdown (m)
	MB2	22.2	6.8		6.3
	New Years Gift	22.6	9.7	9.2	9.4
	Venables	20.6	6.3	5.9	5.9
North East Sub-Basin (NESB)	GAB7	16	2.7	2.7	2.8
	GAB8	11.7	2.0	2.0	2.0
	GAB10	19	2.9	2.9	3.0
	GAB11	20.7	2.9	2.7	3.0
	GAB19	15.1	2.4	2.3	2.4
	HH2	8.2	0.9	1.0	1.0
South West Sub-Basin	HH1	11.1	0.1	0.1	0.1
	HH3	9.3	0.4	0.4	0.2
	HH4	14	0.0	0.2	0.1
Extension	GAB24	39.2	6.0	5.6	6.2
Area	**Well**	**Practical Reference Head (m AHD)**	**Mean Drawdown FY24 (m)**	**Mean Drawdown FY23 (m)**	**FY19-23 Mean Drawdown (m)**
Open GAB	MB1	55.5	0.6	0.4	0.3
	MB5	75.5	1.7		0.9
	MB6	75.0	1.2	1.0	0.9

Note: Data for MB2 and MB5 in FY23 could not be collected due to localised flooding.

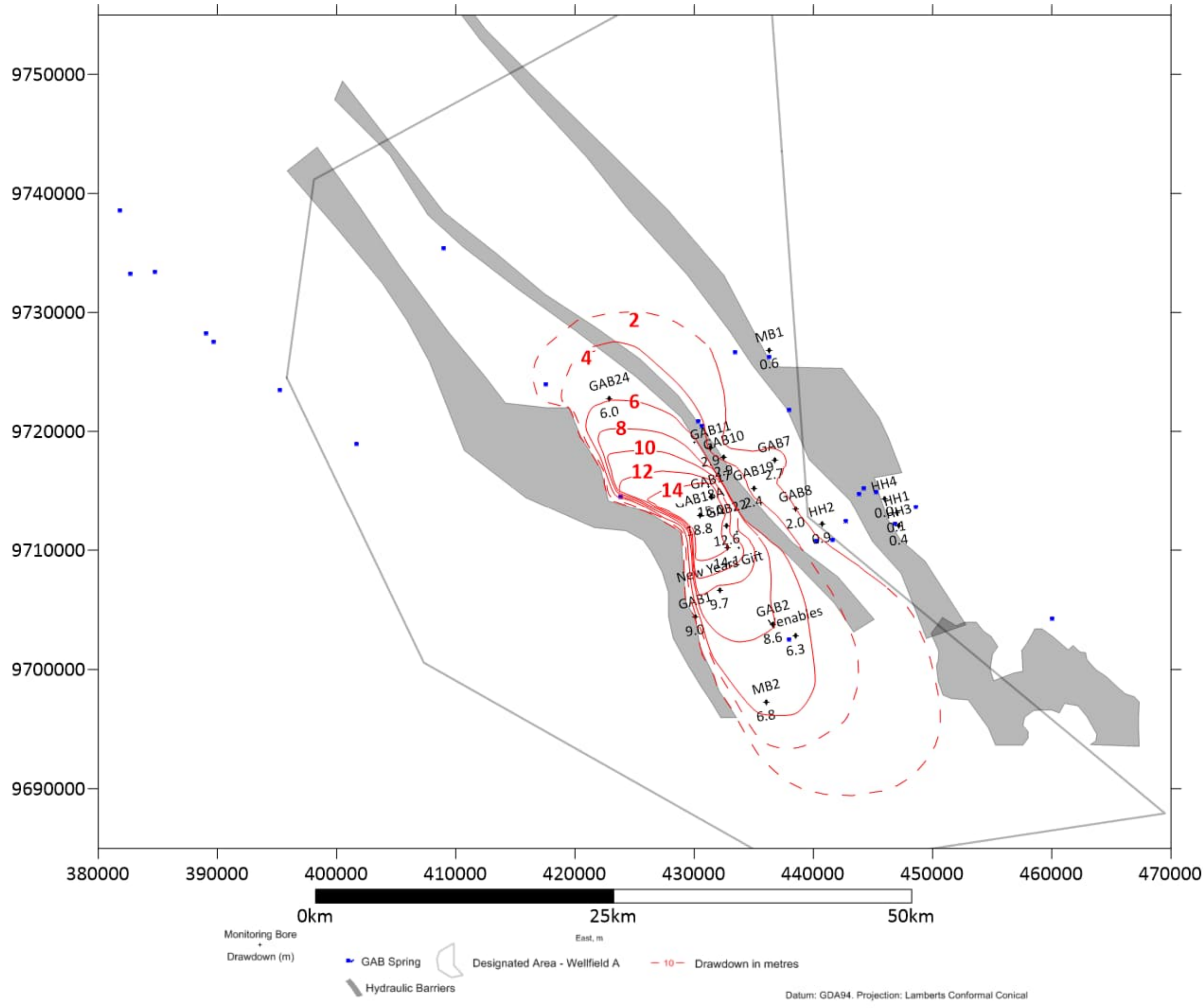


Figure 5-1 Wellfield A total drawdown contours for FY24.

5.5 Evaluation Against Compliance Criteria

5.5.1 Compliance Bores

The Wellfield A Designated Area boundary runs between bores GAB8 and HH2. Boundary drawdown is determined as the 12-month moving average drawdown at a point midway between these two sites.

The FY24 average drawdown at GAB8 was 2 m and 0.9 m at HH2 (Table 5-1), therefore the average boundary drawdown was 1.5 m, within the 4 m compliance criteria (Figure 5-2).

5.5.2 Evaluation Against Leading Indicator

GAB spring flows are primarily driven by groundwater pressure in the GAB aquifer, representing a groundwater pressure head that is greater than the elevation of the spring vent. This pressure head and hydraulic gradient causes discharge and the development of spring flow.

The FY24 hydraulic gradient between wells in the NESB (GAB7, GAB8, GAB10, GAB11, and GAB19) and HH2 is equal to, but does not fall below, the leading indicator gradient of 0.0009 m/m (6-month moving average) during the reporting period (Figure 5-3).

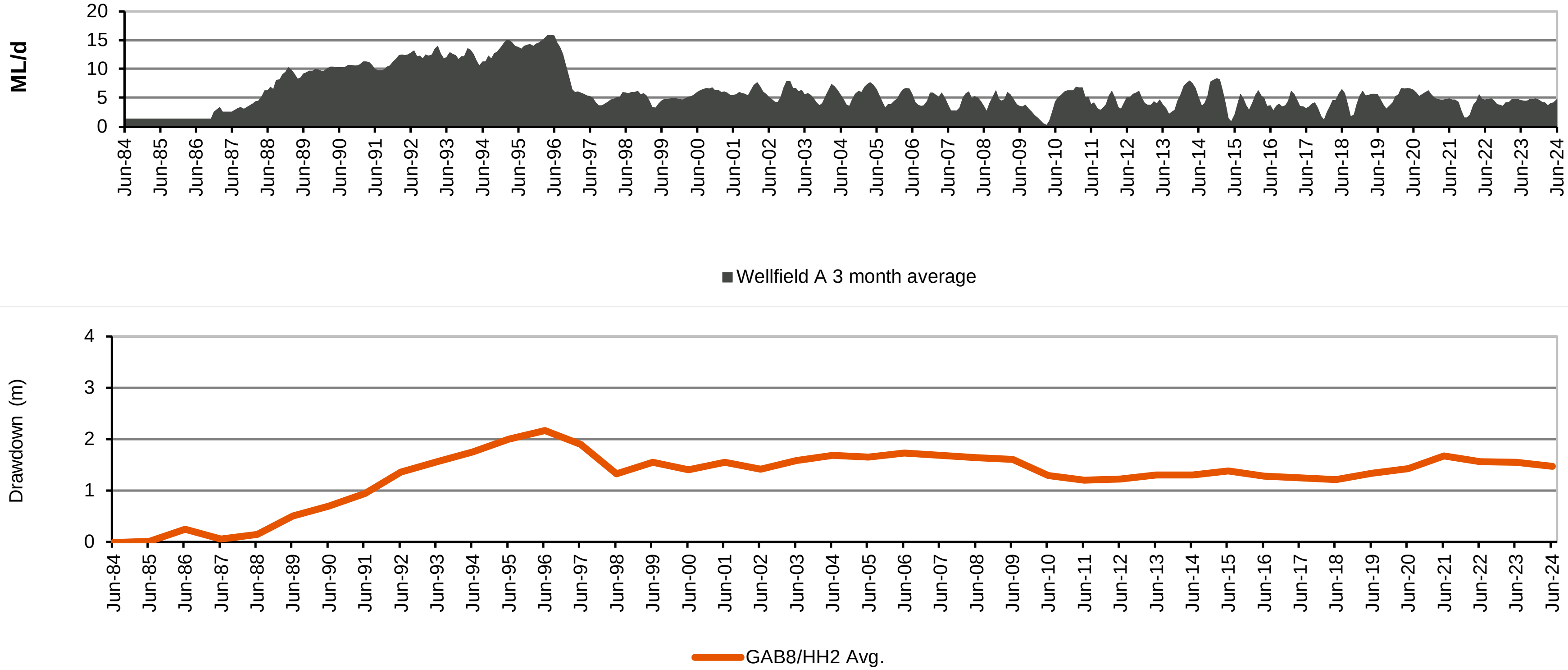


Figure 5-2 **Wellfield A compliance bores – GAB8/HH2.**

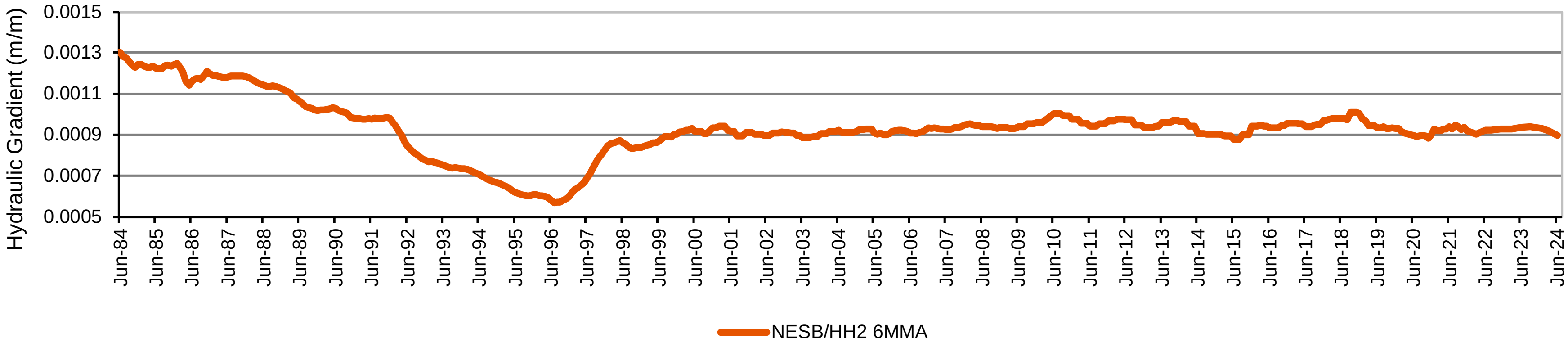


Figure 5-3 **Wellfield A leading indicator – NESB hydraulic gradient.**

6 WELLFIELD B AQUIFER PRESSURE RESPONSE

Drawdown responses due to Wellfield B are measured and reported to the State in accordance with the Indenture[1] and ODC commitments (BHP 2022a and 2022b) as:

- *Temperature-exclusive drawdown*: wellhead pressure difference from reference pressures (PRPs) established for the bores monitored; or
- *Temperature-inclusive drawdown*: as a difference between current measurement and estimated 1996 PRHs.

6.1 Compliance Criteria

A 4 m drawdown limit for Wellfield B at the point between monitoring bores S1[2] and S2 (measured as the average drawdown of the two bores) and based on the 12-month moving average (BHP 2022a).

A drawdown footprint for Wellfield B, measured as the area contained within the 10 m drawdown contour, that is less than or equal to 4,450 km^2 (BHP 2022a).

6.2 Leading Indicators

A drawdown trend at monitoring bore S1[3] that may exceed 4.5 m in the next 12 months (BHP 2022a).

A drawdown footprint for Wellfield B, measured as the area contained within the 10 m drawdown contour that is greater than 4,000 km^2 (BHP 2022a).

A continuing drawdown trend at GAB pastoral bores that may exceed the predictions of the OD EIS of 1997 (BHP 2022a).

6.3 Monitoring Program Requirements

6.3.1 Purpose

Quantify by routine and appropriate methods water pressures and water levels in all monitoring and production wells, and at the boundary of the Designated Areas, as agreed with the State.

Measure or infer the magnitude of the drawdown according to the relevant compliance criteria for Wellfield B.

Provide data to support the leading indicator for GAB impacts, and alert management when levels approach the leading indicator value.

6.3.2 Deliverables

Records of artesian pressure and groundwater level data for assessment of drawdown (GA 3.3) (BHP 2022b)

A contoured drawdown map for Wellfield B (GA 3.1) (BHP 2022b)

6.4 Groundwater Responses To Wellfield B

6.4.1 Whole-of-Wellfield Drawdown Pattern

The groundwater drawdown contours show asymmetry, reflecting structural and palaeogeographical control over hydrogeological conditions resulting in differential drawdown responses as the aquifer thins to the south. The production wells are situated in a northwest oriented hydrogeological trough that contains a thicker, more transmissive aquifer sequence. The trough is flanked by relatively lower transmissivity that limit the propagation of drawdown to the east and west (WMC 1995). Note,

[1] *Roxby Downs (Indenture Ratification) Act 1982* (SA), s13(8)B.
[2] In December 2022 'S1' was decommissioned due to a downhole casing failure. Bore 'S1_New' was constructed to replace 'S1'.
[3] As above.

however, that the State approved kriging methodology that generates these contours (BHP 2022b) is a simplified approach and does not comprehensively account for these hydrogeological conditions.

The drawdown contours shown in Figure 6-1 are consistent with previous reports with the contours continuing to show asymmetry, reflecting variability in aquifer transmissivity from geological controls. Individual drawdown at bores used to create Figure 6-1 are listed Table 5-1. General interpretative comments, describing the drawdown contour reported at individual sites, are:

- Drawdowns are reported for the production bores GAB51, GAB52, and GAB53 as the average difference between respective PRHs and flow pressures. These three production wells were not shut in during FY24.
- Drawdowns that exceed 10 m for FY24 are reported in nine bores (D3, Lake Harry, Marion, MB8, Muloorina H/S, Peachawarrina, S3A, S4 and S5).
- Drawdown along an arc of bores, situated in the west to south/southeast of Wellfield B (S2, WCB1) and closest to the GAB springs, is negative indicating GAB pressures are higher than baseline in that area.
- As indicated earlier, Figure 6-1 presents total drawdown, caused by both Wellfield B and third-party abstractions. The accuracy of the reported total drawdown at pastoral bores or at those used for any purpose other than dedicated monitoring, will be affected by both Wellfield B and third-party abstractions. Of the 50 sites monitored in Wellfield B, 33 are pastoral bores and as such are not dedicated monitoring bores (BHP 2022b).
- The extent of the 1 m drawdown contour to the southwest of the wellfields is generally an overprediction and is interpreted to have extended south over some of the monitored GAB Springs, however the spring flows monitored during FY24 (Table 7-1) do not reflect the 1 m drawdown contour. As the kriging process is conservative, it generally overpredicts drawdown. As such, it is expected that the 1 m drawdown contour has not extended this far south and the hydraulic gradient towards the springs is preserved (see Section 6.5.2).
- An artefact of the kriging process for contour preparation is interpreted to introduce an over-projection of drawdown trends from near Wellfield B to areas without any measured observations, such as from the northwest to the northeast of Georgia bore 2 in Figure 6-1. Kriging would have left the 2, 4 and 6 m contours open (i.e. these contours would not be closed within the northern extent of Figure 6-1). Contouring by hand would have closed the 4, 6 and 8 m groundwater contour lines within the extent of Figure 6-1. For these reasons, the 1, 2, 4 and 6 m contours in Figure 6-1 were omitted and blanked outside the Designated Area, from the northwest to the northeast of Wellfield B. This contouring approach, however, did not influence the size of the 10 m drawdown footprint.

Table 6-1 Summary of drawdowns used for Wellfield B contouring FY24

Bore	PRH (m AHD)	Mean Drawdown FY24 (m)	Mean Drawdown FY23 (m)	Change in Mean Drawdown (m)[4]
Charles Angus[5]	50.5			
D2	90.5	9.5	8.3	1.2
D3	86	11.3	10.5	0.9
Dulkaninna[4]	88		10.1	
GAB51[6]	87.5	41.9	44.6	-2.8
GAB52	87.5	28.2	35	-6.8
GAB53	88	35.4	46.1	-10.7
Georgia 2	83.5	8.4	7.6	0.7
HH1	11.1	0.1	0.1	0.1
HH2	8.2	0.9	1.0	-0.2
HH3	9.3	0.4	0.4	0.0
HH4	14	0.0	0.2	-0.1
Jackboot	84	3.3	2.9	0.4
Lake Harry	84.9	14.2	10.6	3.6
Marion	87.5	12.7	11.9	0.8
MB1	55.5	0.6	0.2	0.2
MB5[7]	75.5	1.7		
MB6	75	1.2	1.0	0.2
MB7	87	9.6	8.8	0.8
MB8	88	13.3	12.7	0.6
Muloorina	85.4	21.3	18.7	2.7
OB1	80	3.9	3.5	0.4
OB3	82	7.0	6.2	0.8
OB6	83	8.2	7.7	0.5
Peachawarrina[8]	85.2	15.5	14.0	1.5
S1_New[9]	70.5	1.6	1.5	0.1
S2	54	-0.3	-0.1	-0.1
S3	72.5	1.5	1.1	0.4
S3A	85	10.2	9.6	0.5
S4	87	10.7	10.0	0.7
S5	86.5	15.7	14.9	0.8
Sinclair	87	6.6	6.5	0.1
Two Mile 2	72	1.5	1.5	0.0
WCB1	64.5	-0.5	-1.3	0.8
WCB2		7.3	6.8	0.5

Note: The monitoring points that demonstrated non-representative data were Charles Angus; Dulkaninna, D3; Jackboot; Lake Harry; Muloorina; Peachawarrina; and Sinclair.

[4] Negative numbers indicate a reduction in drawdown (i.e. an increase in head) during FY24.
[5] Charles Angus and Dulkaninna were not included in drawdowns for Wellfield B as data was considered unreliable due to antecedent flow.
[6] Drawdown for wells GAB51-53 was measured with flow pressures during FY24. Reduced drawdown for FY24 compared to FY23 illustrates ODC production at Business as Usual (BaU). Noting that FY23 incurred higher temporal flow rates after SM21.
[7] MB5 FY23 data not included as no data could be collected due to localised flooding.
[8] FY24 data is likely over-represented. In FY24 Peachawarrina was determined failed downhole.
[9] S1_New replaces S1. The PRH is corrected for S1_New to consider the different height in bore headworks.

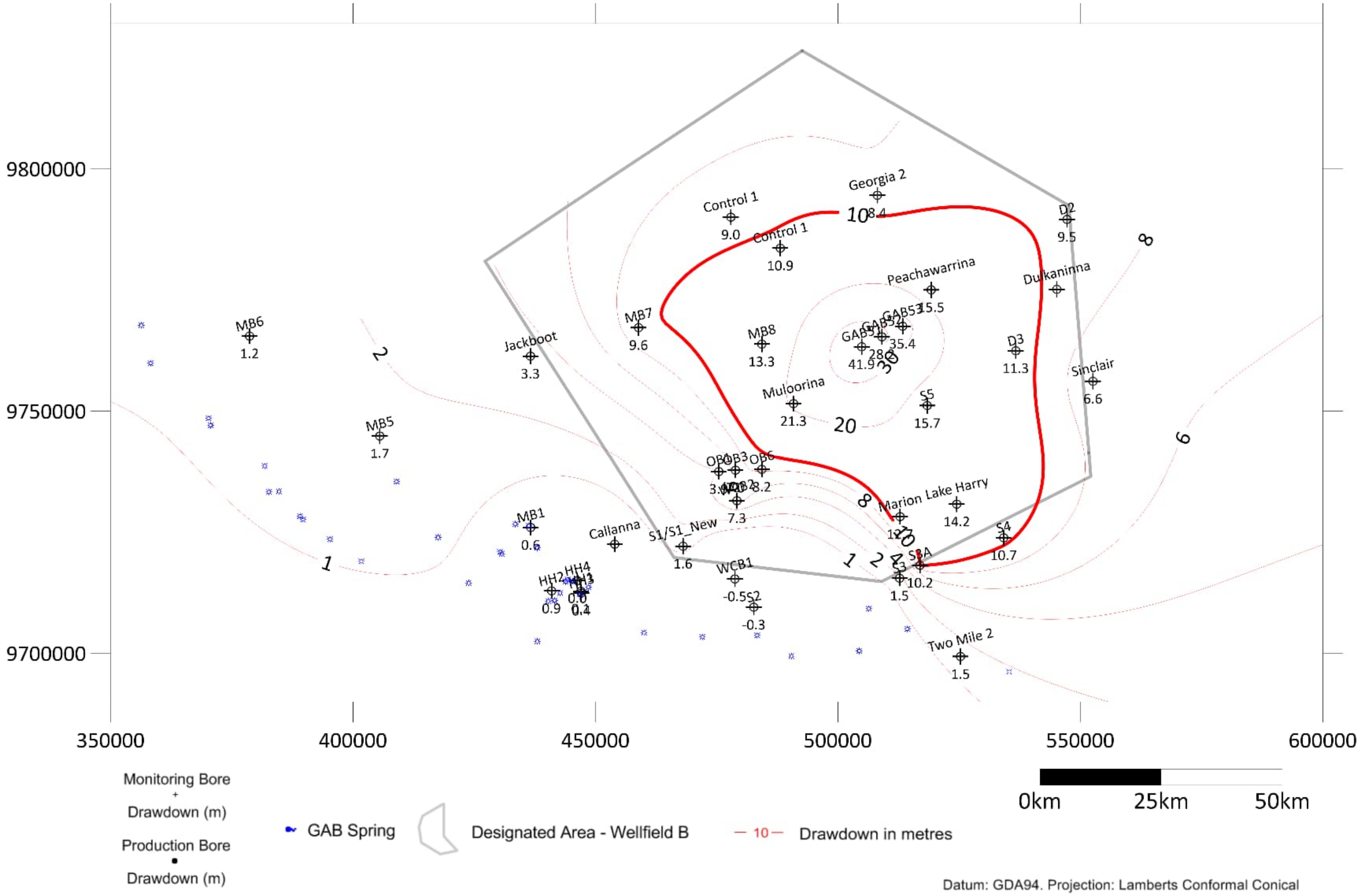


Figure 6-1 **Wellfield B total drawdown contours for FY24, generated by kriging.**

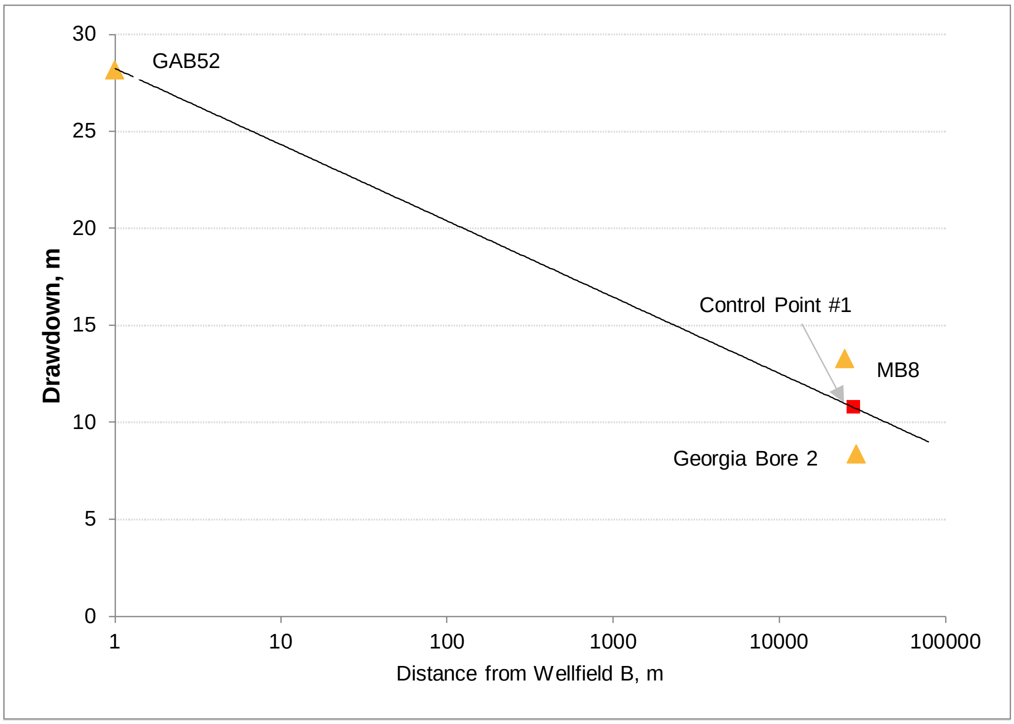
Note: Total drawdown includes those caused by Wellfield B and third-party abstractions. Data from third-party abstraction points are impacted by ageing infrastructure.

6.4.2 Drawdown Pattern Around Wellfield B

The drawdown map presented in Figure 6-1 followed the procedure as described in the Great Artesian Basin Monitoring Program (BHP 2022b). Groundwater drawdown at two interpreted control points were estimated to the northwest of Wellfield B, between MB8 and Georgia Bore 2 (Control Point #1), and MB7 and Georgia Bore 2 (Control Point #2). Typically, one control point is used to infer the contour development in areas where monitoring does not exist, however two control points are used in this reporting period because monitoring data from both MB8 and MB7 were incomplete for FY24.

The drawdown for the control points in the northwest (Control 1 and Control 2 in Figure 6-1) was determined as follows:

1. Drawdowns at Wellfield B GAB52 (28.2 m), MB8 (13.3 m) and Georgia Bore 2 (8.4 m) were plotted vs. their respective distance from Wellfield B. For Wellfield B, a nominal distance of 1 m was used for illustration purposes on Figure 6-2.
2. Drawdowns at Wellfield B GAB52 (28.2 m), MB7 (9.6 m) and Georgia Bore 2 (8.4 m) were plotted vs. their respective distance from Wellfield B. For Wellfield B, a nominal distance of 1 m was used for illustration purposes on Figure 6-2.
3. The Control Points were calculated as 10.9 m for Control Point 1 (the average for MB8 and Georgia Bore 2) and 9 m for Control Point 2 (the average for MB7 and Georgia Bore 2).
4. A logarithmic trend was fitted to the distance-drawdown relationship, a standard groundwater hydraulic relationship for an extensive confined aquifer.
5. Using the logarithmic distance-drawdown trend, the control points were placed at that distance and to the northwest of Wellfield B (red marker Figure 6-2 and “Control 1” and “Control 2” in Figure 6-1).



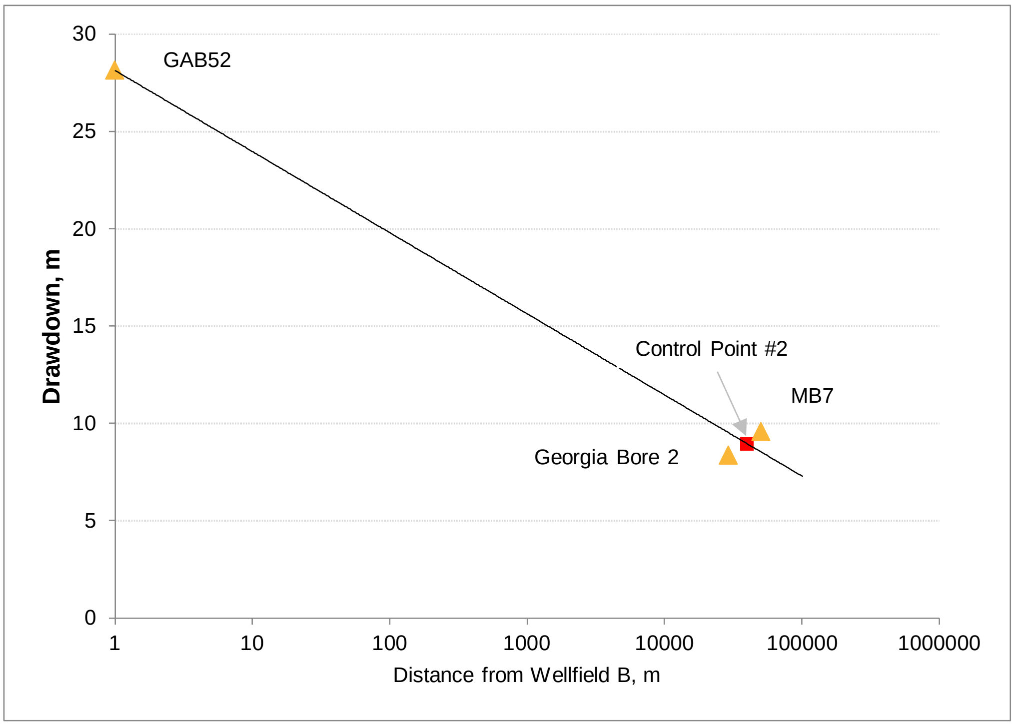


Figure 6-2 Assessment of drawdown at control points 1 and 2.

6.5 Evaluation Against Compliance Criteria

6.5.1 The Area Contained Within The 10 m Drawdown Contour

The area contained within the 10 m drawdown contour line in Figure 6-1 is 4,004 km^2, below the maximum 4,450 km^2 compliance criteria, but slightly above the 4,000 km^2 leading indicator.

As Figure 6-3 indicates, the measured value (black) for the 10 m drawdown contour in FY24 is outside of modelled 95% confidence limits. The expanded extent of the inferred 10 m contour in FY24 is influenced twofold leading to potential error and conservatism in the measurements:

- The first is due to mixed-use water bores and infrastructure, whereby taking data from flowing or recently operated pastoral or third-party bores (where water temperatures are elevated at surface) provides for non-representative data of the aquifer.
- The second factor is accurate measurement of third-party abstraction; where the majority of mixed-use infrastructure is not managed or controlled in any way by ODC and there are no flow meters installed, the quantum of antecedent flow can only be estimated.

These two compounding factors are likely to overpredict the aquifer drawdown.

The monitored bores that demonstrated non-representative data were Callanna; Chapalana 2; Charles Angus; Dulkaninna, D3; Jackboot; Kopperamanna; Lake Harry; Maynards; Muloorina; Peachawarrina; Peters and Sinclair. The majority of these monitoring points are in the east of the Wellfield B Designated Area (see Section 6.5.3).

As a result of the poor-quality pastoral data in the east, the increase of the 10 m drawdown contour from FY23 at 3,452 km^2 to 4,004 km^2 in this reporting period is due to an extension of the groundwater contour toward that eastern side, which is not mirrored in the 30 m or 20 m drawdown contours. The 30 m contour surrounding the GAB51, GAB52 and GAB53 production bores is observed to be smaller than that of FY23, although the ODC pumping rate remained relatively consistent.

The numerical model 95% confidence interval predicts that, at the current abstraction rate, from a combination of Wellfield B and pastoral bores the 10 m drawdown contour will be exceeded by 2026.

The extension of the 10 m drawdown contour to the east is under assessment to determine if the expansion of the drawdown contour is representative of combined Wellfield B and pastoral abstraction or due to inherent errors introduced from monitoring data obtained from third-party infrastructure and abstraction estimates. To address this, ODC is in the process of undertaking a bore census and condition survey to evaluate drawdown responses along with bore use, condition and data integrity in Wellfield B during 2024 and 2025.

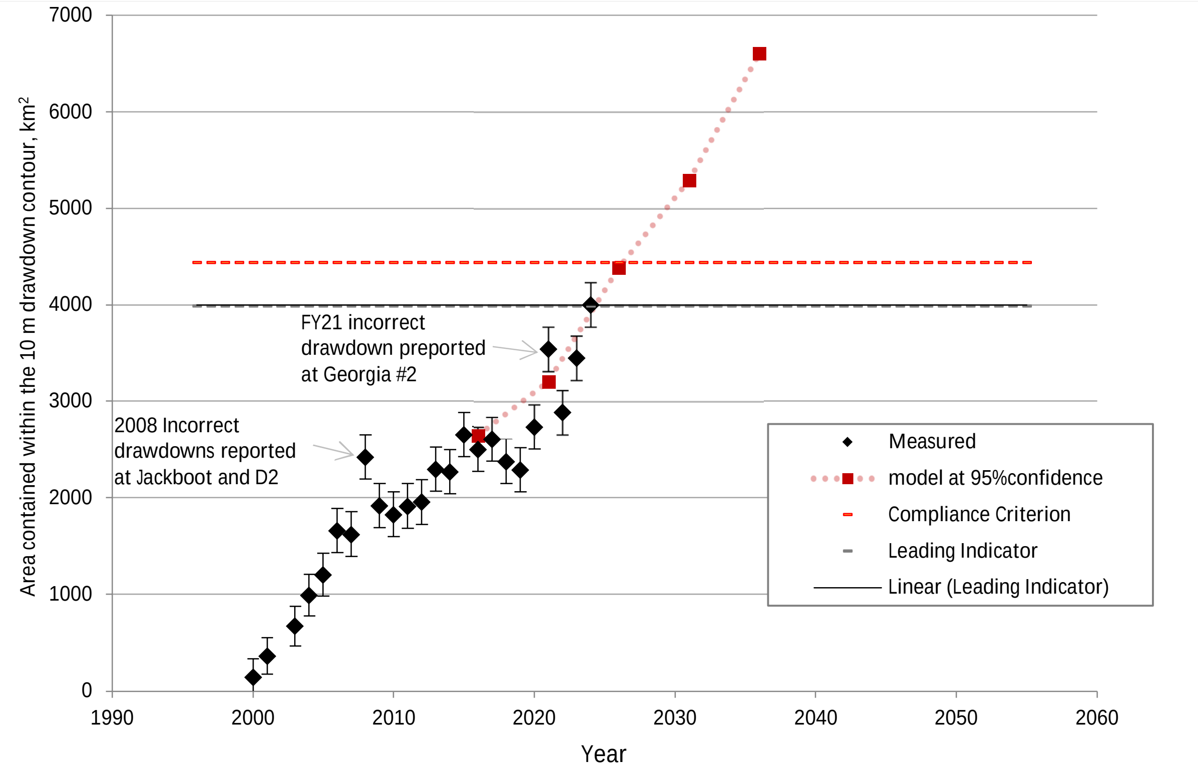


Figure 6-3 **Area contained within the 10 m drawdown contour.**

Note: 'Model at 95% confidence' has been updated following the triennial groundwater model review in FY24.

6.5.2 Drawdown At Bores S1 And S2

Site S1 (replaced by S1_New) and site S2 are the closest dedicated monitoring bores to the GAB springs and were therefore selected as compliance sites.

Table 6-1 **Summary of drawdown at S1 and S2, to June 2024.**

Bore	PRH (m AHD)	Mean Potentiometric Head FY24 (m AHD)	Mean Drawdown FY24 (m)
S1/S1_New	70*	68.4	1.6
S2	54.0	54.3	- 0.3
S1/S1_New – S2 12 month moving drawdown average			1.7

Note: PRH (mAHD) has been adjusted to incorporate the 0.5 m RL difference between S1 and S1_New.

As Figure 6-4 indicates, the average drawdown in these monitoring bores has fluctuated between -0.5 and +0.6 m and has remained very consistent and close to 0 m since 2010. The latest reported drawdown at the point between monitoring bores S1/S1_New and S2 (measured as the average drawdown of the two bores based on the 12-month moving average) is 1.7 m, within the 4 m drawdown compliance criteria. This 12-month moving average includes data from S1 prior to decommissioning and as such is a reflection of aggregating data from the failed bore with data from the newly commissioned bore ('S1_New').

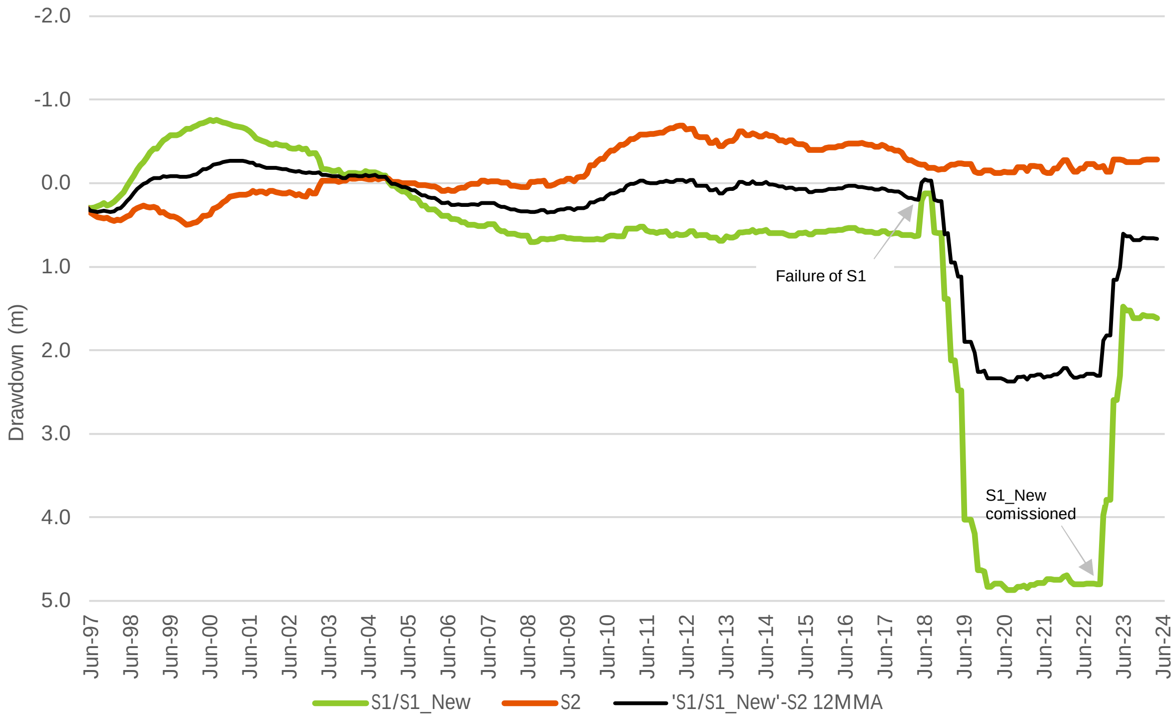


Figure 6-4 Drawdown at Wellfield B compliance bores S1/S1_New and S2.

6.5.3 Evaluation Against Leading Indicator

Pastoral wells are monitored to increase the density of observation points and to confirm that artesian pressures are preserved. As the pastoral properties are large (~ 5000 km^2), the water supply lines for their livestock can exceed 20 km in places. The area is remote with inherent access and safety issues, and the drilling costs for bores that are several hundred metres deep are high. As a consequence, many of these pastoral wells are used more or less continuously and have influence on aquifer pressure and temperature measurements used in the monitoring program. This can lead to some monitoring error which must be considered in context to the age and operational configuration of the pastoral bore and associated infrastructure. An example of this is the re-establishment of Jackboot Bore headworks. Prior to re-establishment the estimated drawdowns were suspected to be over-estimated. After headworks improvement the recovery of shut-in pressure confirmed the previous over-estimation of drawdown by several metres. The separation of drawdown caused by Wellfield B from that caused by pastoral wells is uncertain. The drawdowns presented in this report, therefore, are total drawdowns caused by both Wellfield B and pastoral abstractions.

Total drawdown at EIS pastoral bore sites (Kinhill Engineers 1997, updated Golder Associates 2016) can be assessed from Figure 6-1, which shows drawdown contours in the Wellfield B area due to all groundwater abstractions. A summary of measured drawdown is shown in Table 6-2.

Drawdown is not reported for all 1997 EIS pastoral sites in Table 6-2. The reasons for this vary. For some bores there is no baseline head or pressure available or those assigned proved to be incorrect, and for others contemporary measurements are not possible (the bore cannot be accessed or shut-in). For other bores, the shut-in times adopted appear to be insufficient (not long enough to minimise the influence of antecedent flow). Leaks inside bores or on the wellhead or the delivery infrastructure also render some pressure measurements non-representative of the GAB aquifer (the pressure measured is lower than the correct pressure at the same place and time in the aquifer) and hence would report incorrect drawdowns

The PRH for EIS pastoral bores has been calculated as the temperature corrected 1997 EIS kPa (pressure) value. The predicted drawdown is taken from the review and update completed in 2016 by Golders Associates.

In total, drawdown at pastoral bores remains less than the predicted long-term impact as presented in the EIS (Kinhill Engineers 1997, updated Golder 2016) with the exception of three monitoring wells, Lake Harry, Muloorina, and Peachawarrina. The maximum drawdown (8.7 m) was at Muloorina in FY24.

Muloorina well is close to the Wellfield B production wells, however it has a large antecedent flow feeding an extensive wetland which contributes to total drawdown at the site. Drawdown at this well has been consistently larger and more variable than proximal well MB8 for about 10 years. This suggests the drawdown at Muloorina is a localised effect.

In FY24, Peachawarrina was determined to be failed downhole. Decommissioning and replacement of this bore is planned for FY25. Any data points from this monitoring well in FY24 are therefore likely to be an overestimation of drawdown as pressure losses are incurred with failure of infrastructure downhole.

Lake Harry had significant antecedent flow during the FY24 monitoring event. The data presented in Table 6-3 is therefore an overestimation of drawdown and departs from a consistent annual drawdown (0.2 m) since FY16.

Dulkaninna is indicating an increased drawdown compared to last year. This coincides with visible integrity issues such as leakage of the headworks and uncontrolled flow at surface. Drawdown at proximal bores (namely D2 and Sinclair) do not align with the drawdown at Dulkaninna, suggesting the drawdown at Dulkaninna is a localised effect.

Shut in pressures could not be collected from several sites in FY24. The Clayton 1 and 2 and Yarra Hill bores were not shut in (were flowing) at the request of the land owner. Tarkaninna # 2 has failed below ground and has an uncontrolled flow to surface. The Callanna, Chapalana 2, Charles Angus, Dulkaninna and Maynards bores were not able to be adequately shut-in at the time of monitoring, due to headworks condition.

In FY25 ODC will work with the State and third-parties to resolve issues with data collection and data integrity.

Table 6-2 Drawdown at 1997 EIS pastoral bores.

Well	Temp Inclusive Drawdown		Predicted Drawdown
	PRH (mAHD)	Drawdown (m)	(m)
Callanna	48.9		0.8
Cannuwaukaninna 2[10]	90	1.4	2.9
Chapalana 2[11]	92		1.8
Charles Angus	50.5		0.3
Clayton #1[12]	71.5		2
Clayton #2[13]	73.8		2
Cooranna	43.3	0.1	2
Cooryaninna	96.3	2.2	2.6
Dulkaninna 2	89		3.3
Jackboot	84	1.6	2.3
Kopperamanna	92.1	1.7	2.4
Lake Harry	84.9	3.8	3
Marion	87.5	1.5	3.1
Maynards	55.4		1.4
Morphetts	54.3	0.2	0.7
Morris Creek	63	1.6	2.2
Muloorina	85.4	8.7	3.8
Peachawarrina	85.2	4.2	3.7
Peters[14]	52.4	2.8	3.3
Tarkanina #2[15]	86.8		2.6
Yarra Hill[16]	87.7		2.3

Notes:

1. *EIS (Kinhill Engineers 1997, updated Golder Associates 2016) predicted drawdown is for the period 2016-2036. Note that the PRH used is from the EIS baseline, however the expected drawdown values are taken from the updated 2016-2036 review as these are accepted to be the more accurate predictions. Where there are gaps in this dataset, the 1997 EIS predictions are used.*
2. *PRH is calculated as the temperature corrected EIS pressure from 1997.*
3. *Drawdown (m) is the difference between measured data from FY16 to FY24.*
4. *Cooranna baseline pressure was given in the 1997 EIS as 61 kPa. This is an incorrect value for the bore and represents a flow pressure rather than a shut-in pressure.*
5. *The monitoring points that demonstrated non-representative data were Callanna; Chapalana 2; Charles Angus; Dulkaninna; Jackboot; Kopperamanna; Lake Harry; Maynards; Muloorina; Peachawarrina and Peters. Where data has been omitted a pressure read was not possible. Where data has been provided, the drawdowns are likely an over-estimation.*

[10] Cannuwaukaninna was replaced with Cannuwaukaninna 2 in 2022. The PRH has been corrected from 90.3 to 90 mAHD to account for the difference in headworks.
[11] First measurement from 'Chapalana 2' was 2017.
[12] Well not shut-in at the request of land owner.
[13] Well not shut-in at the request of land owner.
[14] Measured pressures and calculated heads at Peters appear to be below those of adjacent GAB bores. Although drawdown is calculated, the reference level for the well may be incorrect.
[15] Well not shut-in at the request of land owner.
[16] Well not shut-in at the request of land owner.

7 GAB SPRING FLOWS

Groundwater abstraction from the GAB has the potential to reduce aquifer pressures and the flow of water to the springs in the vicinity of wellfield pumping. In turn a reduction in spring flow can potentially affect the hydrological conditions and associated spring habitat area that is available to organisms, increasing the likelihood of spring extinctions. A core group of 41 GAB springs in the vicinity of the wellfields are monitored annually (BHP 2022b). During this monitoring, flow rates and field chemistry (pH, Electrical Conductivity (EC) and temperature) are recorded.

7.1 Leading Indicator

A combination of the following factors that can be attributed to water extraction from Wellfields A and B:

- Evidence that flow reductions at GAB springs in the vicinity of the wellfields may exceed the predictions made in the OD EIS' of 1982 and 1997.
- Evidence of water quality change (measured as pH or conductivity) at GAB springs.

7.2 Monitoring Program Requirements

7.2.1 Purpose

Determine the extent of flow change at GAB springs within each hydrogeological zone of impact that may be attributed to water abstraction from Wellfields A and B.

To provide data to support the leading indicator for GAB impacts, and alert management when levels approach the leading indicator value.

7.2.2 Deliverables

Records of spring flow data for assessment of flow trends and possible drawdown impacts (GA 3.4).

7.3 Evaluation Against Leading Indicator

Spring flows are presented by hydrological zone based on Kinhill Stearns (1984) and Kinhill Engineers (1997) (updated Golder Associates 2016) and further refined in the BHP GAB Contingency Plan (BHP 2021). During FY24 the monitoring results indicated that the spring flows increased in all hydrogeological management zones except the Wellfield A hydrogeological zone, which remained stable and within historical trends. All GAB spring flows remained within the predicted long-term impact (as presented in the EIS; (Kinhill Engineers 1997, updated Golder Associates 2016). Individual springs within each zone are listed in APPENDIX 8.

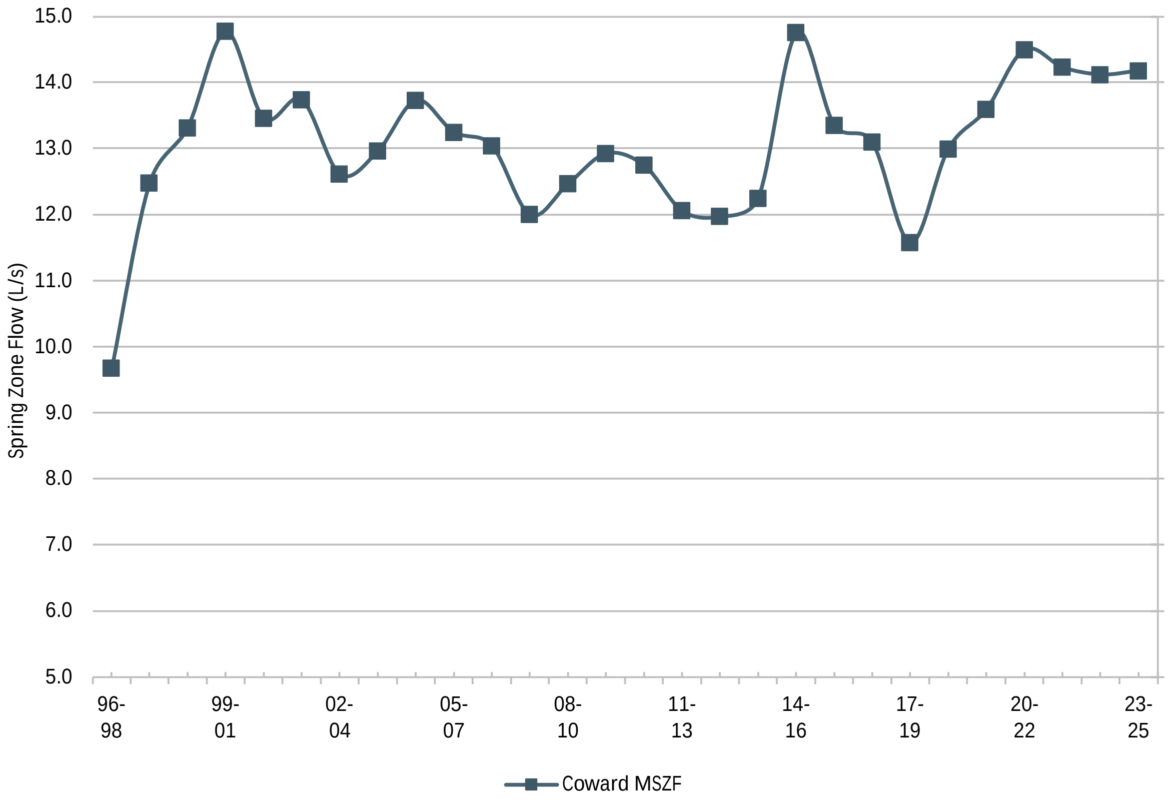
Monitored Spring Zone Flows (MSZF) are shown in Figure 7-1. Flows are calculated as a 3-year rolling average (Table 7-1).

Pastoral flows declined significantly during the period between 2000-2010 due to the bore closure program ODC participated in during that time. Through the provision of closed reticulation, decommissioning wells and restricting flows, ODC has realised approximately 42 ML/d in ongoing water savings for the GAB region. Since FY21, ODC has limited the abstraction from Wellfield A to less than 5 ML/d. The cumulative reduction in local GAB abstraction resulted in increased aquifer pressure and spring flows in the wellfields area (Figure 7-1).

Table 7-1 Summary of spring flow data FY24.

Hydrogeological Zone	No. of Records in Period	2023-2025 Average (L/s)	1996-1998 Average (L/s)	Predicted Loss (%) 1982 EIS	Predicted Change (% 1996-2016) 1997 EIS	EIS Predicted Decline (%)	2023-2025 Flow Change (%)
Coward	6	14.18	9.68	<1	0	<1	+46.49
South West	11	1.58	1.13	>1<3	-1	>1- <3	+39.77
Western Lake Eyre South	8	4.36	4.02	2	- 3-17	3-17	+ 8.47
South East	14	2.63	2.52	<1	- 3-16.5	3-16.5	+4.31
North East	20	1.82	1.59	8-20	- 1	8-20	+14.19
Wellfield A	6	0.23	0.39	60-100	-	60-100	-40.54

Note: 'No. of records in period' refers to the number of times a flow reading was taken within the hydrogeological zone for the financial periods between 2023 and 2025.



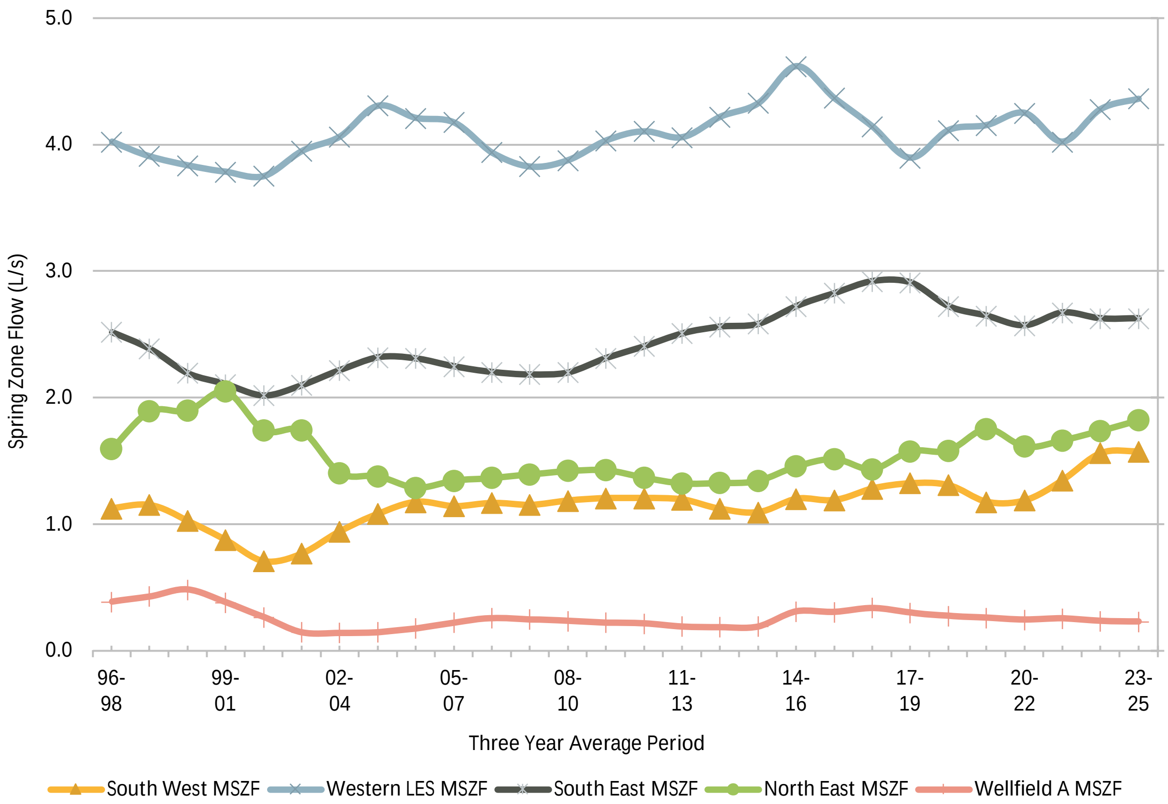


Figure 7-1 **Monitored Spring Zone Flows (MSZF).**

7.3.1 Coward Zone

Springs in the Coward zone have been observed to produce highly variable flow rates. Measured flow remained stable in FY24 and within historical ranges. Measured flow rate was 46.5% (4.5 litres per second (L/s)) higher than the 1996-1998 average (Table 7-1).

7.3.2 South Western Zone

GAB spring flow rates in the South Western zone increased again from FY23 and appear to be above historical variation, however one site (‘Old Woman’) could not be accessed for monitoring for cultural reasons. Measured flow rate was 39.8% (0.45 L/s) higher than the 1996-1998 average (Table 7-1).

7.3.3 Western Lake Eyre South Zone

GAB spring flow rates in the Western Lake Eyre South (LES) zone increased from FY23 but remained within observed historical variation. The flow rate was 8.47% (0.34 L/s) higher than 1996-1998 average (Table 7-1).

7.3.4 South Eastern Spring Zone

GAB spring flow rates in the South Eastern Spring zone remained stable compared to FY23. The flow rate was 4.31% (0.11 L/s) higher than 1996-1998 average (Table 7-1).

7.3.5 North East Zone

GAB spring flow rates in the North East zone increased further from FY23 and remained within the range of historical observations. The flow rate was 14.19% (0.23 L/s) higher than EIS background (Table 7-1).

7.3.6 Wellfield A Zone

GAB spring flow rates in the Wellfield A zone remained stable and within the range of historical observations. The flow rate was 40.5% (0.16 L/s) lower than the 1996-1998 average (Table 7-1) and remains within the predicted decline of 60-100%.

8 GROUNDWATER CHEMISTRY

Assessment of spatial variation of groundwater chemistry throughout the wellfield and monitored area has been discussed previously by AGC (1982) and Habermehl (1983) and is not included in this report. In general, spatial variations in chemistry of the GAB aquifer occur on a very broad scale. A review of groundwater chemistry data collected in the vicinity of the OD Wellfields has been provided in a previous wellfield report (WMC, 2002).

Shallow aquifers containing saline water (20,000–50,000 mg/L TDS) occur in the vicinity of Wellfields A and B. A reduction in aquifer pressures caused by abstraction could conceivably reverse the potential for upward groundwater movement from the GAB aquifer to the shallow aquifers and potentially affect water quality in the main GAB aquifer in the very long term.

Salinity, measured as EC is the simplest, most robust diagnostic monitoring parameter and is the focus of the monitoring program.

8.1 Leading Indicator

- A combination of the following factors that can be attributed to water extraction from Wellfields A and B.
- Evidence of water quality change (measured as pH or conductivity) at GAB springs.

8.2 Monitoring Program Requirements

8.2.1 Purpose

Quantify by routine and appropriate methods, water qualities in all monitoring and production wells on a quarterly basis, as stated in the Indenture.

Identify any changes in EC at bores and springs in the region of either Wellfields A or B that, combined with other influencing factors, may be attributed to abstraction.

Provide data to support the leading indicator for GAB impacts, and alert management when levels approach the leading indicators.

8.3 Deliverables

Records of GAB water, EC, pH and temperature data for assessment of changes and trends in water quality (GA 3.2).

8.4 Evaluation Against Leading Indicator

A summary of EC and pH values during FY24 and the previous reporting period is provided in Appendix 3. Large variations of the average EC can occur at many springs from year to year. Despite such fluctuations, averages of field water quality generally remained within or close to the historical ranges.

As in previous years, statistically significant linear regression coefficients over the entire record (different from zero at the 95% confidence level) were identified and are shown in Figure 8-1. Sites identified by this method that had a regression coefficient (the slope of a regression line fitted to the dataset) outside the range of -0.10 to +0.10 were further analysed. Of the 125 groundwater and spring sites, two were identified as having regression coefficients outside that range, with one (Bopeechee HBO007) indicating increasing salinity and one (Old Finniss HOF033) showing a decreasing trend (Figure 8-1), Welcome WWS001 and Welcome WWS013 have been historically identified as having an increasing salinity trend, so have been included in Figure 8-1. GAB21 is identified as being outside the 95th percentile and showing an increasing trend in EC since approximately 2019.

Data shown in Appendix 3 also includes the 5th and 95th percentile values for the historical range of values and identifies where the FY24 average is above the 95th percentile. Individual trend graphs for these sites are provided in Appendix 5.

8.4.1 Wellfield A Salinity Trends

Three sites were identified in Wellfield A:

- Two sites with increasing salinity trend (Bopeechee HBO007 and GAB21).
- One site with decreasing salinity trend (Old Finniss HOF033).

The results above are consistent with the general rise in salinity for Wellfield A, discussed in a previous wellfield reports. It should be noted from the graphs however, that correlations (as measured by the correlation coefficient square) in Appendix 5 particularly for springs, are generally poor.

The increasing trend observed at Bopeechee HBO007 (Figure 8-1) did not continue in FY24 and has been lessening since FY23. This small spring has seen an increase in large herbivore disturbance in recent years causing the minor discharge from the vent pool to slow down. This may be causing the vent pool water to increase salinity concentration.

The decreasing trend observed since the mid 2000's at Old Finniss HOF033 has further stabilised in FY24. The decreasing trend coincides broadly with an increase in flow over the same time period.

The increasing trend identified at GAB21 is also seen in the nearby well GAB16, but no other proximal bores (GAB16A or GAB6A) thus is interpreted as a being isolated and not part of a broader trend. Previous reports identified increased salinity trends in proximal well GAB15, which was identified as upwards leakage from basement rocks ((WMC 2004) and (Woodward-Clyde 1992)).

8.4.2 Wellfield B Salinity Trends

There were no monitoring sites in Wellfield B for FY24 that identified trending data greater than the 95th percentile. Four sites indicated anomalous values that are attributable to equipment calibration (Appendix 5).

Two sites (WWS001 and WWS013) have historically recorded an increasing salinity trend and have been included in Figure 8-1 based on the trend.

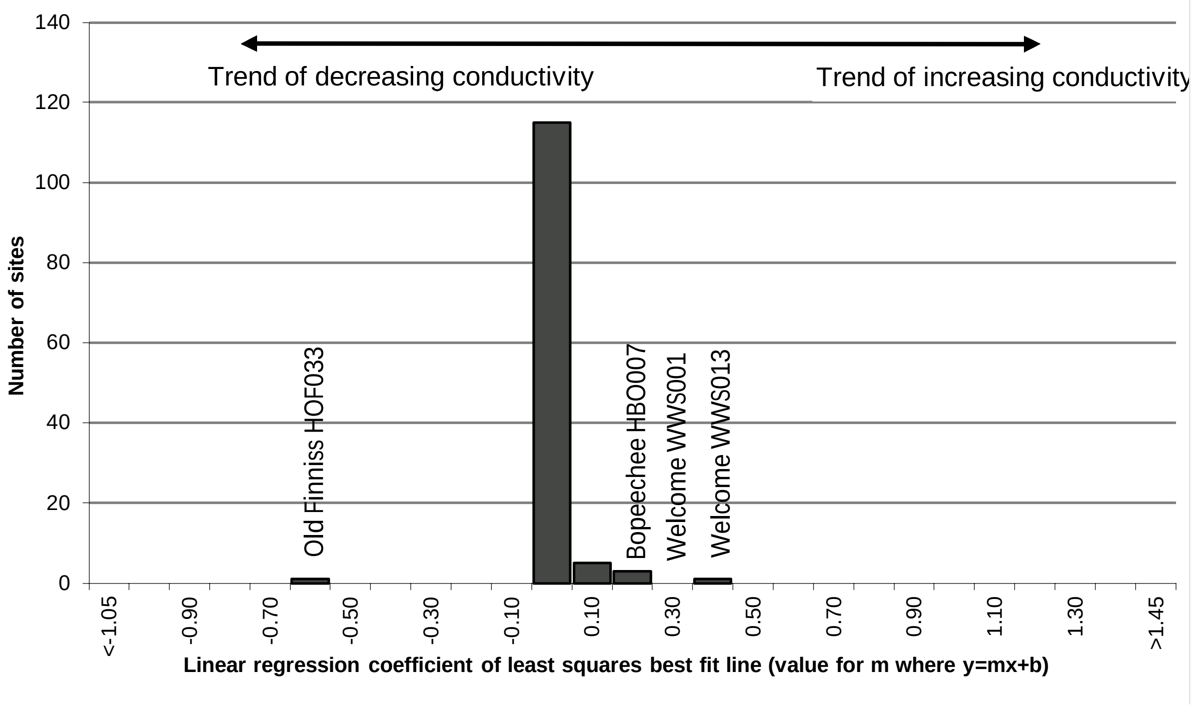


Figure 8-1 Frequency distribution of conductivity trends for the wellfields area.

9 GAB WATER USE EFFICIENCY

The efficiency of water use at OD and Roxby Downs is a significant driver in minimising the rate of water abstraction from the GAB. Efficient water use practice at the operation and the Roxby Downs township is promoted through education and engineering controls. Targets and key performance indicators are developed to promote continuous improvement in water use efficiency. An efficiency rate of 1.24 kilolitres (kL) of water per tonne of ore milled (kL/t), for a production rate of 200,000 tonnes per annum (tpa) was anticipated in the 1997 EIS (Kinhill Engineers 1997). The 1997 EIS assessment report (Department of the Environment 1997) required OD to improve efficiency of water use and supply practices.

9.1 Monitoring Program Requirements

9.1.1 Purpose

Measure the industrial water use efficiency of the operation and total potable water use of associated townships and accommodation villages, including Andamooka.

Quantify by routine and appropriate methods total water quantities withdrawn from any wellfield on both an individual well and wellfield basis, with abstraction added to the record on a monthly basis, as required by the Indenture.

Provide a 10-year forward schedule for abstraction of groundwater from the GAB.

9.1.2 Deliverable(s)

Collated domestic and industrial water use efficiency data, to assess performance against improvement targets (GA 3.5).

Ten-year water use schedule to be submitted to the Indenture Minister by 1 January annually (GA 3.5).

9.2 Results

In FY24 the GAB Industrial Water Efficiency of the operation was 1.0 kL/t compared to the target of 1.16 kL/t and actual of 0.98 kL/t for FY23.

It is worth noting that the water efficiencies achieved in FY23 and FY24 are historically the most effective. This is largely due to the high milled tonnes, however previous years with similar production did not achieve the same efficiency. The efforts of ODC to control water use have therefore contributed to the improvement of the 0.98 and 1.0 kL/t figures. This has been achieved by incorporating monitoring of water use into daily production review meetings, to improve understanding of the drivers of water consumption, and to respond quickly to variations.

Domestic water use during FY24 averaged 2.35 ML/d compared to 2.09 ML/d in FY23, below the target of 3.2 ML/d.

The current 10-year water use schedule, as provided to the Minister for Energy and Mining in December 2023, is presented in Appendix 6. An updated schedule will be provided by 1 January 2025.

10 RESOURCE SUSTAINABILITY AND MANAGEMENT

10.1 Further Exploration And Development

Further development of existing wellfield infrastructure, including additional production wells and associated pipeline infrastructure, may be required to supply additional capacity to the operation as part of the 10-year water forecast. The 10-year forecast includes current business as usual (BaU) operations. This additional water abstraction is expected to come from Wellfield B, however ODC is actively considering other potential non-GAB water sources.

10.2 Future Perspective

The 10-year BaU forecast (Appendix 6) predicts total OD wellfield abstraction will reach 36.1 ML/day by 2034 and total water demand for Olympic Dam is forecast to reach 42.6 ML/d. Abstraction rates for Wellfield A are expected to remain less than an annual average of 4.4 ML/d and consistent at 33.7 ML/d for Wellfield B from 2031, with the balance to come from saline sources within the OD Special Mining Lease (SML). ODC is also considering other potential water sources such as the Northern Water Supply project.[17]

10.3 Sustainability Comments

Since 2000, OD has conducted an ongoing program of pastoral bore flow restrictions in conjunction with GABSI (now Interim Great Artesian Basin Infrastructure Investment Program) with a focus on recovering pressure in the Wellfields A and B area. Through the provision of closed reticulation systems, decommissioning wells and restricting flows ODC has realised approximately 340 gigalitres (GL) in cumulative water savings for the GAB region since 1999 (Figure 10-1) at an ongoing rate of approximately 42 ML/d (above BHP's 5-year average abstraction rate of ~ 30 ML/d (Flow rate from 29 important pastoral bores in the wellfields area, where variation in flow rate could produce short-term impacts on regional monitoring, is estimated at the end of the review period. Pastoral abstractions from those 29 bores and those from Wellfields A and B are shown in Figure 4-2.

Total abstraction from the wellfields area, including ODC wellfields and the 29 pastoral bores rose from approximately 40 ML/d in 1995 to 60–70 ML/d in 2000–01 and subsequently declined to 45-50 ML/d since 2010 (Figure 4-2). Total abstraction from the wellfields area in FY24 is estimated at 49.4 ML/d.

Pastoral flows declined significantly in the period from 2000-2010 due to the bore closure program that ODC participated in during that time. Water savings of approximately 42 ML/d have been achieved through the sponsored closure of free-flowing pastoral wells in the ODC wellfield area. Third–party pastoral use was estimated during the reporting period.

Table 4-1)). Since FY21, ODC has limited the abstraction from Wellfield A to less than 5 ML/d. The cumulative reduction in local GAB abstraction resulted in increased aquifer pressure and spring flows in the wellfields area.

In the Wellfield A area, groundwater heads and spring flow rates have now been relatively stable for approximately 20 years. Boundary drawdown, determined as the average drawdown at GAB8 and HH2, was 1.5 m, slightly higher than the average since 2010 but less than the 4 m compliance criteria.

The FY24 hydraulic gradient between nominated wells in the Wellfield A region was equal to, but did not exceed, the leading indicator. This leading indicator value was set to ensure the pressure gradient continues to drive water from the open GAB south towards the spring zones. The monitoring data demonstrates that Wellfield A is operating within compliance criteria.

For Wellfield B, the drawdown response and propagation of the potentiometric surface continues to show asymmetry, reflecting structural and palaeogeographical control over aquifer conditions. The production wells are situated in a northwest oriented wide basin trough, which contains a thicker,

[17] Northern Water | Northern Water

more transmissive aquifer sequence. The drawdown pattern is similar to that of earlier reports and in line with modelled predictions.

The area contained within the 10 m drawdown contour line is 4,004 km^2, below the maximum 4,450 km^2 compliance criteria. The latest reported average drawdown for bores S1/S1_New and S2 was 1.7 m, less than the maximum 4 m drawdown limit set for Wellfield B. The existing abstraction rate, attributable to ODC operations, has demonstrated a consistent 30 m drawdown contour and predictable 20 m contour in alignment with modelling predictions. However, the 10 m drawdown contour is a reflection of cumulative abstraction attributable to multiple users north of Wellfield B and third-party antecedent flow to the east of the Wellfield B designated area, some of which is outside the principles of the Far North Prescribed Wells Area Water Allocation Plan (SAAL 2020). The 10 m cumulative drawdown contour is predicted to expand further to the east in FY25 and is outside of ODC's management control. Although some of this drawdown is potentially due to inaccuracies introduced through monitoring error and integrity issues with pastoral wells, the BHP numerical model does predict that the 10 m groundwater contour will be exceeded by 2026. Other industry abstraction further north in the GAB outside BHP's area of management could be influencing the movement of this contour.

ODC will review the expansion of the drawdown to the east during FY25 to evaluate the aquifer conditions, other aquifer industry abstraction further north and uncertainty related to bore monitoring performance, conditions and suitability. This includes working with the State and third-parties to resolve data collection and data integrity.

GAB spring flows are primarily driven by groundwater pressure as a potentiometric head in the GAB aquifer. Springs flow when the aquifer pressure head is maintained greater than the elevation of the spring vent. Spring monitoring during FY24 has demonstrated flows and quality within historical limits and within compliance criteria.

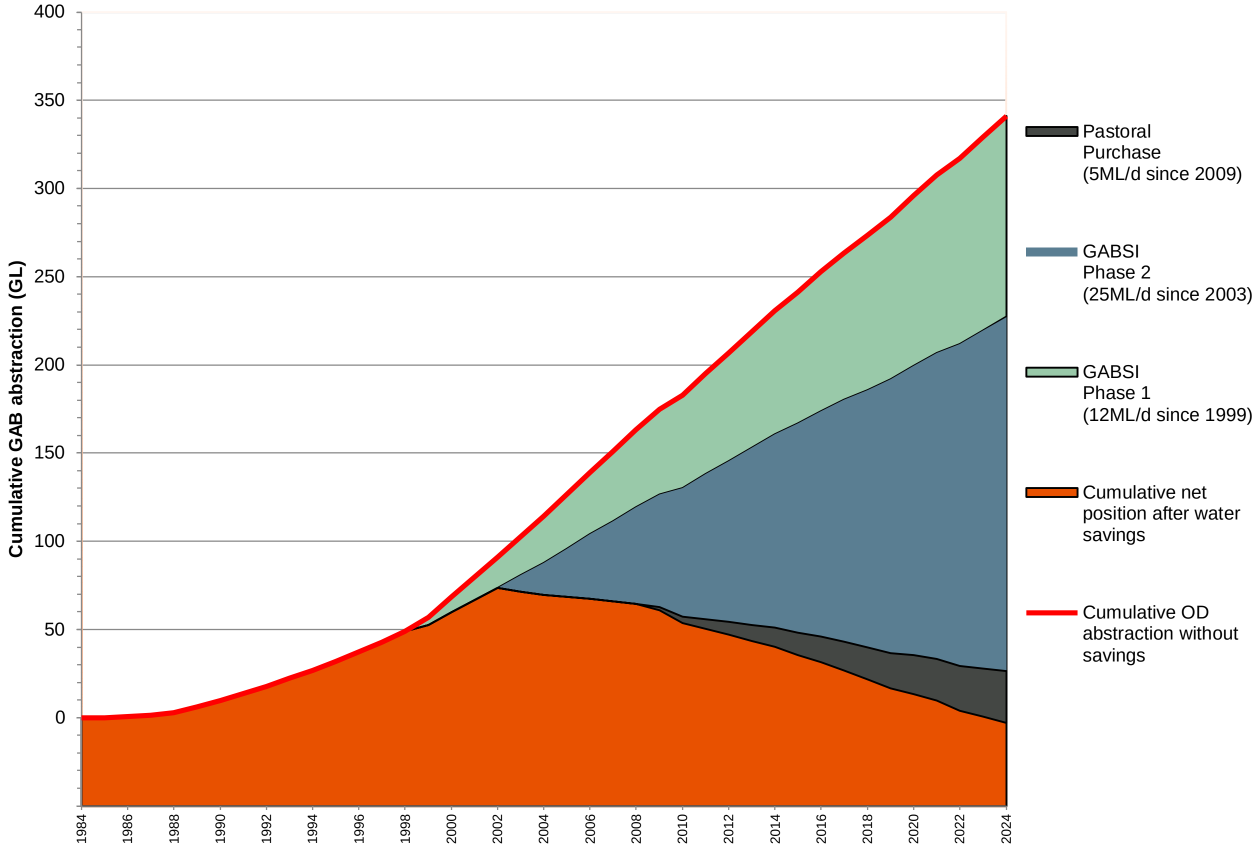


Figure 10-1 ODC cumulative GAB water savings

10.4 GAB Groundwater Model Update

In FY24 a triennial update of the GAB groundwater model (ODGABv2) was undertaken, as part of ODC's commitments (BHP 2022b). The ODGABv2 model was developed in 2020 and is the most recent and major update of ODC's GAB groundwater model, which includes a complete model rebuild based on an updated hydrogeological conceptualisation (Groundwater Logic 2020).

The triennial update included a calibration to data collected up to and including FY23. The data included monitoring data collected by ODC, publicly available information on abstraction by the petroleum industry, estimations on other third-party use (i.e. pastoral use and antecedent flow) and updated bore reference elevation survey information as a collation of ODC survey data and publicly available information. The triennial update provides:

- Improved simulated pressure responses to abstraction;
- Minor improvements to history-matching; and
- Identifies differences between expected and observed aquifer pressure in the eastern part of Wellfield B, likely due to groundwater use external to ODC abstraction such as antecedent flow, third-party use and ageing bore infrastructure, (which is also discussed in Section 6.5.1 and 6.5.3).

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12 APPENDIX 1: SUMMARY OF MONITORING RECORDS FOR FY24

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Beatrice Bore HBS004					1	1	1	1	
Boocaltaninna (6640-20)	1	1	1	1	1	1	1	1	
Bopeechee Bore HBO013 (6338-6)	4	4	4	4	4	4	4	4	
Bopeechee HBO004					1	1	1	1	
Bopeechee HBO007					1	1	1	1	
Bopeechee HBO011					1	1	1	1	
Brolga (Highway) (6438-92)	1	1	1	1	1	1	1	1	
Callanna (6438-95)	1	1	1	1	1	1	1	1	
Cannuwaukaninna 2 (6640-30)	1	1	1	1	1	1	1	1	
Chapalanna 2 (6639-19)	1	1	1	1	1	1	1	1	
Charles Angus (6438-1)	1	1	1	1	1	1	1	1	
Clayton #1 (6539-2)	1		1		1		1	1	Well was not shut in/monitored at land owners request

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Clayton #2 (6539-9)	1		1		1		1		Well was not shut in/monitored at land owners request
Clayton Dam 2 (6639-21)	1		1		1		1	1	Well was not shut in/monitored at land owners request
Cooranna (6438-4)	2	1	1	1	1	1	2	1	Access issues
Cooryaninna 2 (6639-16)	1	1	1	1	1	1	1	1	
Coward CBC001					1	1	1	1	
Coward CBC002					1	1	1	1	
Coward CBC013					1	1	1	1	
D2 (6540-15)	4	4					4	4	
D3 (6539-17)	4	4					4	4	
Davenport WDS001					1	1	1	1	
Davenport WDS042					1	1	1	1	
Davenport WDS052					1	1	1	1	
Dead Boy HDB004					1	1	1	1	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Dead Boy HDB005					1	1	1	1	
Dulkaninna 2 (6539-14)	1	1	1	1	1	1	1	1	
Emerald LES001					1	1	1	1	
Fred LFE001					1	1	1	1	
Fred LFE006					1	1	1	1	
GAB1 (6338-27)	4	4					4	4	
GAB2 (6338-31)	4	4					4	0	Well sub artesian and WQ cannot be collected
GAB5A (6338-36)	4	4					4	4	
GAB6 (6338-22)	4	0			Continuous		4	4	SIP only measured as production well not in use
GAB6A (6338-23)	4	4					4	4	
GAB7 (6338-24)	4	4					4	4	
GAB8 (6338-44)	4	4					4	4	WQ only collected when well is artesian flow
GAB10 (6338-46)	4	4					4	4	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
GAB11 (6338-47)	4	4					4	4	
GAB12 (6338-57)	4	0			Continuous		4	4	SIP only measured as production well not in use
GAB12A (6338-50)	4	4					4	4	
GAB13A (6338-51)	4	4					4	0	When well is sub artesian WQ cannot be collected
GAB14 (6338-58)	4	0			Continuous		4	1	When well is not running WQ cannot be collected. SIP only measured as production well not in use
GAB14A (6338-52)	4	4					4	0	When well is sub artesian WQ cannot be collected
GAB16 (6338-60)	4	0			Continuous		4	4	SIP only measured as production well not in use
GAB16A (6338-54)	4	4					4	4	
GAB17 (6338-55)	4	3					3	0	When well is sub artesian WQ cannot be collected. Access to bore head is limited
GAB18 (6338-61)	4	0			Continuous		4	2	When well is not running WQ cannot be collected. SIP only measured as production well not in use
GAB18A (6338-56)	4	4					4		When well is sub artesian WQ cannot be collected
GAB19 (6338-63)	4	4					4	4	
GAB21 (6338-66)	4	4					4	4	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
GAB22 (6338-65)	4	4					4	4	
GAB23 (6338-64)	4						4		SIP only collected when well is artesian condition. When well is sub artesian WQ cannot be collected
GAB24 (6339-12)	4	4					4	4	
GAB30A (6338-71)	4	4					4	4	
GAB31A (6338-72)	4	4					4	4	
GAB33A (6339-15)	4	4					4	4	
GAB51 (6539-19)	4		4	4	Continuous		4	4	Production wells were not shut in
GAB52 (6539-20)	4		4	4	Continuous		4	4	Production wells were not shut in
GAB53 (6539-18)	4		4	4	Continuous		4	4	Production wells were not shut in
Georgia 2 (6540-16)	4	4	4	4	1	1	4	1	
Gosse LGS002					1	1	1	1	
Gosse LGS004					1	1	1	1	
Hermit Hill HHS028					1	1	1	1	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Hermit Hill HHS035					1	1	1	1	
Hermit Hill HHS101					1	1	1	1	
Hermit Hill HHS125A					1	1	1	1	
Hermit Hill HHS137					1	1	1	1	
Hermit Hill HHS170					1	1	1	1	
HH1 (6338-38)	4	4					4	4	
HH2 (6338-39)	4	4					4	4	
HH3 (6338-40)	4	4					4	0	Sub artesian well, WQ cannot be collected
HH4 (6338-42)	4	4					4	4	
Jackboot (6339-6)	4	4	4	4	1	1	4	4	
Jewellery Creek (6639-17)	1	0	1	0	1	0	1	1	Well is broken at surface – no data collected
Kopperamanna (New) (6640-1)	1	1	1	1	1	1	1	1	
Lake Billy #2 (6538-67)	4	4	4	4	1	1	4	4	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Lake Harry (6539-5)	2	2	2	2	1	1	2	2	
Marion (6539-4)	1	2	1	2	1	1	1	2	
Maynards (6438-79)	1	1	1	1	1	1	1	1	
MB1 (6339-9)	4	4					4	4	
MB2 (6338-49)	4	4					3	0	Sub artesian well, WQ cannot be collected
MB5 (6339-55)	4	4					4	4	
MB6 (6239-759)	4	4					4	4	
MB7 (6439-39)	4	4					4	4	
MB8 (6439-40)	4	4					4	4	
McLachlan LMS004B					1	1	1	1	
Morphetts (6438-87)	1	1	1	1	1	1	1	1	
Morris Creek (6439-9)	1	1	1	1	1	1	1	1	
Muloorina (6439-20)	2	2	2	2	1	1	2	2	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
New Years Gift (6338-2)	4	4					4	4	
OB1 (6439-27)	4	4					4	4	
OB3 (6439-26)	4	4	4	4	1	1	4	4	
OB6 (6439-24)	4	4					4	4	
Old Finniss HOF004					1	1	1	1	
Old Finniss HOF033					1	1	1	1	
Old Finniss HOF081					1	1	1	1	
Old Finniss HOF094					1	1	1	1	No flow in FY24. ODC will investigate an alternative location to HOF094 for spring flow in FY26
Old Finniss HOF096					1	1	1	1	
Old Woman HOW009					1	0	1	0	No monitoring due to cultural sensitivities
Old Woman HOW015					1	0	1	0	No monitoring due to cultural sensitivities
Old Woman HOW025					1	0	1	0	No monitoring due to cultural sensitivities
Peachawarrina (6539-1)	1	1	1	1	1	1	1	1	

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Peters (6539-8)	1	1	1	1	1	1	1	1	
S1_New (6438-505)	4	4					4	4	
S2 (6438-96)	4	4					4	4	
S3 (6538-70)	4	4					4	0	WQ cannot be collected – well does not sustain flow
S3A (6538-71)	4	4					4	4	
S4 (6539-16)	4	4					4	4	
S5 (6539-15)	4	4					4	4	
Sinclair (6639-2)	1	1	1	1	1	1	1	1	
Sulphuric HSS011					1	1	1	1	
Sulphuric HSS012					1	1	1	1	
Sulphuric HSS024					1	1	1	1	
Tarkanina #2 (6639-18)	4	0	4	0	1	0	4	4	Well has failed below ground and cannot be shut in
Tent Hill #2 (6538-188)	4	4					4	0	WQ cannot be collected – well does not sustain flow

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Two Mile #2 (6538-166)	4	4		0		0	1	0	
Venables (6338-33)	4	4			1	1	1	0	WQ not collected as well non-artesian
WCB01 (6438-80)	4	4	4	1	1	1	4	4	
WCB02 (6439-18)	4	4	4	4	1	1	4	4	
Welcome WWS001					1	1	1	1	
Welcome WWS002					1	1	1	1	
Welcome WWS004					1	1	1	1	
Welcome WWS013					1	1	1	1	
Well Creek #2 (6538-167)	4	4	4	4	1	1	4	4	
West Finniss HWF002					1	1	1	1	
West Finniss HWF003					1	1	1	1	
West Finniss HWF048					1	1	1	1	
Wirringinna Spring MWI001	4	0					1	0	Water in well not safe to reach – unstable ground conditions

Site (Unit No.)	SIP/SWL		Flow Pressure		Flow Rate		Quality		Comments
	Required	Actual	Required	Actual	Required	Actual	Required	Actual	
Yarra Hill (6639-8)	1	0	1	0	1	1	1	1	Offtakes for pressure reading unable to be accessed

Note: Categories are defined in Great Artesian Basin Monitoring Program (BHP 2022).

13 APPENDIX 2: CALIBRATION CERTIFICATES FOR DRUCK PRESSURE TRANSDUCER

Abstec Calibrations Australia Pty Ltd
A.C.N. 074 824 847 ABN 91 751 155 014
79 Ledger Road, Beverley SA 5009
Telephone (08) 8244 1355
abstec@abstec.com.au
www.abstec.com.au

Accreditation No. 11087

Calibration Report
Digital Pressure Gauge

BHP Billiton
Olympic Way
Olympic Dam SA 5725

Report No: A41925PA
Report Date: 3 August 2023
Page Number: Page 1 of 1
Order No: Nil
Calibration Date: 3 August 2023
Next Calibration: 3 August 2024

Manufacturer: Parker
Model: SCJN-016-01
Serial Number: 3884LLD
ID Number: N/A
References Used: 32640-L
Tolerance:
Manufacturers Specification: 0.5 %fsd

Max Range: 0 kPa to 1600 kPa
Divisions: 1 kPa
Mount Angle: Vertical
Test Medium: Nitrogen

Ambient Temp: 20.1 ± 1°C
Humidity: 54.1 ± 5%
Calibration Location: Abstec Laboratory

Test Procedure Information:
Abstec Test Procedure TPV6 2.15 & MSA Test method 1 - 2008, Calibration of Pressure Calibrators, Indicators & Transducers.

Maximum error as found: 0.19% fsd

Summary of Results:
The unit was not adjusted. The tabulated information relating to the uncertainty of each test is expressed at approximately 95% confidence level. K=2.01

Actual Applied Pressure	Calibration Units	Specified Tolerance	Rising Reading	Rising Correction	Falling Reading	Falling Correction	Uncertainty	Conformity
0	kPa	±8	0	0	0	0	±0.6	Conforms
150	kPa	±8	150	0	151	-1	±0.6	Conforms
200	kPa	±8	200	0	201	-1	±0.6	Conforms
400	kPa	±8	401	-1	402	-2	±0.6	Conforms
600	kPa	±8	602	-2	603	-3	±0.6	Conforms
800	kPa	±8	803	-3	803	-3	±0.6	Conforms
1000	kPa	±8	1002	-2	1003	-3	±0.6	Conforms
1200	kPa	±8	1201	-1	1202	-2	±0.6	Conforms
1400	kPa	±8	1400	0	1401	-1	±0.6	Conforms
1600	kPa	±8	1600	0			±0.6	Conforms

Signed:

N.T. Doherty Authorised Signatory

Checked By:

Abstec CALIBRATIONS®

Accreditation No. 11087

Abstec Calibrations Australia Pty Ltd
A.C.N. 074 824 847 ABN 91 751 155 014
79 Ledger Road, Beverley SA 5009
Telephone (08) 8244 1355
abstec@abstec.com.au
www.abstec.com.au

Calibration Report
Digital Pressure Gauge

BHP Billiton
Olympic Way
Olympic Dam SA 5725

Report No: A41925PB
Report Date: 3 August 2023
Page Number: Page 1 of 1
Order No: Nil
Calibration Date: 3 August 2023
Next Calibration: 3 August 2024

Manufacturer: Druck
Model: DPI 705E
Serial Number: 12396987
ID Number: N/A
References Used: 32640-L
Tolerance:
Manufacturers Specification: 0.1 %fsd

Max Range: 0 kPa to 2000 kPa
Divisions: 0.1 kPa
Mount Angle: Vertical
Test Medium: Nitrogen

Ambient Temp: 20.1 ± 1°C
Humidity: 54.1 ± 5%
Calibration Location: Abstec Laboratory

Test Procedure Information:
Abstec Test Procedure TPV6 2.15 & MSA Test method 1 - 2008, Calibration of Pressure Calibrators, Indicators & Transducers.

Maximum error as found: 0.12 % fsd

Maximum error after adjustment: 0.05% fsd

Summary of Results:
The unit was adjusted. The maximum as found error is listed above. The tabulated information relating to the uncertainty of each test is expressed at approximately 95% confidence level. K=2.01

Actual Applied Pressure	Calibration Units	Specified Tolerance	Rising Reading	Rising Correction	Falling Reading	Falling Correction	Uncertainty	Conformity
0	kPa	±2	0	0	0	0	±0.6	Conforms
200	kPa	±2	200	0	200	0	±0.6	Conforms
400	kPa	±2	400	0	400	0	±0.6	Conforms
600	kPa	±2	600	0	600	0	±0.6	Conforms
800	kPa	±2	800	0	800	0	±0.6	Conforms
1000	kPa	±2	999	+1	999	+1	±0.6	Conforms
1200	kPa	±2	1200	0	1200	0	±0.6	Conforms
1400	kPa	±2	1400	0	1400	0	±0.6	Conforms
1600	kPa	±2	1600	0	1600	0	±0.6	Conforms
1800	kPa	±2	1800	0	1800	0	±0.6	Conforms
2000	kPa	±2	2000	0			±0.6	Conforms

Signed:

N.T. Doherty Authorised Signatory

Checked By:

Druck
a Baker Hughes business

CALIBRATION CERTIFICATE

Page 1 of 1

UNIT2.

UNIT UNDER TEST (UUT)

Manufacturer : Druck
Type : DPI705E
Serial Number : 12999289
Works Order ID : 32498422
Calibration Date : 04 April 2024
Calibrated By : Phyllis Tolan

Ambient Conditions

Ambient Temperature : 20°C

Comments

Calibrator Information

Instrument	Serial Number	Calibrated Against [1]	Medium
PACE1003	11420850	UKAS Lab.0822	Air

Performance Data

Parameter Range 0.000 to 20.000 bar g

Applied	Reading [2]	Deviation [3]	Permissable [4] Deviation
-0.0001 bar	-0.0003 bar	-0.0002 bar	±0.0160 bar
3.9986 bar	3.9984 bar	-0.0002 bar	±0.0160 bar
7.9970 bar	7.9968 bar	-0.0002 bar	±0.0160 bar
9.9966 bar	9.9963 bar	-0.0003 bar	±0.0160 bar
11.9959 bar	11.9956 bar	-0.0003 bar	±0.0160 bar
15.9948 bar	15.9945 bar	-0.0003 bar	±0.0160 bar
19.9930 bar	19.9925 bar	-0.0005 bar	±0.0160 bar
9.9974 bar	9.9968 bar	-0.0006 bar	±0.0160 bar
0.0003 bar	-0.0006 bar	-0.0009 bar	±0.0160 bar

Parameter Range 0.000 to 290.075 psi g

Applied	Reading [2]	Deviation [3]	Permissable [4] Deviation
-0.0015 psi	-0.0044 psi	-0.0029 psi	±0.2321 psi
57.9948 psi	57.9919 psi	-0.0029 psi	±0.2321 psi
115.9866 psi	115.9837 psi	-0.0029 psi	±0.2321 psi
144.9884 psi	144.9840 psi	-0.0044 psi	±0.2321 psi
173.9858 psi	173.9814 psi	-0.0044 psi	±0.2321 psi
231.9849 psi	231.9805 psi	-0.0044 psi	±0.2321 psi
289.9738 psi	289.9666 psi	-0.0073 psi	±0.2321 psi
145.0000 psi	144.9913 psi	-0.0087 psi	±0.2321 psi
0.0044 psi	-0.0087 psi	-0.0131 psi	±0.2321 psi

Parameter Range 0.000 to 2000.000 kPa g

Applied	Reading [2]	Deviation [3]	Permissable [4] Deviation
-0.0100 kPa	-0.0300 kPa	-0.0200 kPa	±1.6000 kPa
399.8600 kPa	399.8400 kPa	-0.0200 kPa	±1.6000 kPa
799.7000 kPa	799.6800 kPa	-0.0200 kPa	±1.6000 kPa
999.6600 kPa	999.6300 kPa	-0.0300 kPa	±1.6000 kPa
1199.5900 kPa	1199.5600 kPa	-0.0300 kPa	±1.6000 kPa
1599.4800 kPa	1599.4500 kPa	-0.0300 kPa	±1.6000 kPa
1999.3000 kPa	1999.2500 kPa	-0.0500 kPa	±1.6000 kPa
999.7400 kPa	999.6800 kPa	-0.0600 kPa	±1.6000 kPa
0.0300 kPa	-0.0600 kPa	-0.0900 kPa	±1.6000 kPa

Signed : ______ Stamp : 1019 Date: 03 May 2024

Notes

[1] This certificate provides traceability of measurement to recognised national standards and to units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories.
[2] Actual recorded values. For specification see Permissible Deviation column.
[3] Deviation calculated from reading minus actual applied value.
[4] Non linearity, hysterisis and repeatability.

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PS1206

14 APPENDIX 3: SUMMARY OF FIELD CHEMISTRY DATA FY24

Site	FY24 +Average			Historical Range		FY24 Average
	No. Of Records	EC25 (µS/cm)	pH	5th Percentile	95th Percentile	Above 95th Percentile
Beatrice Bore HBS004	1	3583	8.42	3280	4432	
Boocaltaninna	1	1497	6.98	1310	1795	
Bopeechee Bore HBO013	4	3884	7.19	3435	4301	
Bopeechee HBO004	1	4280	7.55	3500	4650	
Bopeechee HBO007	1	4672	8.01	3496	6545	
Bopeechee HBO011	1	3795	8.48	3528	5936	
Brolga (Highway)	1	3480	7.68	2993.5	3824	
Callanna	1	3360	7.89	2641	3552	
Cannuwaukaninna 2	1	1744	6.94	1582	1746	
CHAPALANNA2	1	1858	7.47	1692	2575	
Charles Angus	1	2880	7.44	2561	3317	
Clayton #1	2	1851	7.54	1674	2325	
Clayton #2	1	1912	7.47	1645	2229	
CLAYTONDAM2	2	2695	7.58	2586	2916	
Cooranna	1	2410	7.93	2158	2670	
Cooryaninna	1	1647	7.24	1275	2001	
Coward CBC001	1	7583	7.8	6280	7800	
Coward CBC002	1	5521	6.99	3135	5601	
Coward CBC013	1	5620	7.1	4776	5846	
D2	3	3134	6.84	1662	2158	Anomalous values due to equipment calibration issues
D3	4	2259	7.48	1908	2447	
Davenport WDS001	1	3815	7.68	3000	4195	
Davenport WDS042	1	3457	8.87	2980	4826	
Davenport WDS052	1	2990	8.93	2616	5470	
Dead Boy HDB004	1	2936	7.83	2710	4645	
Dead Boy HDB005	1	3736	7.97	3252	5087	
Dulkaninna	1	1660	7.8	1523	2070	
Emerald LES001	1	3841	8.35	3083	4693	

Site	FY24 +Average			Historical Range		FY24 Average
	No. Of Records	EC25 (µS/cm)	pH	5th Percentile	95th Percentile	Above 95th Percentile
Finniss Well HFL001	1	3120	8.08	2947.5	3525.4	Refer to HOF096 record
Fred LFE001	1	3071	8.51	2802	4475	
Fred LFE006	1	2919	8.13	2602.25	4810	
GAB001	4	5415	7.3	4465	5680	
GAB2						No samples. Well non-artesian in FY24
GAB005A	4	2881	8.38	2672.5	3295	
GAB006	4	3701	7.14	3165	3960	
GAB006A	4	3584	7.17	3236	3908	
GAB007	4	3413	7.07	2960	3642	
GAB008	4	3358	7.23	2834	3910	
GAB010	4	2906	7.21	2662	3386	
GAB011	4	3200	7.17	2950	3660	
GAB012	1	4022	7.39	3287.5	4085	
GAB012A	4	3549	7.19	3300	3890	
GAB13A						No samples. Well non-artesian in FY24
GAB014						Production bore not pumping during sampling periods
GAB14A						No samples. Well non-artesian in FY24
GAB016	4	4036	7	3307	3978	Anomalous values due to equipment calibration issues
GAB016A	4	3531	7.11	3387	3973	
GAB17	-	-	-	3688	5032	No samples. Well non-artesian in FY24
GAB018	3	4309	7.14	3441.5	4583.5	
GAB18A						No samples. Well non-artesian in FY24
GAB019	4	3172	7.1	2767.5	3490	
GAB021	4	5933	7	3359.5	5560	EC373 (µS/cm), above 95th percentile
GAB022	4	3518	7.24	3304	3918	
GAB23	1	3430	7.25	3425.5	3864	
GAB024	4	3749	7.02	3073.2	4040	
GAB030A	4	3652	7.03	3122	3886.8	
GAB031A	4	3554	7.06	3040	3755	
GAB033A	4	4161	7.21	3648	4453	

Site	FY24 +Average			Historical Range		FY24 Average
	No. Of Records	EC25 (µS/cm)	pH	5th Percentile	95th Percentile	Above 95th Percentile
GAB051	4	3429	7.16	2471	3271	Anomalous values due to equipment calibration issues
GAB052	4	3157	7.12	2337	3150	Anomalous values due to equipment calibration issues
GAB053	4	2873	7.09	2394	3062	
GEORGIA2	4	2571	6.86	2055	2656	
Gosse LGS002	1	2985	7.28	2700	3200	
Gosse LGS004	1	2968	7.26	2523	3100	
Hermit Hill HHS028	1	2976	8.51	2972.1	5482	
Hermit Hill HHS035	1	4964	9.18	2739.7	6713.5	
Hermit Hill HHS101	1	5213	7	3485	9905.65	
Hermit Hill HHS125A	1	3446	9.08	2189	3777.5	
Hermit Hill HHS137	1	2783	8.21	2641.2	5004.5	
Hermit Hill HHS170	1	2822	8.86	2614	3730	
HH001	4	3028	7.44	2723.5	3357	
HH002	4	2763	7.21	2792.5	3618	
HH003						No sample. Well sub artesian
HH004	4	3035	7.54	2865	5552	
Jackboot	5	4258	7.29	3880	4900	
Jewellery Creek	1	1615	6.97	1510.8	2081.95	
Kopperamanna	4	6143	7.12	5144	6560	
Lake Billy #2	2	2230	7.53	2104.5	2641	
Lake Harry	2	2169	7.67	2008.7	2596.5	
Marion	1	3310	7.61	2760	3750	
Maynards	4	2986	7.24	2511.5	3090.1	
MB001	4	3035	7.54	2865	5552	
MB02						No sample. Well sub artesian
MB005	4	4150	7.09	3656	4460	
MB006	5	7465	6.74	6295	7731	
MB007	3	2683	7.09	2370	2944	
MB008	5	2920	7.15	2369.3	2978	
McLachlan LMS004B	1	2864	8.39	2697	3604	
Morphetts	1	3790	7.64	3300	4100	

Site	FY24 +Average			Historical Range		FY24 Average
	No. Of Records	EC25 (µS/cm)	pH	5th Percentile	95th Percentile	Above 95th Percentile
Morris Creek	1	2870	7.27	2563.5	3295.85	
Muloorina	2	3436	7.5	2365	2967	Anomalous values may be due to equipment calibration issues
New Years Gift	4	4960	7.6	3801.5	5212.5	
OB001	4	2705	7.7	2407	2850	
OB003	4	2984	7.7	2583.5	3082.65	
OB006	4	2930	7.61	2485	2970	
Old Finniss HOF004	1	2768	7.87	2376	4590.2	
Old Finniss HOF033	1	4746	8.44	3965	12575	
Old Finniss HOF081	1	3269	8.04	3000	4792.9	
Old Finniss HOF094	1	3345	9	3183	8070	
Old Finniss HOF096[18]						Refer to HFL001 record
Old Woman HOW009						Not monitored due to cultural sensitivities
Old Woman HOW015						Not monitored due to cultural sensitivities
Old Woman HOW025						Not monitored due to cultural sensitivities
Peachawarrina	1	2590	7.08	2365	3047	
Peters	1	2260	7.7	2073.2	2517.8	
S1 New (S1 replacement)	5	3005	7.68	2737.5	3622.75	
S002	4	3607	7.85	2990.5	3830	
S003						Well does not flow – no sample
S003A	4	2310	7.7	2063	2547.3	
S004	4	2690	7.45	2377	2956	
S005	4	2193	7.46	1907.5	2480	
Sinclair	1	1853	7.42	1671.95	2210.45	
Sulphuric HSS011	1	3896	8.32	3183.5	3998.5	
Sulphuric HSS012	1	3290	7.97	3054.5	4970	
Sulphuric HSS024	1	2755	8.7	2677.5	4500	
Tarkanina #2	4	1969	7.69	1847.9	2312	
Tent Hill						No samples. Well does not flow enough to collect water samples
Two Mile #2						No samples. Well non-artesian in FY24

[18] HOF096 has been historically mis-identified. All records relating to HOF096 are now referred to as HFL001.

Site	FY24 +Average			Historical Range		FY24 Average
	No. Of Records	EC25 (µS/cm)	pH	5th Percentile	95th Percentile	Above 95th Percentile
Venables						No samples. Well non-artesian in FY24
WCB01	4	3015	7.89	2581	3139	
WCB02	4	2534	7.83	2150	2608	
Welcome WWS001	1	4673	7.76	4208	7521.6	
Welcome WWS002	1	7485	7.36	6214.3	9048.25	
Welcome WWS004	1	3975	7.73	3500	4208.5	
Welcome WWS013	1	6176	7.67	2652.5	7597.75	
Well Creek #2	4	2642	7.8	2196.5	2830.5	
West Finniss HWF002	1	3271	8.24	3098.3	5275	
West Finniss HWF003	1	3634	8.75	3097	5625	
West Finniss HWF048	1	3846	8.48	2917.5	5615	
Wirringinna Spring MWI001						Stagnant water – no sample taken
Yarra Hill	1	2100	7.57	1725.35	2356.4	

15 APPENDIX 4: PRESSURE TREND DATA

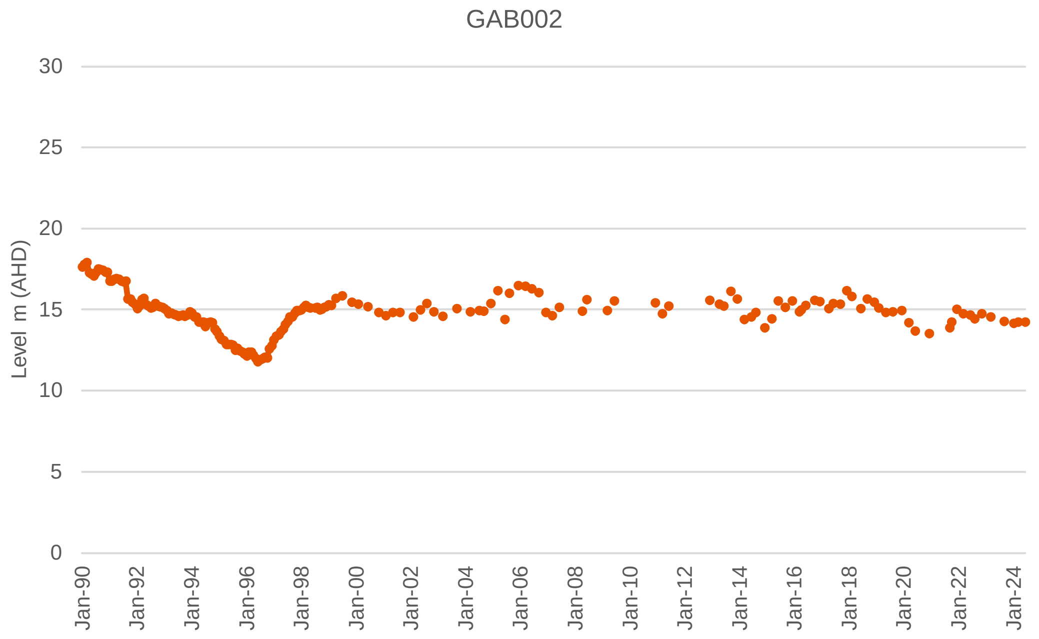

Figure 15-1 **Groundwater level for GAB2**

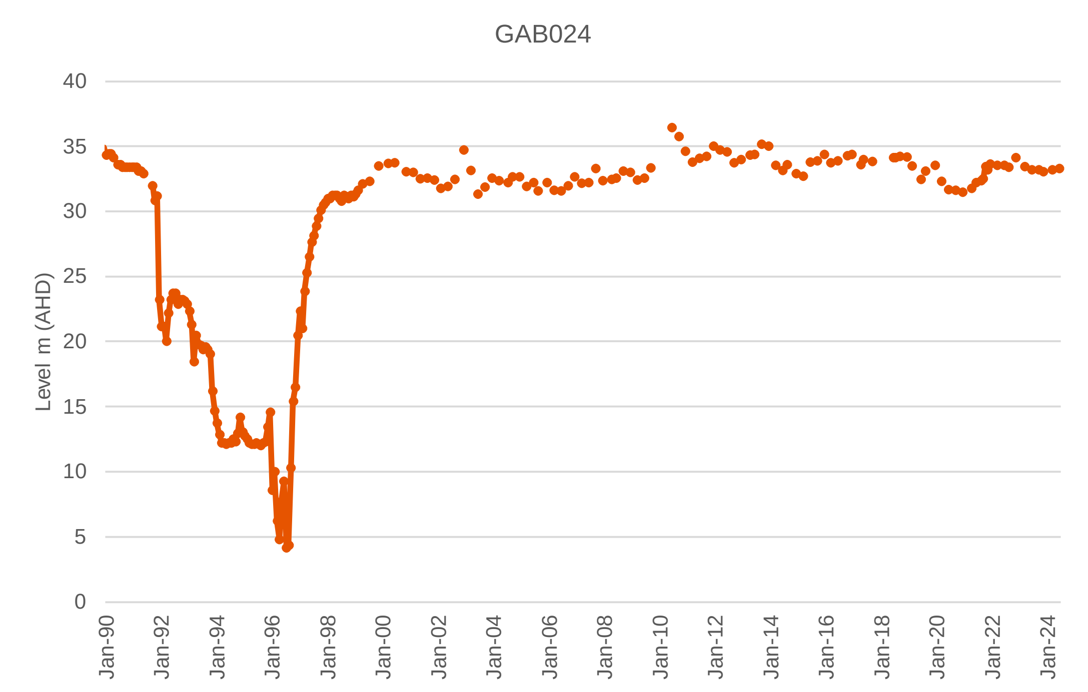

Figure 15-2 **Groundwater level for GAB24**

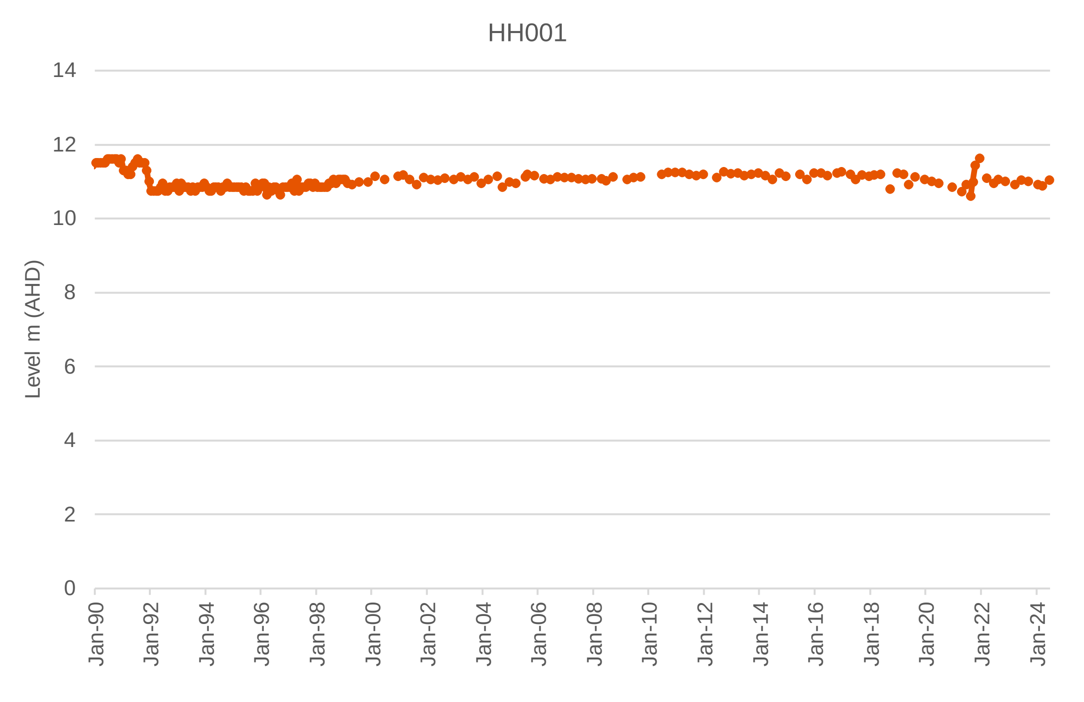

Figure 15-3 Groundwater level for HH1

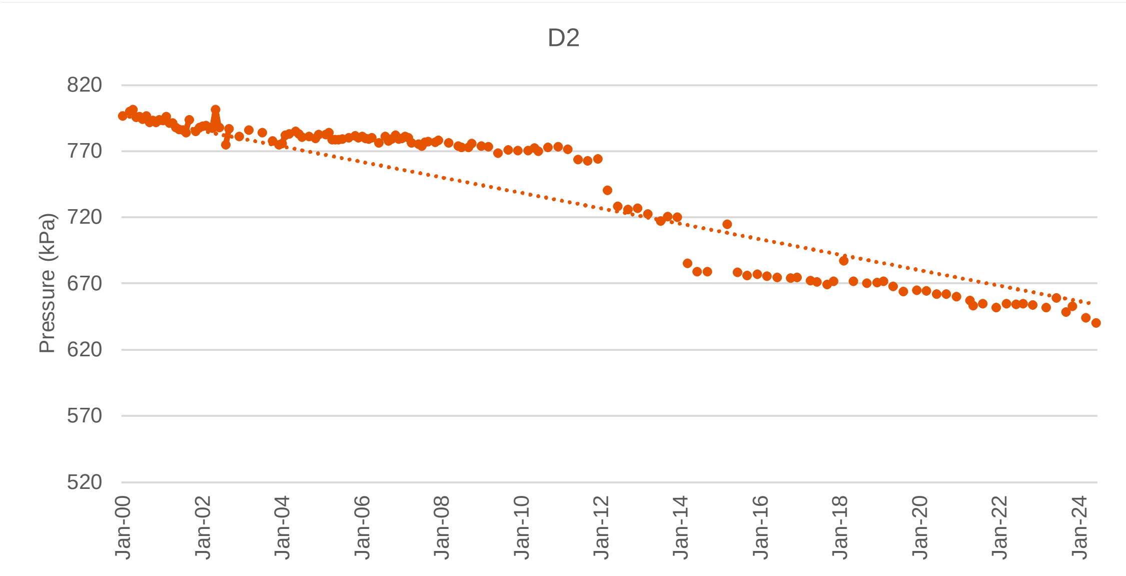

Figure 15-4 Groundwater pressure for D2

** Pressure measurements at D2 are taken as a cold shut in pressure since 2014. Prior to this, a pre-heat procedure was use measuring maximum pressure rather than cold pressure.*

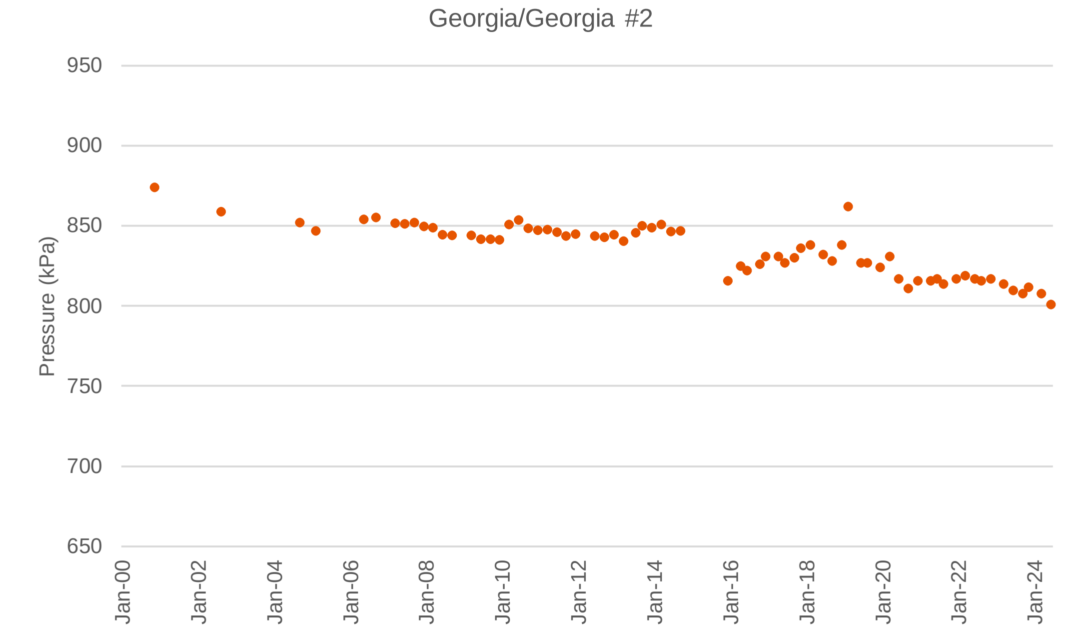

Figure 15-5 Groundwater pressure for Georgia/Georgia #2

Measurements from October 2016 are from Georgia 2 – this well has a higher reference AHD hence a change in measured kPa.

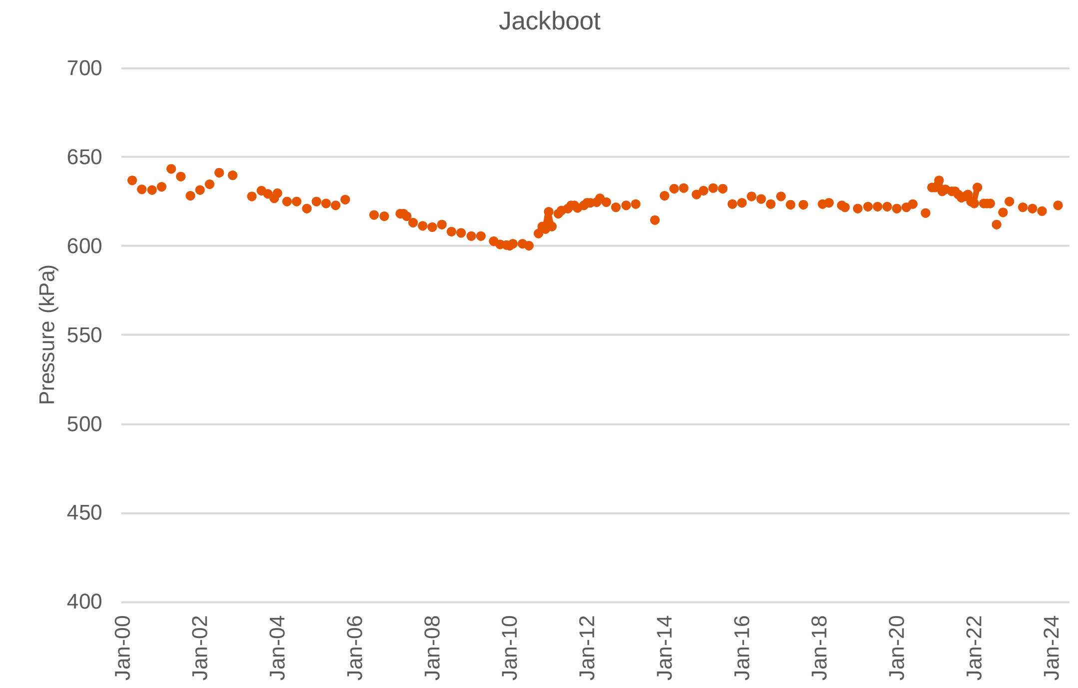

Figure 15-6 Groundwater pressure for Jackboot

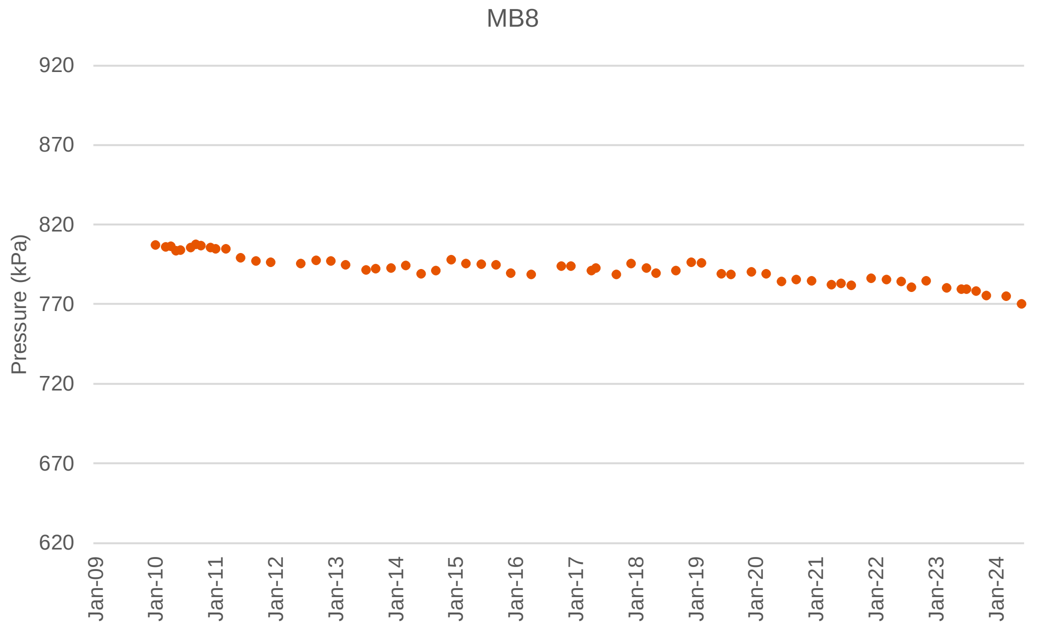

Figure 15-7 **Groundwater pressure for MB8**

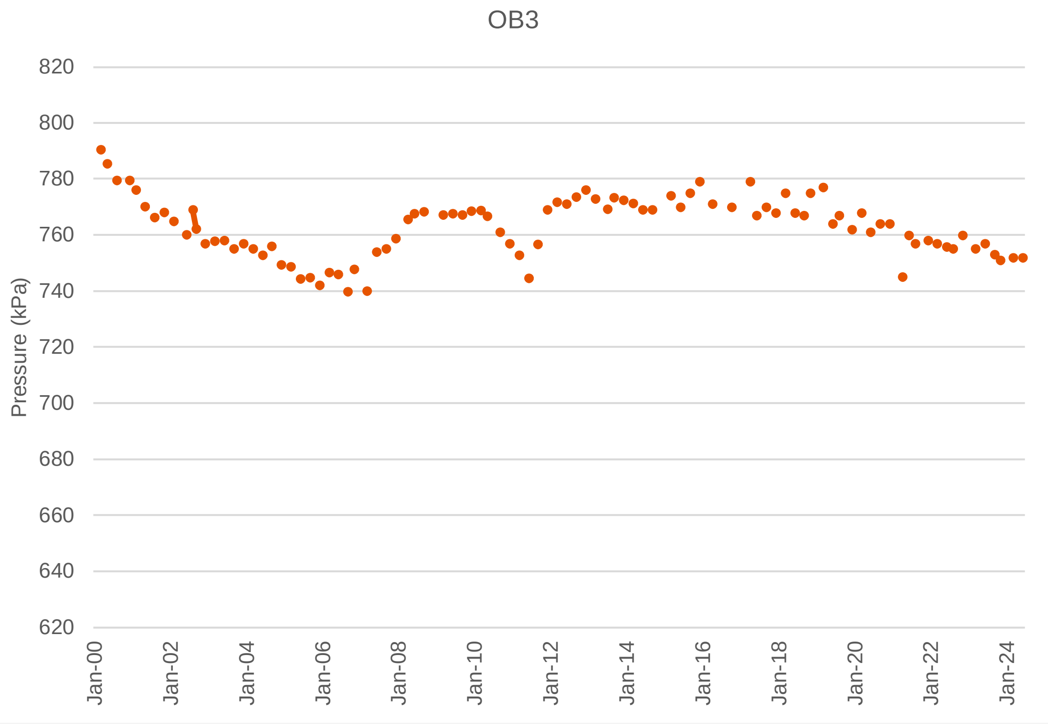

Figure 15-8 **Groundwater pressure for OB3**

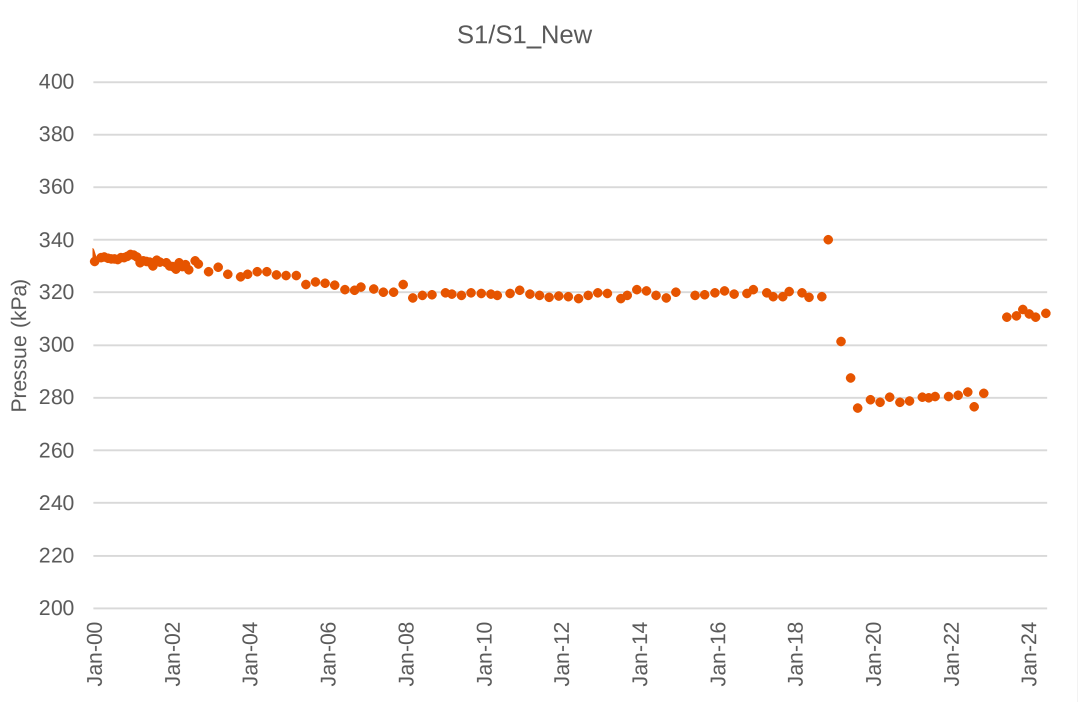

Figure 15-9 Groundwater pressure for S1/S1_New

Measurements from June 2023 are from S1_New – this well has a lower reference AHD (approximately 0.5 m) hence a change in measured kPa.

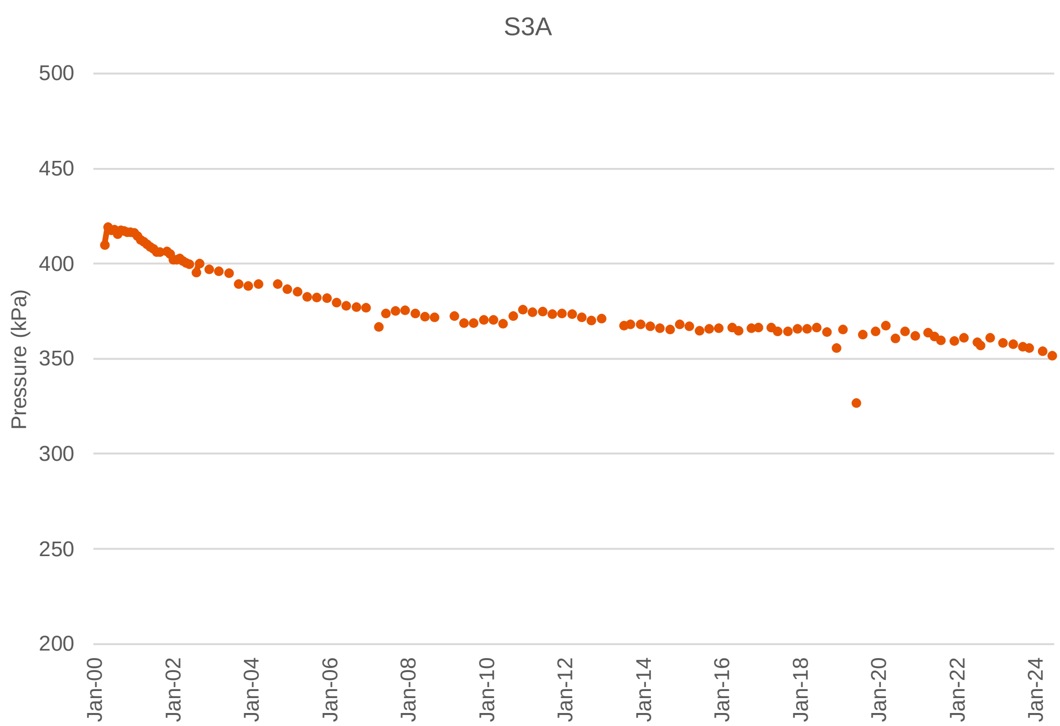

Figure 15-10 Groundwater pressure for S3A

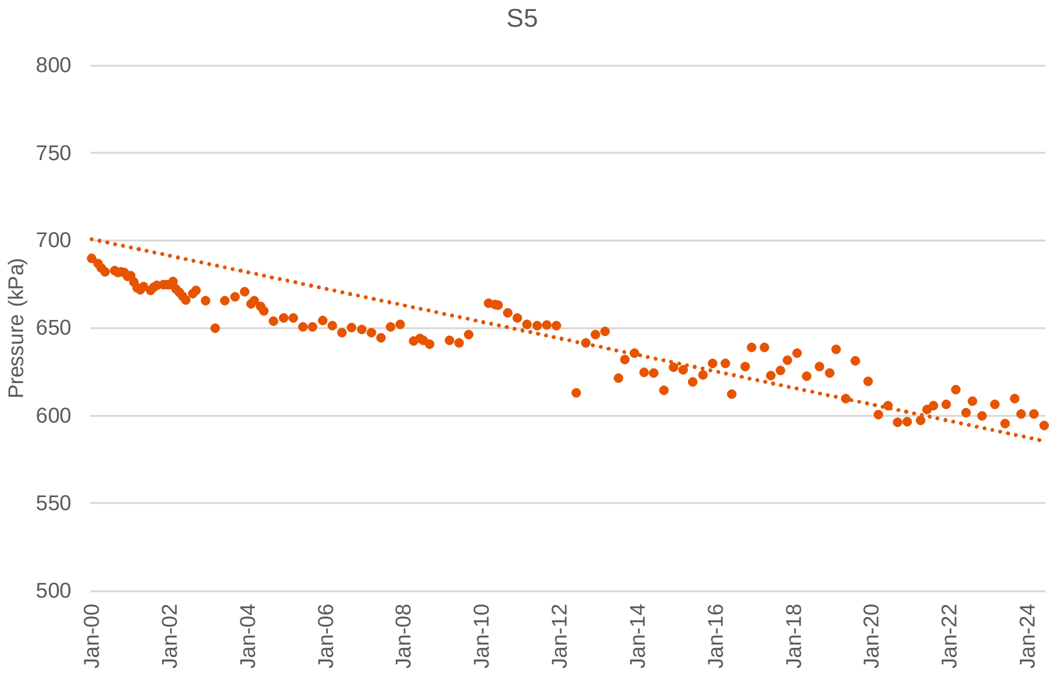

Figure 15-11 Groundwater pressure for S5

16 APPENDIX 5: CONDUCTIVITY TREND DATA

Conductivity trend graphs are provided here for:

- Bores and springs that have a regression coefficient that statistically differs from zero at the 95% confidence level and is greater than 0.10 or less than -0.10.
- Bores and springs that have an average conductivity for FY24 that is greater than the 95th percentile for that bore or spring.

Refer to Section 8 for discussion of this data.

The following statistics are provided for each graph in this section:

n	The number of data points used in the regression calculation.
F	Overall F test value for null hypothesis H0:m=0 versus the alternative Ha:m≠0, where m is the slope of the line (regression coefficient) in the equation y=mx+b.
p	The associated significance value for the F test at the 95% confidence level.
r^2	R squared.

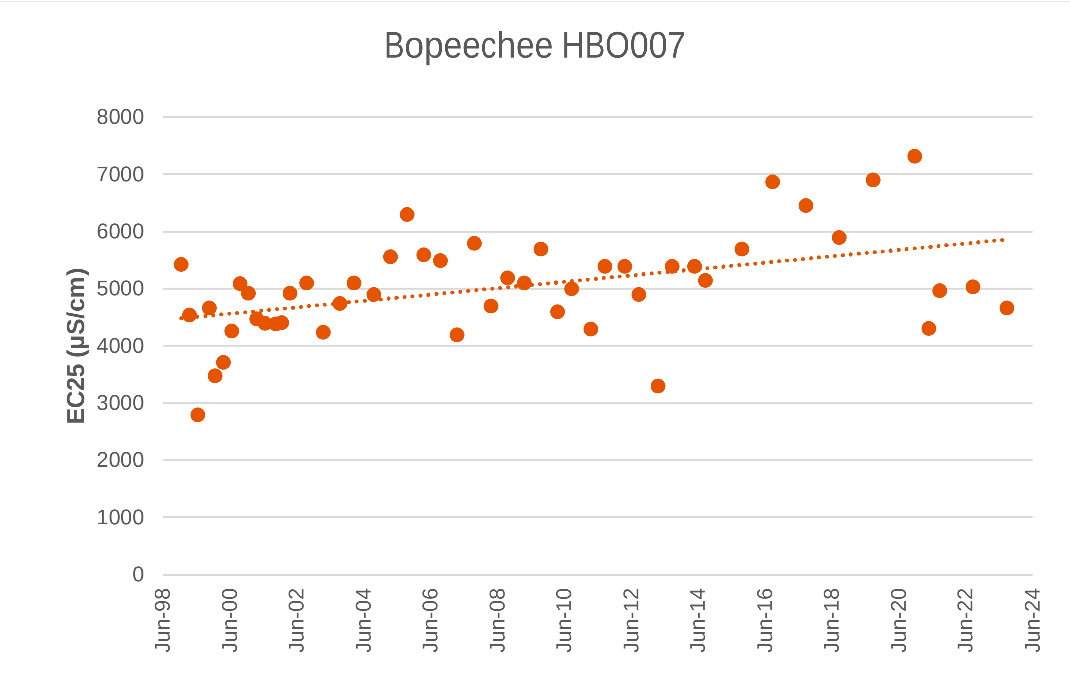

Figure 16-1 Conductivity trend for Bopeechee HBO007.

(n = 49, F = 12.86, p = 0.0008, r^2 = 0.21, significant (P<0.05) trend).

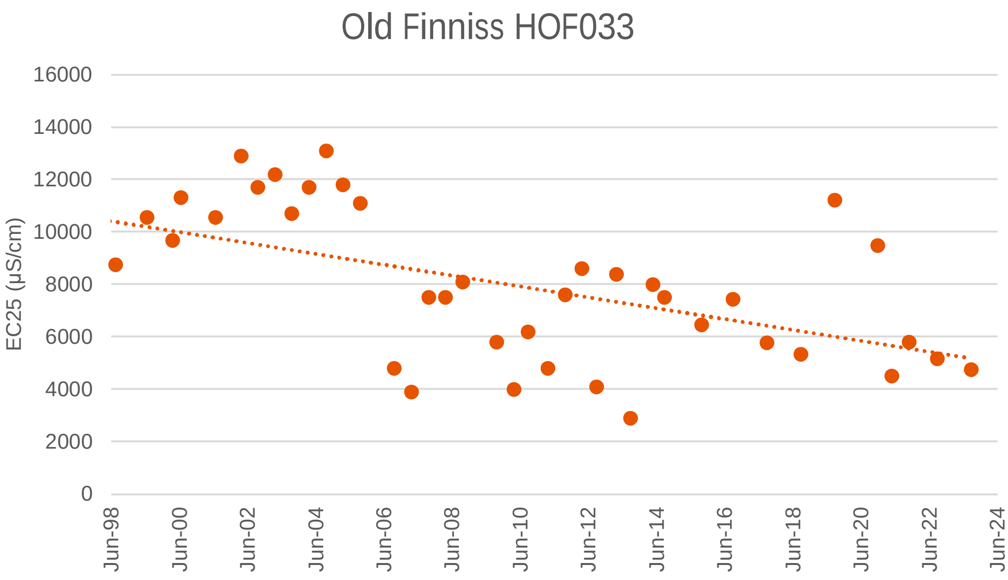

Figure 16-2 Conductivity trend for Old Finniss HOF033.

(n = 45, F = 24.61, p = 0.000012, r2 = 0.36, significant (P<0.05) trend).

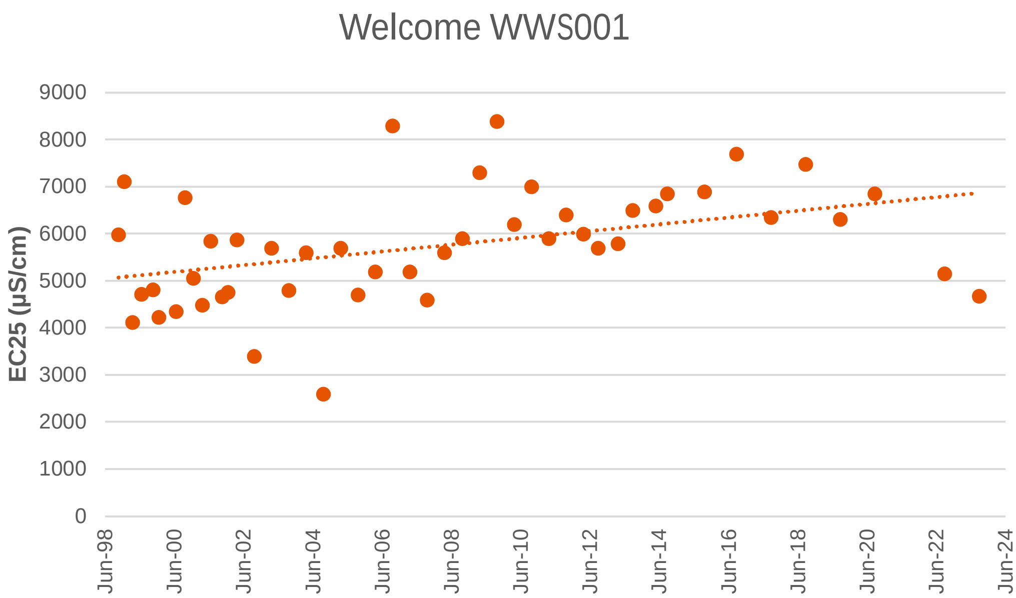

Figure 16-3 Conductivity trend for Welcome WWS001*.

(n = 47, F = 9.38, p= 0.0037, r2 = 0.17, significant (P<0.05) trend. Not sampled in FY22).

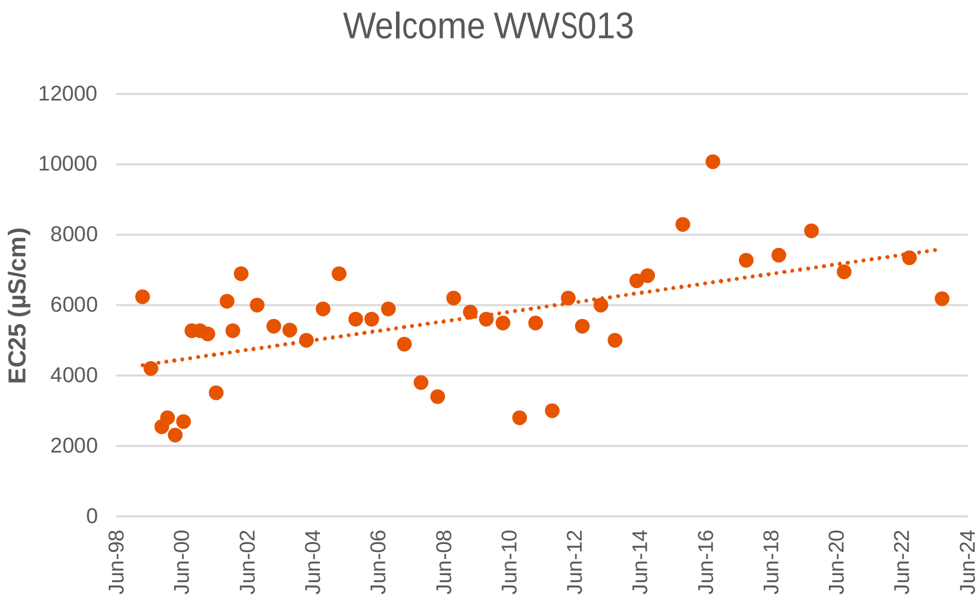

Figure 16-4 Conductivity trend for Welcome WWS013*.

(n = 46, F = 20.99, p= 0.000038, r2 = 0.32, significant (P<0.05) trend).
(Not sampled in FY22. Included based on historical increasing salinity trend).

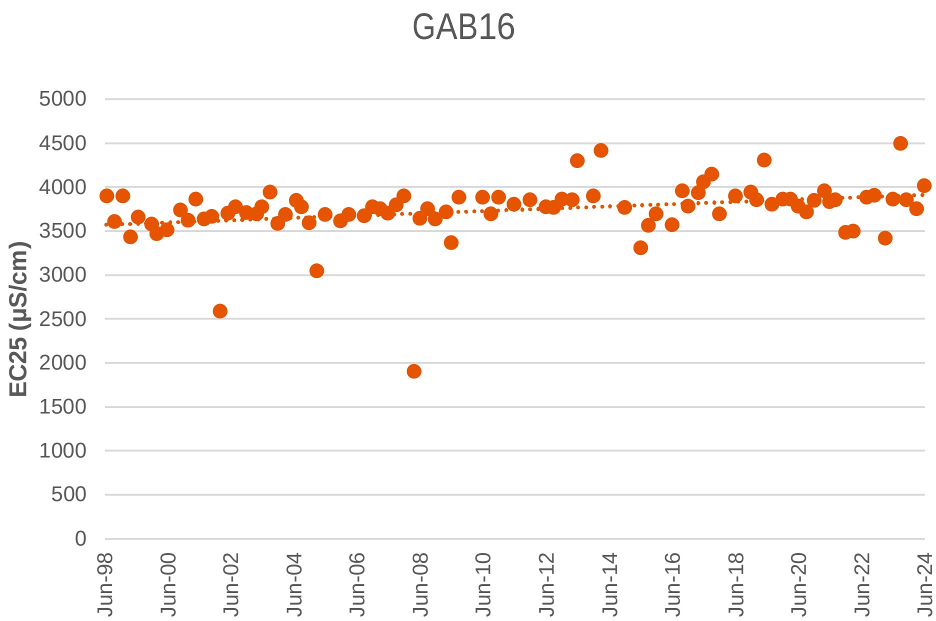

Figure 16-5 Conductivity trend for GAB16.

(n = 132, F = 36.56, p= 0.000000015, r^2 = 0.22, average FY24 conductivity greater than 95th percentile).

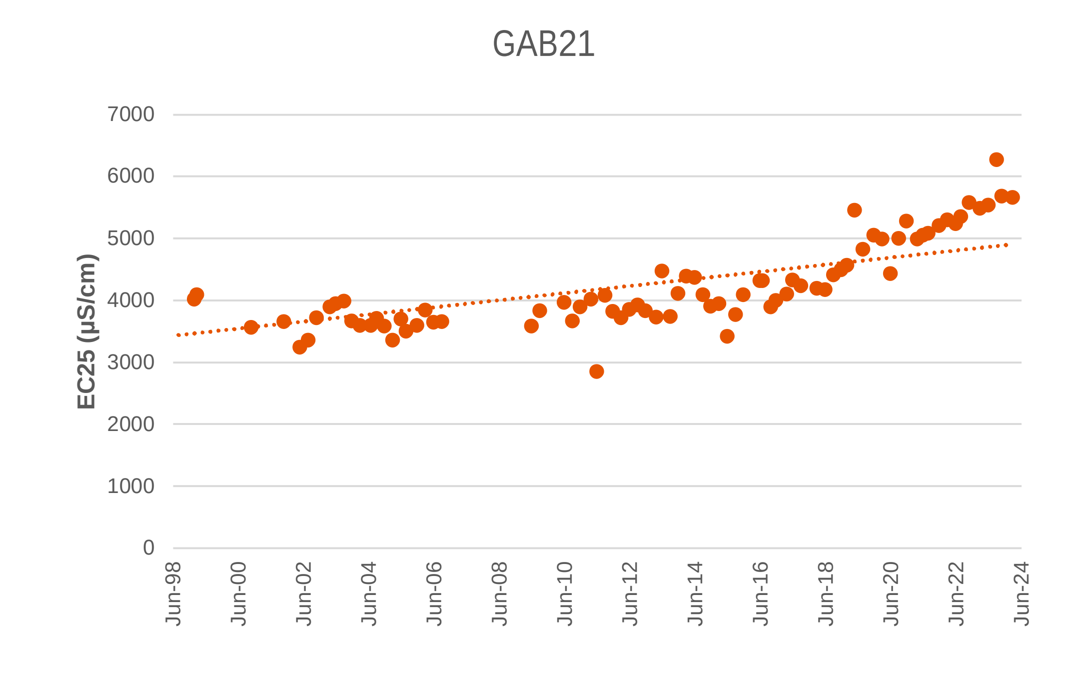

Figure 16-6 Conductivity trend for GAB21.

(n = 89, F = 114.89, p= 0.000000000000000014, r^2 = 0.57, significant ($P<0.05$) trend).

17 APPENDIX 6: TEN YEAR FORWARD SCHEDULE FOR GAB ABSTRACTION

	Demand (ML/day)			*Total Water Requirement ML/day*	Supply – Source of Water (ML/d)		
CY	Potable Water Township	Potable Water Plant & Mine	Non-potable Water Plant & Mine		GAB Borefield A	GAB Borefield B	On-Site Sources
2024	2.6	8.9	25.1	36.6	3.4	31.7	1.5
2025	2.6	9.0	24.9	36.5	3.3	31.7	1.5
2026	2.6	9.1	24.3	36.0	2.8	31.7	1.5
2027	2.6	9.1	23.4	35.1	1.9	31.7	1.5
2028	2.6	8.9	21.7	33.2	0.0	31.7	1.5
2029	2.6	10.1	22.7	35.4	2.2	31.7	1.5
2030	2.6	12.3	25.2	40.1	1.9	31.7	6.5
2031	2.6	13.7	25.7	42.0	1.8	33.7	6.5
2032	2.6	13.9	25.6	42.1	1.9	33.7	6.5
2033	2.6	14.1	25.5	42.2	2.0	33.7	6.5
2034	2.6	14.4	25.6	42.6	2.4	33.7	6.5

Notes: As provided to the Minister for Energy and Mining in December 2023. An updated schedule will be provided by 1 January 2025.

18 APPENDIX 7: PASTORAL BORES IN THE WELLFIELD AREA

Bore	Flow Measured (M) / Estimated (E)
Boocaltaninna	M
Brolga (Highway)	E
Cannuwaukaninna 2	M
Chapalanna 2	M
Charles Angus	E
Clayton 1	E
Clayton 2	E
Clayton Dam 2	E
Cooranna	E
Cooryaninna	M
Dulkaninna	M
Georgia #2	M
Jewellery Creek	E
Kopperamanna	M
Lake Harry	M
Marion	M
Maynards	M
Morphetts	M
Morris Creek	E
Mulka Bore 2	E
Muloorina	M
Mungerannie 2	E
Peachawarinna	M
Peters	M
Poonarunna	E
Prices	E
Sinclair	M
Tarkanina #2	E
Yarra Hill	E

19 APPENDIX 8: GAB SPRING ZONES

Hydrogeological Zone	Springs Within Zone
Coward	Blanche Cup
South West	Hermit Hill, Finniss Well, Old Finniss, Old Woman
Western Lake Eyre South	Emerald, Gosse, McLachlan
South East	Davenport, Welcome
North East	Bopeechee, Sulphuric, Dead Boy, West Finniss
Wellfield A	Beatrice, Venables, Fred