Annual Report 2026

Groundwater Management and Monitoring Plan

For Bowen Gas Project Stage 1

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REVISION HISTORY

Revision	Revision Date	Revision Summary
0	May 2026	Final report for release

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EXECUTIVE SUMMARY

This report forms the seventh annual review of the Groundwater Monitoring and Management Plan (GMMP) for the Bowen Gas Project (BGP) Stage 1 and includes baseline data from BGP operations.

Currently, Arrow Energy operates the Bowen Gas Project (BGP), which includes PL486 and ATPs 1103, 1031, and 742. These tenures are jointly held by CH4 Pty Ltd, Arrow CSG (ATP 364) Pty Ltd, AGL Energy Limited, and Bow CSG Pty Ltd.

The BGP GMMP was approved with conditions by the (then) Department of Environment and Energy (DoEE), now the Department of Climate Change, Energy, the Environment and Water (DCCEEW), on 24 October 2019. This report is due annually, 3 months after the anniversary date of the commencement of the BGP. The BGP commenced on 14 February 2019[1] and on this basis, annual reports will be submitted to DCCEEW and uploaded to Arrow Energy's website by 14 May of each year. This report satisfies requirements for the annual report as outlined in Section 6.2.4 of the GMMP. A summary of the report is outlined as per below:

- Seven (7) production wells have been installed as heel intersects wells on multi-branch laterals, less than the 1408 authorised operational wells for Stage 1 of the BGP. The seven production wells were installed in 2019 in the Red Hill Central Petroleum Lease (within PL486).
- Production from Red Hill Central Petroleum Lease (within PL486) commenced in 2022.
- A total of nine (9) locations are now monitored in this reporting period as part of the BGP monitoring network.
- There is no apparent influence of CSG production to the Tertiary Sediment, Fort Cooper Coal Measures (FCCM) and Rewan aquifers in the installed monitoring network for the BGP.
- A review of the groundwater quality data indicates that there are no notable trends for both the shallow and deep aquifers.
- No non-compliances were recorded for the BGP GMMP bores and therefore no remedial actions were undertaken.
- All monitoring obligations have been met and no exceedances under the GMMP early warning system (EWS) recorded across the monitoring network.
- The 2025 Bowen Underground Water Impact Report (2025 Bowen UWIR) was approved with conditions by DETSI on 12 January 2026. This 2025 Bowen UWIR includes results from the updated 2025 Bowen groundwater model. The 2025 Bowen UWIR concluded that the data obtained to date is in support of the existing conceptual hydrogeological model, and the 2025 groundwater model is considered to be suitable for predicting depressurisation impacts as a result of CSG operations for the Project Areas. Magnitude and location of impacts predicted from the 2025 UWIR model remain in line with the GMMP model, with some delay in timing of these impacts. The groundwater monitoring network identified as part of the water monitoring strategy of the 2025 UWIR remains the same as that provided in the GMMP, and there is no additional impact to MNES identified.
- No out of cycle UWIR was submitted.

[1] DCCEEW was notified by email of the commencement on 7 March 2019 (reference: 2012/6377).

1 INTRODUCTION

This report forms the seventh annual review of the Groundwater Monitoring and Management Plan (GMMP) for the Bowen Gas Project (BGP) Stage 1. The purpose of the GMMP is to address specific requirements for monitoring of groundwater and assessing potential groundwater-related impacts resulting from the development of Stage 1. It includes detailed information on:

- A groundwater monitoring network to provide early detection of any changes in groundwater regime and impacts on groundwater dependent ecosystems;
- A baseline monitoring data acquisition program;
- An Early Warning System (EWS) including:
    - early warning indicators, trigger thresholds and limits for detecting impacts on groundwater levels, and;
    - exceedance response actions and timeframes.
- The timeframe for a regular review of the GMMP aligned with the state of Queensland required Bowen UWIR; and
- Provisions to make monitoring results publicly available.

Figure 1 shows the location of Arrow Energy's tenures in the Bowen Basin, and Figure 2 displays the project area for Stage 1 of the BGP.

The GMMP was approved with conditions by the then Department of Environment and Energy (DoEE), now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 24 October 2019. This report is due annually, 3 months after the anniversary date of the commencement of the BGP, which was triggered on 14 February 2019. DCCEEW was notified of the commencement on 7 March 2019 (reference: 2012/6377). On this basis, annual reports will be submitted to DCCEEW and uploaded to Arrow Energy's website by 14 May of each year. Periodic revisions of the GMMP are required to be submitted to the DCCEEW every three years if it is deemed that there are material changes to forecast production or groundwater modelling impacts.

For the purposes of reporting and alignment with the annual review of Arrow Energy's Bowen UWIR, the data collected and analysed will be for the calendar year (i.e. 1 Jan 2025 to 31 Dec 2025) and include groundwater data for Arrow's BGP production areas.

As per Section 6.2.4 of the GMMP, the annual report requires the following to be addressed:

- Report on any relevant ongoing studies and research projects and include any supporting technical studies as appendices to the annual report (Section 5);
- Document the number of coal seam gas wells, including (Section 2):
    - Total number of wells installed, including a breakdown of operational wells, non-operational wells, and wells that have been decommissioned or have failed; and
    - Confirmation that production is not from more than 1,408 operational wells.
- Provide an update on the implementation of the groundwater monitoring network and baseline monitoring, and summarise relevant monitoring results, including (Sections 3 and 4):
    - Groundwater levels and trends (Section 4.2);
    - Groundwater chemistry results and trends (Section 4.3);

- Analysis and interpretation of data and identification whether drawdown predictions made have changed materially (Section 4.2); and
- An assessment of factors contributing to observed groundwater level changes e.g. non-CSG versus CSG influences (Section 4.2).

- Provide any updates to the groundwater monitoring network if required (Section 3);
- Detail any confirmed non-compliances along with details of any remedial actions (Sections 3 and 4);
- Document compliance against the approval conditions over the preceding 12 months, including monitoring obligations and implementation of the EWS (Sections 3 and 4);
- Document corrective actions implemented to address any exceedances of trigger thresholds, limits, or non-compliance with approval conditions (Sections 3 and 4);
- Report against the performance measure criteria (Section 3); and
- Identify if an out of cycle UWIR was submitted (due to a material change or error in the information or predictions) and if practical consider a review of the GMMP outside of the 3-yearly review schedule. No out of cycle UWIR was submitted.

2 WATER PRODUCTION REVIEW

A summary of existing and forecast water production for the BGP is provided below. This information is also included in the 2025 Bowen UWIR (Arrow Energy, 2025), approved by DETSI on 12 January 2026.

Table 1 displays the current status of production wells within the BGP. Production does not exceed the 1,408 authorised operational wells. There has been no change in the number of operational wells since the previous GMMP annual report.

Table 1: BGP well status

Field development plan area		Approximate number of anticipated production wells[1]	Wells installed	Operational wells	Non-operational wells	Decommissioned or failed wells
Project Stage 1	Red Hill Central	31	7	7	0	0
	Remainder of the Project Stage 1 area	1,377	0	0	0	0
	GMMP Total	1,408	7	7	0	0

[1] Well locations and numbers for Red Hill and the remainder of Project Stage 1 area are indicative only. Total well count, however, will not exceed 1,408 for Project Stage 1. The well counts are for vertical production wells only.

2.1 Existing Water Production – BGP

Historical water production data for the production and production testing wells on PL 486 and ATP 742, 1031 and 1103 is summarised below.

2.1.1 PL486

PL 486, which incorporates the Red Hill Central (RHC) development, is located approximately 30 km north of the township of Moranbah.

Prior to the grant of PL486, the area of this production tenure was included in the exploration tenure ATP1103. Water volumes for the production testing (from wells RH098A, RH099A and RH100A) during the time this area was under ATP1103 are therefore included in ATP1103 water volumes. Following the grant of PL486, production from PL486 commenced in June 2022.

Table 2 presents the actual water production in 2025 versus forecast water production from the 2025 Bowen UWIR. The actual water production due to production testing (from wells RH104, RH105, RH106, RH107, RH108, RH109, and RH110) in 2025 is 0.4 ML more than forecast water production from the 2025 Bowen UWIR (8.7% more).

Table 2: Actual and forecast water production PL486 during the current review period

Year	2025 Bowen UWIR Forecast Water Production (ML)	Actual Water Production (ML)	Difference
2025	4.6	5.0	0.4 ML more than forecast (8.7% more)

2.1.2 ATP1103

ATP1103 is a large exploration tenure located in the North, East and South of the BGP.

As per the 2025 Bowen UWIR (Arrow Energy, 2025), a total of 305.478 ML of water was produced as part of production testing on ATP1103 between 2008 and the end of 2022. No further production testing on ATP1103 has occurred since that time. In addition, 5.3 ML of water was produced as part of production testing through to August 2022 on the area of ATP1103 before it was converted to PL486. This water volume is from production testing wells (RH098A, RH099A and RH100A) on what was ATP1103, which has now been converted to PL486 (Red Hill Central). Production from these wells occurred through to August 2022, with no further production test since that time.

2.1.3 ATP1031

ATP1031 lies approximately 100 km to the south of Moranbah. A total of 15.894 ML of water has been produced as part of production testing on ATP1031 between 2012 and 2021 (Arrow Energy, 2025). No further production testing has been undertaken since 2021.

2.1.4 ATP742

ATP742 is located approximately 50 kilometres north of Moranbah. As per the 2025 Bowen UWIR (Arrow Energy, 2025), a total of 2.892 ML of water has been produced as part of production testing on ATP742 between 2015 and 2017. No further production testing has been undertaken since 2017.

2.2 Forecast Appraisal Program – BGP

New production testing had been planned, the Wards Well pilot approximately 5km north of PL486 in ATP1103, and the Ellensfield pilot in ATP1103 approximately 13 km east of the production wells in PL486. The Wards Well pilot was forecast to operate from 2025 to 2027 and produce approximately 51.9 ML of water. The Ellensfield pilot was forecast to operate from 2025 to 2026 and produce approximately 8.2 ML of water. Although the 2025 Bowen UWIR forecast the commencement of production testing at these pilots during this Annual Review period, Arrow has not conducted any production testing from pilot wells during the period.

2.3 Forecast Water Production – BGP

Arrow Energy's proposed BGP involves a phased expansion of Arrow Energy's CSG production in the Bowen Basin. It comprises an update of development plans in the same general areas (i.e. within tenements ATP742, ATP1103, and ATP1031) from those presented in the Supplementary Report to the Environmental Impact Statement (SREIS). The project, as described in the 2016 Bowen UWIR, included development in 3 phases (1, 2 and 3). The groundwater modelling undertaken for the 2016 Bowen UWIR simulated phase 1, 2 and 3 of the BGP (with associated water production of 116 GL) occurring over 30 years commencing 2019 (and continuing to 2049). This production has been revised, and the 2025 Bowen UWIR is based on an updated field development plan (FDP) as follows:

- Red Hill Central (PL486) commenced 2022 and continuing to 2027.
- the remainder of the FDP area (ATP1103, ATP742 and ATP1031) commencing 2045 and continuing to 2063.

A forecast of the quantity of water to be produced against respective project timelines for the BGP FDP has been prepared and discussed below:

- water production from Red Hill Central is currently forecast to occur from 2022 to 2027, with a total of 55.1 ML of water to be produced (based on actual production of 47.5 ML from 2022 to 2025 and forecast water production of 7.6 ML from 2026 to 2027); and
- production from the remainder of the FDP area, tentatively planned from 2045 to 2063, will comprise 1,377 wells and total water production of 39.93 GL.

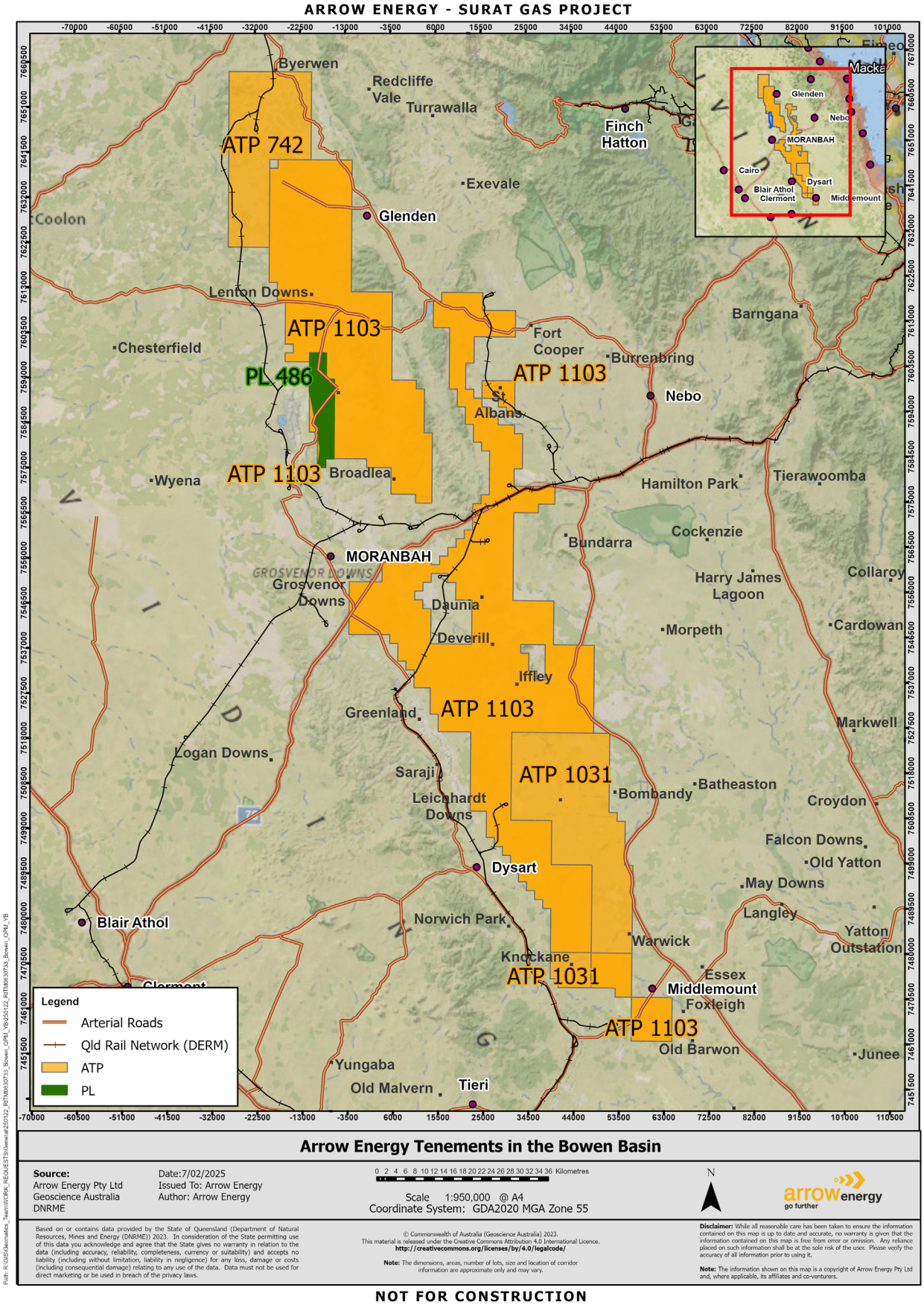


Figure 1: Arrow Energy's tenements in the Bowen basin

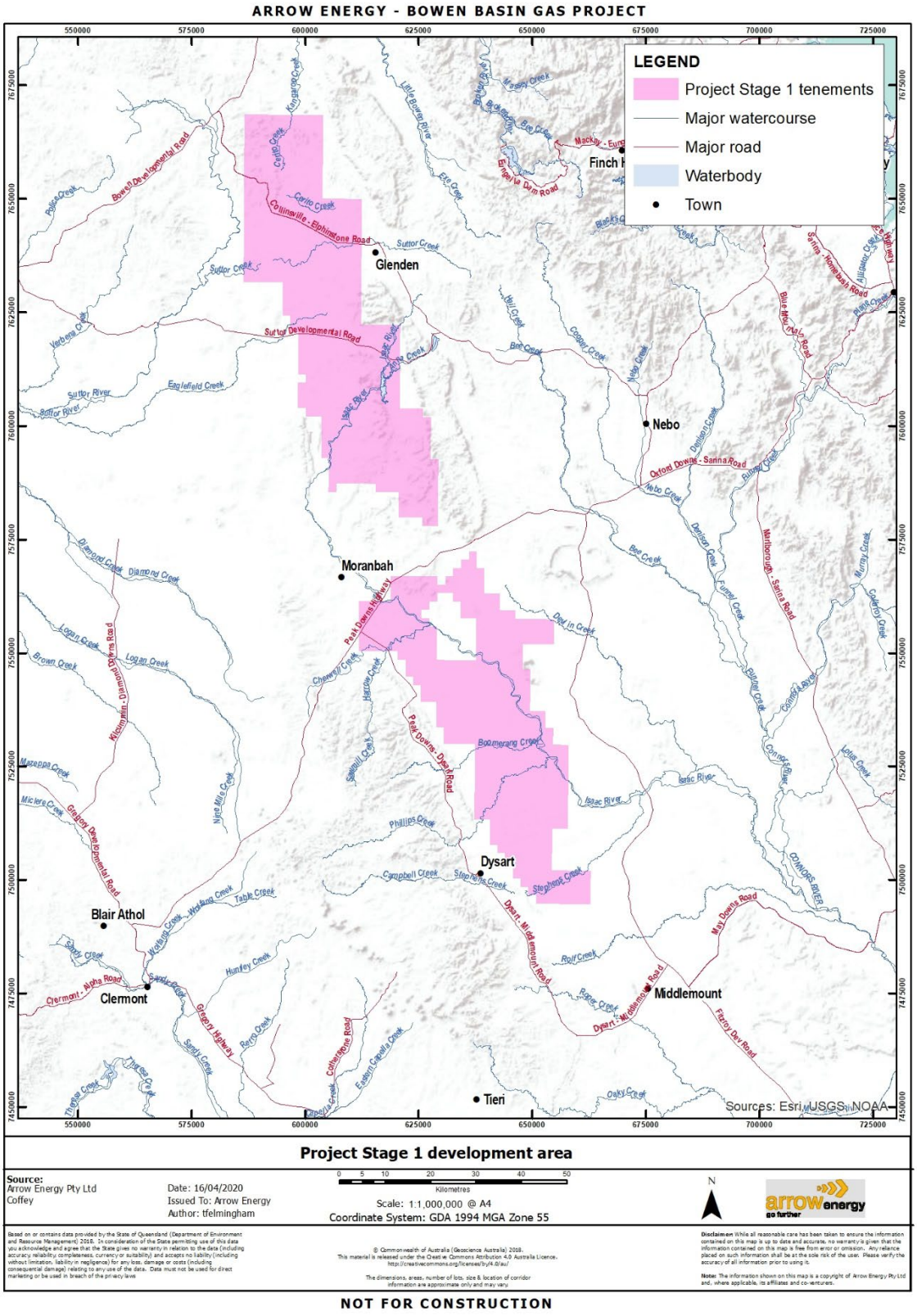


Figure 2: Stage 1 development area for the BGP

3 WATER MONITORING STRATEGY (WMS)

3.1 BGP Area Groundwater Monitoring Network

The approved groundwater monitoring network for the BGP area is comprised of 35 monitoring intervals at 22 separate locations (comprising 12 single sites and 10 nested sites of 23 monitoring intervals). Figure 3 provides an overview of the spatial distribution of the groundwater monitoring network. Table 3 presents the BGP monitoring requirements and the status of each location, with monitoring location names consistent with the 2019 Bowen GMMP approved by the then Department of the Environment and Energy (now DCCEEW) under Arrow Energy's BGP approval. All subsequent reporting is based off this nomenclature.

At present, thirteen intervals points have been installed at nine locations as a part of the monitoring network; MB1-S/I/D, MB2, MB3, MB12, GW004A/B, GW007A/B, AEN1214, AEN1234, and AEN1063 as detailed below. The groundwater levels and water quality of these bores are presented in Section 4.2 and 4.3. No non-compliances have been recorded to date.

MB1-S/I/D

MB1, located within 10 kilometres of the Red Hill Central development area, was installed as an appraisal (pilot) production well (originally named Red Hill-30) in January 2010. Groundwater level observations were made from the Moranbah Coal Measures (i.e. the deep interval) using the well from November 2011 to December 2011. Pumping from the well (for the pilot) was also undertaken during this time.

Pilot operation (and monitoring) ceased between December 2011 and November 2012.

The well was again monitored from 30 November 2012. The water level in Red Hill-30 had recovered to within 92% of its original baseline level prior to pumping for the pilot recommencing in December 2012.

From December 2012 the pilot was again operated (including production from Red Hill-30). Production from Red Hill-30 and the other pilot well in the pilot ceased in May and April 2013 respectively. Monitoring in Red Hill-30 continued until it was suspended in September 2013.

In October 2019, MB1 was modified by installation of a multi-level monitoring system, enabling additional monitoring from the intermediate and shallow intervals, and incorporated into the WMS for the BGP. Groundwater level data has been collected from all three intervals in MB1 since 11 November 2019. Drilling information for MB1 confirmed that sufficient Quaternary / Tertiary Sediment or Rangal Coal Measures were not encountered at this location; and therefore, the shallow and intermediate monitoring points are positioned within the Fort Cooper Coal Measures.

Pressure spikes at the time of water quality sampling from the lower zone from MB1-D are likely associated with spikes in temperature in the Fairhill pressure gauge. The calibration files in the skids use both the temperature and pressure data from the downhole gauge (digital gauges have both temperature and pressure sensors) to calculate the amount of pressure (i.e. water and gas) above the gauge. The temperature is an input to the calibration calculation and so changes in temperature directly affects the calculated pressure. As the temperature spikes are associated with the time of pumping from the lower zone (MCM), it is likely these transient spikes in data don't represent actual changes in pressure.

Groundwater level monitoring has ceased from 21 June 2024 to 2 May 2025 due to the phase-out of the 3G communication system, which required an upgrade to a 4G communication system. Therefore, during this Annual Review period, groundwater logger data was only recorded from 2 May 2025 to 31 December 2025.

MB2

Located within 10 kilometres of the Red Hill Central development area, MB2 was originally installed as an appraisal (pilot) production well (originally named Red Hill-60) in January 2011. Pumping (intermittently) from the well for the pilot was undertaken between 2012 and 2018. Groundwater level observations were made from the Moranbah Coal Measures using the well from September to October 2015 (1.5 months), and October 2017 to May 2018 (8 months). The well was converted to a permanent monitoring well and incorporated into the WMS for the BGP using the existing downhole pressure gauge in February 2019, with twice daily groundwater level observations collected from February 2019 to October 2019 (7 months), followed by a period of data loss between October 2019 to January 2020. This data loss affected MB2 and MB3 due to the installed telemetry system not sending data to Arrow's server. An investigation determined that the root cause of the issue was human error. Following this, routine manual checking of the reporting status of the telemetry system was implemented. Additionally, an automatic alert system was then implemented in January 2021 that alerts Arrow personnel when telemetry data loss is found on monitoring locations and the telemetry system can be restarted to allow continuous logging.

MB2 was worked over in February 2022 to install a digital downhole pressure. During the workover, it was identified that the existing analogue gauge depth was incorrect by 6.32m which has been used to correct the historical data.

Additional data loss due to hardware issues was observed between 14 July 2022 and 14 August 2022, but groundwater level monitoring was resumed afterwards. Groundwater level monitoring has ceased since 2 October 2024 due to the failure of the 3G skid communication system, which requires upgrading to a 4G digital system. The workover was initially delayed due to the absence of a required hazard dossier (an Arrow HSE compliance requirement). Although the hazard dossier has been available for the past six months, wet weather conditions delayed the workover until after the Annual Review period.

MB3

MB3 was installed as an appraisal (pilot) production well (originally named Red Hill-51) in November 2011. The well was converted to a monitoring well using the existing downhole pressure gauge in February 2019 and incorporated into the WMS for the BGP. Similar to MB1-S/I/D and MB2, it is located within 10 kilometres of the Red Hill Central development area. Groundwater observations were made from the Moranbah Coal Measures using the well from September 2013 to May 2014 (9 months), October 2017 to May 2018 (7 months), and February 2019 to October 2019 (7 months, with data loss affecting this site until January 2020, as for MB2). Following reinstatement of the telemetry system, it was identified that the downhole pressure gauge failed during the period of data loss. An adjacent appraisal (pilot) production well (originally named Red Hill-50) was converted to a monitoring well in September 2020 to continue to fulfil monitoring requirements for MB3.

The exact cause of the rise (and subsequent drop) in pressure from 4 November 2021 to 31 December 2021 in MB3 is not fully known. Data was collected during this period, however, given there was no change in wellhead pressure over the same period, there is a chance the data is not reliable for this period.

Additional data loss was observed from 1 January 2022 to 13 February 2022 due to skid communication issues, but groundwater level monitoring was resumed afterwards. Since 2 October 2024, groundwater level monitoring in MB3 experienced the same skid communication failure as MB2, as both MB3 and MB2 operate on the same communication system.

MB12

MB12 was installed as a mine monitoring bore (originally named EFGW5D) by Fitzroy Mining in June 2008. This monitoring location is within 10 kilometres of the Red Hill Central development area. Groundwater level observations were made from the Rewan Formation through both manual water level measurements and hourly data logger measurements since January and July (respectively) 2018. A data logger was installed in the monitoring bore in July 2018 and is still in operation.

During this Annual Review period, groundwater level data was recorded using data loggers from 1 January 2025 to 31 December 2025 supplemented by six-monthly manual water level measurements.

Supplementary monitoring bores

These monitoring locations comprise existing third-party monitoring bores and landholder bores, which form part of the monitoring network.

GW004 (replacement for GW001) and GW007

GW001, GW004 and GW007 were installed as mine monitoring bores by BHP Mitsubishi Alliance (BMA) in 2011. These monitoring locations are within 10 kilometres of the Red Hill Central development area. Arrow commenced monitoring of GW001 and GW007 in November 2019.

GW004 was chosen as a replacement of GW001 from November 2020 due to poor data and logger reliabilities associated with the vibrating wire piezometers installed in GW001 which failed in March 2020. A logger was deployed in GW004 during the November 2020 sampling round.

During this Annual Review period, GW004 and GW007 groundwater level data has been recorded from 1 January 2025 to 31 December 2025.

AEN1063 (replacement for AEN1036)

A logger was deployed in a private water bore owned by a landholder, AEN1063, during the November 2020 sampling round after an access and monitoring agreement was completed with the landholder. The location of this bore is on the same property and same formation (Blackwater Group) as the monitoring point AEN1036, which was proposed in the GMMP. AEN1063 was chosen for monitoring after assessment of the bores on the property, with this bore being the most suitable for long term monitoring.

Groundwater level has been monitored for this bore from 1 January 2025 to 31 December 2025 during this Annual Review period.

AEN1214

AEN1214 is a private water bore owned by a landholder. With a total constructed depth of 37.3m, it was installed in Rangal Coal Measures and monitored since November 2020. Manual measurements are recorded every 6-months.

AEN1234

Similar to AEN1214, AEN1234 is a private water bore owned by a landholder. AEN1234, with a total constructed depth of 102m, was installed in Blackwater Group and monitored since November 2020. Manual measurements are recorded every 6-months.

Table 3: BGP monitoring network

Monitoring location	Monitoring interval and target formation	Development area	Status/Indicative year of installation	Status
MB1	S – Quaternary / Tertiary I – RCM D – MCM	PL486	Current	Currently on monitoring. Groundwater level monitoring was required twice daily until 11/11/2020, which has been achieved. Going forward, a minimum of 6-monthly water level measurements are required for remainder of CSG production. Water quality sampling was required from MB1-D at biannual frequency for the first year, which has been achieved. Going forward annual monitoring is required.
MB2	MCM		Current	Currently on monitoring. Groundwater level monitoring was required twice daily until 31/10/2020, which has been achieved. Going forward, a minimum of 6-monthly water level measurements are required for remainder of CSG production.
MB3	MCM		Current	Currently on monitoring. Groundwater level monitoring was required twice daily until 31/10/2020, which has been achieved. Going forward, a minimum of 6-monthly water level measurements are required for remainder of CSG production.
MB4	Unconfined alluvium		Contingent	Not currently required as criteria not yet triggered. Requirement for installation is based on (modelled) increased risk of depressurisation resulting from changes in the FDP, or MB1 groundwater level monitoring data indicate interconnectivity of MCM with overlying units.
MB5	Tertiary / Triassic	ATP1103	2020	Not currently required due to no development scheduled within 10km.
MB6	Quaternary / Tertiary	ATP742	Contingent	Not currently required as criteria not yet triggered. Requirement for installation is based on (modelled) increased risk of depressurisation resulting from changes in the FDP, or monitoring of other sites in the northern development area indicate the potential or likelihood of preferential groundwater flow occurring across formations by way of geological faults.
MB7	S – Tertiary D – RCM	ATP742	2029	Not currently required due to no development within 10km.
MB8	Quaternary / Tertiary	ATP742	2030	Not currently required due to no development within 10km.
MB9	S – Quaternary / Tertiary I – RCM D – MCM / FCCM	ATP1103	2029	Not currently required due to no development within 10km.
MB10	Tertiary	ATP1103	2030	Requires installation immediately prior to commencement of pumping from Wards Well pilot wells.
MB11	S – Quaternary / Tertiary or Rewan Formation D – RCM	ATP1103	2029	Not currently required due to no development within 10km.
MB12	Quaternary / Tertiary	ATP1103	Current	Existing Fitzroy Mining monitoring bore (EFGW5D) being utilised to obtain groundwater level monitoring data in place of MB12. EFGW5D is located approximately 345m from the proposed location for MB12. Monitoring commenced in July 2018. Groundwater level monitoring will include 6-monthly water level measurements for remainder of CSG production.
MB13	S – Quaternary / Tertiary (if present) D – Blackwater Group (RCM / FCCM / MCM)	ATP1103 ATP1103	Contingent - 2028	MB13S not currently required due to no development within 10km. Requirement for installation of MB13D is based on monitoring of MB13-S and/or other monitoring points in the southern development area indicates the potential or likelihood of preferential groundwater flow occurring across formations by way of geological faults, or ongoing modelling or revised development indicates a greater risk of depressurisation impact at this location.
MB14	S – Quaternary / Tertiary I – RCM D – MCM / RCCM	ATP1103 ATP1103 ATP1103	2029	Not currently required due to no development within 10km.
MB15	S – Unconfined alluvium I – Tertiary / Triassic	ATP1103 ATP1103	2029	Not currently required due to no development within 10km.
MB16	Tertiary	ATP1103	2029	Not currently required due to no development within 10km.
MB17	S – Unconfined alluvium I – Rewan Formation	ATP 1103 (in proximity to Lake Elphinstone)	Contingent	Not currently required as criteria not yet triggered. Requirement for installation is based on if revised modelling indicates a risk of depressurisation impacts to Lake Elphinstone, or if impacts are detected at MB11-S.
Supplementary monitoring bores				
AEN1214	Rangal Coal Measures	ATP742	Current	Manual measurements recorded every 6-months.
AEN1063	Blackwater Group	ATP1031	Current	On monitoring as of November 2020. Suitable replacement for proposed AEN1036 as on same property and drilled to the same formation.
AEN1234	Quaternary alluvium	ATP1234	Current	Suitable replacement for proposed AEN1050. Manual measurements recorded every 6-months.
GW004	Alluvium Fort Cooper Coal Measures	ATP1103	Current	On monitoring as of November 2020. Replaced GW001 due to logger failure.
GW007	Alluvium Fort Cooper Coal Measures	PL486	Current	On monitoring as of November 2020.

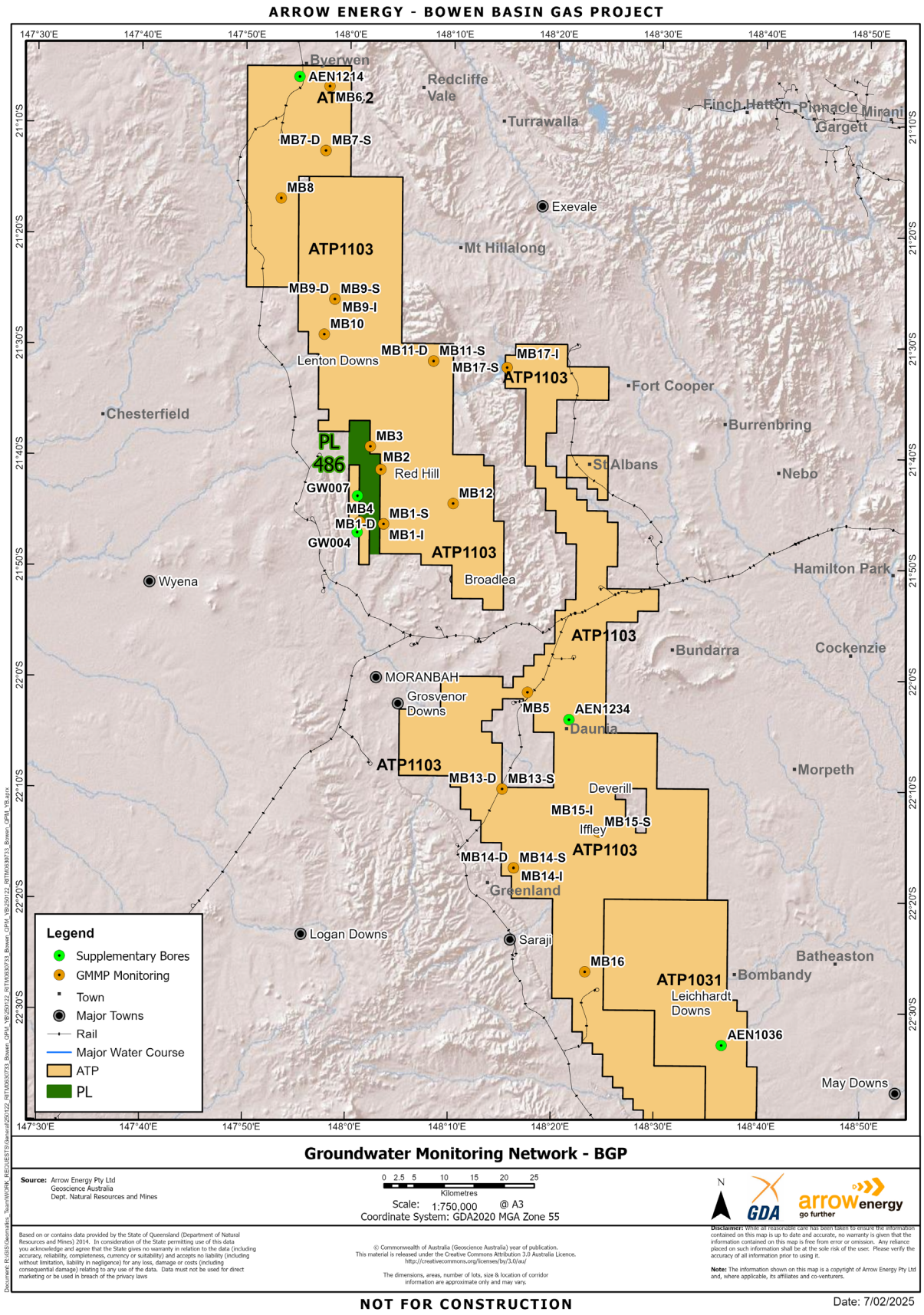


Figure 3: BGP groundwater monitoring network

4 GROUNDWATER ASSESSMENT UPDATE

4.1 Trigger Levels

Arrow's early warning system (EWS) is based on comparing modelled groundwater drawdowns derived from the GMMP groundwater model with early warning indicator levels (EWI), trigger threshold (TT), and drawdown limits, to inform escalating response actions.

The values of the EWI, TT and limits for the Quaternary age alluvium, Tertiary age sediments and basalts and Triassic age Clematis sandstone are presented below.

- EWI – Predicted drawdown by more than the applicable bore trigger threshold (BTT) (2 metres for unconsolidated aquifers and 5 metres for consolidated aquifers) for the Quaternary age alluvium, Tertiary age sediments and basalts and Triassic age Clematis sandstone;
- TT – Predicted drawdown by more than the BTT for the Quaternary age alluvium, Tertiary age sediments and basalts and Triassic age Clematis sandstone within three years;
- Limit – Predicted drawdown by more than double the applicable BTT for the Quaternary age alluvium, Tertiary age sediments and basalts and Triassic age Clematis sandstone within three years; and
- The EWS values are not assigned to the coal measures (Moranbah Coal Measures and Rangal Coal Measures) per the GMMP.

The 2025 Bowen UWIR indicated that drawdown is not predicted in the unconsolidated aquifers and the Clematis sandstone.

There have been no exceedances of EWS values to date.

4.2 Groundwater Level Monitoring

4.2.1 Shallow UWIR Monitoring Data Summary

Groundwater level monitoring has been undertaken in the following shallow groundwater monitoring bores which form part of the BGP monitoring network. Table 4 provides a summary of these bores.

- Monitoring since January 2018 for bore MB12;
- Monitoring since November 2019 for bores MB1-S, and GW007A; and
- Monitoring since November 2020 for bores GW004A, GW004B, AEN1214, AEN1234 and AEN1063.

Table 4: BGP shallow groundwater monitoring bores

Bore ID	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation	Tenure Holder
MB1-S	60	45 – 50	Fort Cooper Coal Measures – Girrah Seam	Arrow Energy
MB12	59.1	56 – 59	Rewan Formation	Arrow Energy
GW004A	13.5	7.5 – 13.5	Tertiary Sediment	Arrow Energy
GW004B	59	53.0 – 59.0	Fort Cooper Coal Measures	Arrow Energy
GW007A	7.5	1.5 – 7.5	Tertiary Sediment	Arrow Energy
AEN1214	37.32	*	Rangal Coal Measures	Landholder (private bore)
AEN1234	102	48.2 – 102	Blackwater Group	Landholder (private bore)
AEN1063	52.6	39.6 – 45.7	Blackwater Group	Landholder (private bore)

* Screened interval could not be determined due to pumping infrastructure

The groundwater level monitoring results are shown in Appendix A. Groundwater levels, as shown in Figure 4, range from:

- 233.95 to 235.16 m Australian Height Datum (AHD) in the Tertiary Sediment aquifer;
- 230.95 to 263.51 m AHD in the weathered Fort Cooper Coal Measures aquifer;
- 286.31 to 299.62 m AHD in the Rewan Formation;

- 210.89 to 217.69 m AHD in the Rangal Coal Measures; and
- 142.53 to 185.86 m AHD in the Blackwater Group.

Groundwater level monitoring indicates:

- Groundwater levels are stable in the shallow bores;
- GW007A was recorded as dry. The Tertiary Sediment may not form an aquifer in this area; and
- Water level decline in MB12 from Q4 2018 to Q4 2020 is due to water quality sampling (pumping) being undertaken in the bore. The frequency of water quality sampling was decreased in Q2 2021 where subsequent water level data show water level recovery between monitoring events.

Based on the presented monitoring data in Figure 4, there is no apparent influence of CSG production to the Tertiary Sediment, Fort Cooper Coal Measures and Rewan aquifers in which these bores are installed and thus no thresholds have been exceeded as per the EWI. This is expected given the limited water production in the PL486 (Red Hill Central) area from the seven production wells, and no development has commenced in the remainder of the BGP area.

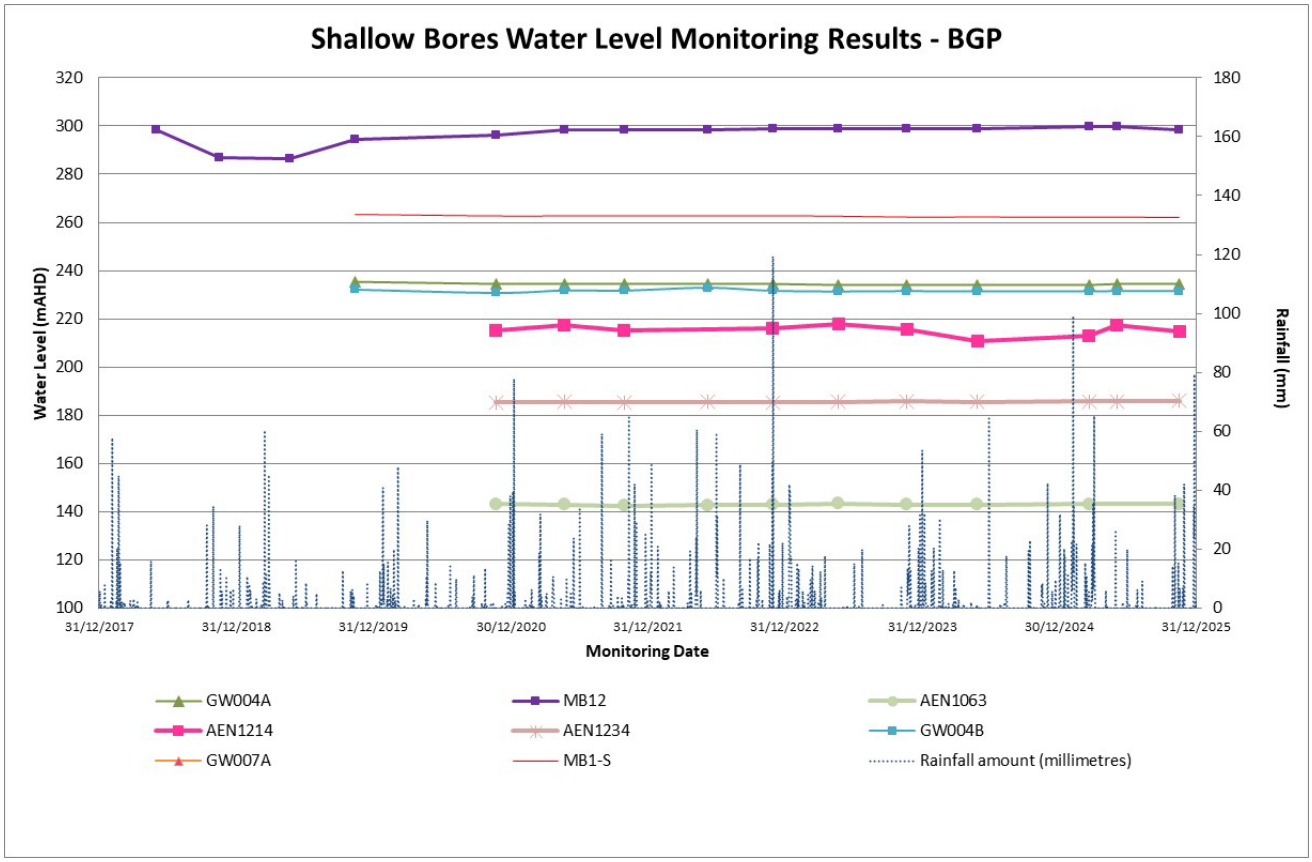


Figure 4: BGP shallow bores water level monitoring results

4.2.2 Deep UWIR Monitoring Data Summary

Groundwater level monitoring has been undertaken in the following deep groundwater monitoring bores which form part of the BGP monitoring network. Table 5 provides a summary of these bores.

- Monitoring since November 2011 for MB1-D and since November 2019 for MB1-I;
- Monitoring since September 2015 for bore MB2;
- Monitoring since September 2013 for bore MB3; and
- Monitoring since November 2019 for bore GW007B.

Table 5: BGP deep groundwater monitoring bores

Bore ID	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation	Tenure Holder
MB1	550.0	336.0 – 340.0 423.9 – 506.6	Fort Cooper Coal Measures Moranbah Coal Measures	Arrow Energy
MB2	834.0	701.1 – 814.7	Moranbah Coal Measures	Arrow Energy
MB3	796.3	712.3 – 717.9	Moranbah Coal Measures	Arrow Energy
GW007B	181.5	175.5 – 181.5	Fort Cooper Coal Measures	Arrow Energy

The groundwater level monitoring results are shown in Figure 5. Observed groundwater levels or calculated potentiometric water level ranged from:

- 238.96 to 264.98 m AHD in the FCCM; and
- -356.33 to 214.93 m AHD in the MCM.

As displayed above, there is a large range in water levels in the MCM. This is due to recovery of water levels at the monitoring locations from historical production. Analysis of MB1-D, MB2 and MB3 water levels was conducted to determine the recovery time of the water levels to a static condition prior to modelled drawdown at these locations to fulfil the requirements of the GMMP. The Theis recovery method (Theis, 1935) was used to analyse that data and concluded that MB1 has fully recovered, and MB2 and MB3 will recover fully prior to predicted drawdown. Appendix B displays the curve analysis and graphs, with Figure 6 to Figure 8 showing the water level recovery of these wells compared to the calculated recovery. These figures show:

- MB1-D water level has fully recovered;
- MB2 water level is recovering in-line with the calculated recovery; and
- MB3 water level recovery is less than calculated. Due to the limited amount of data since relocation of the monitoring point (from Red Hill-51 to Red Hill 50), analysis will be undertaken in future reports.

Table 6 displays the predicted recovery year for each bore. As discussed in Section 3.1, the location of MB3 was changed due to a failure in a pressure gauge.

Table 6: Recovery dates – MB1, MB2 & MB3

Bore ID	Recovery date	Predicted drawdown year
MB1	05/06/2014	2028
MB2	14/02/2027	2035
MB3	28/04/2027	2033

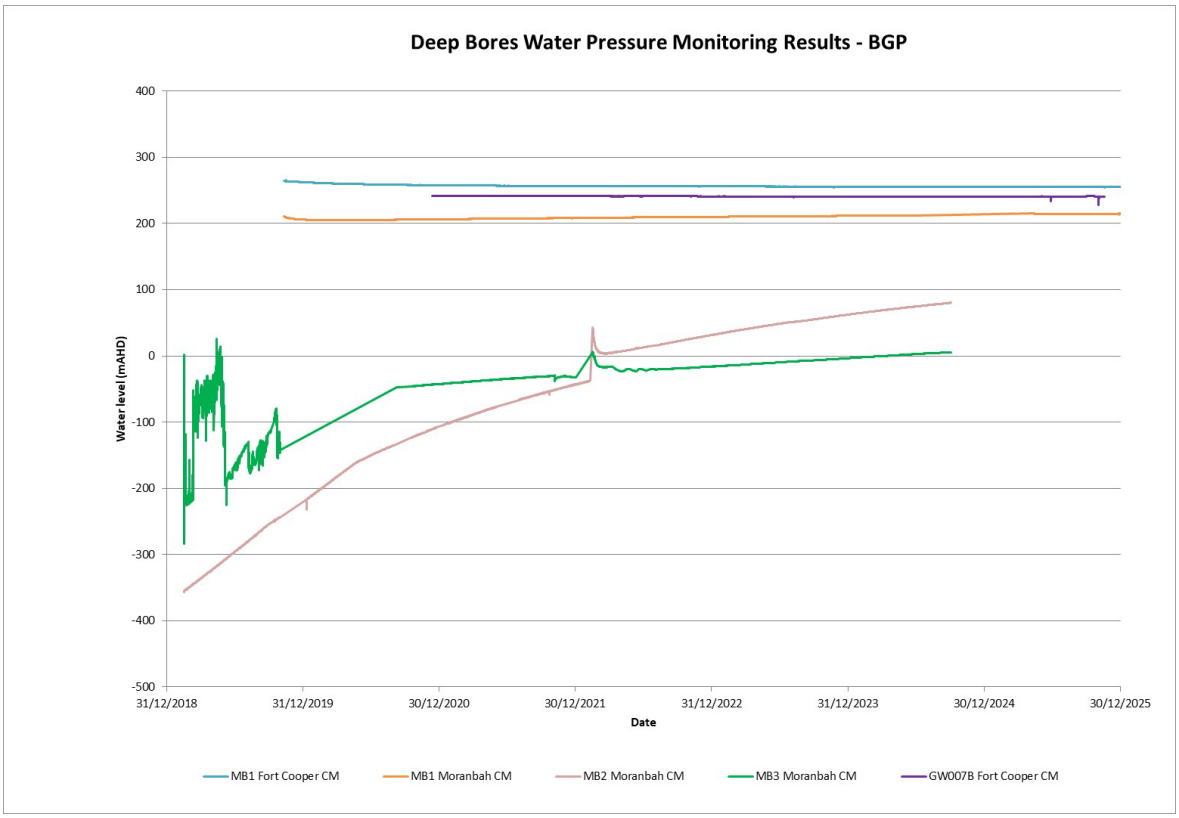


Figure 5: BGP deep bores water level monitoring results

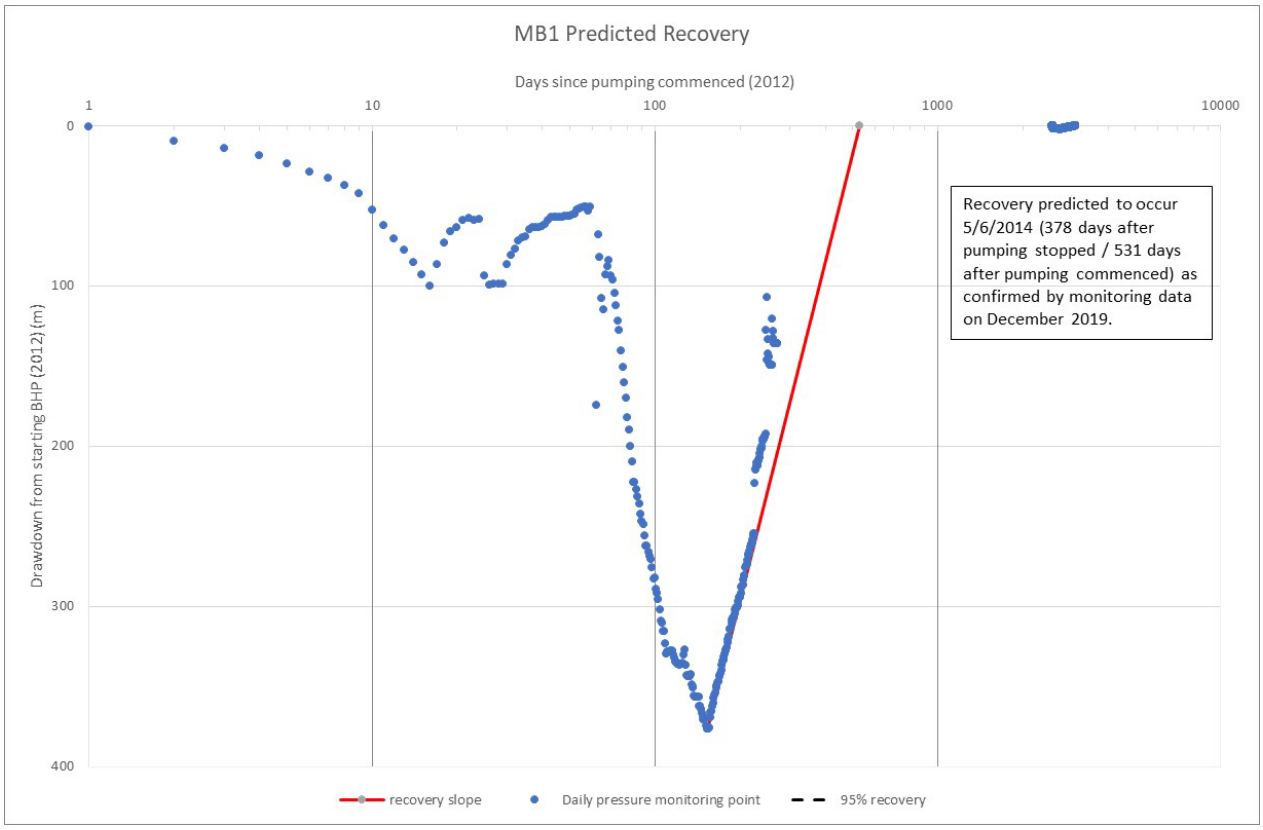


Figure 6: MB1-D recovery data

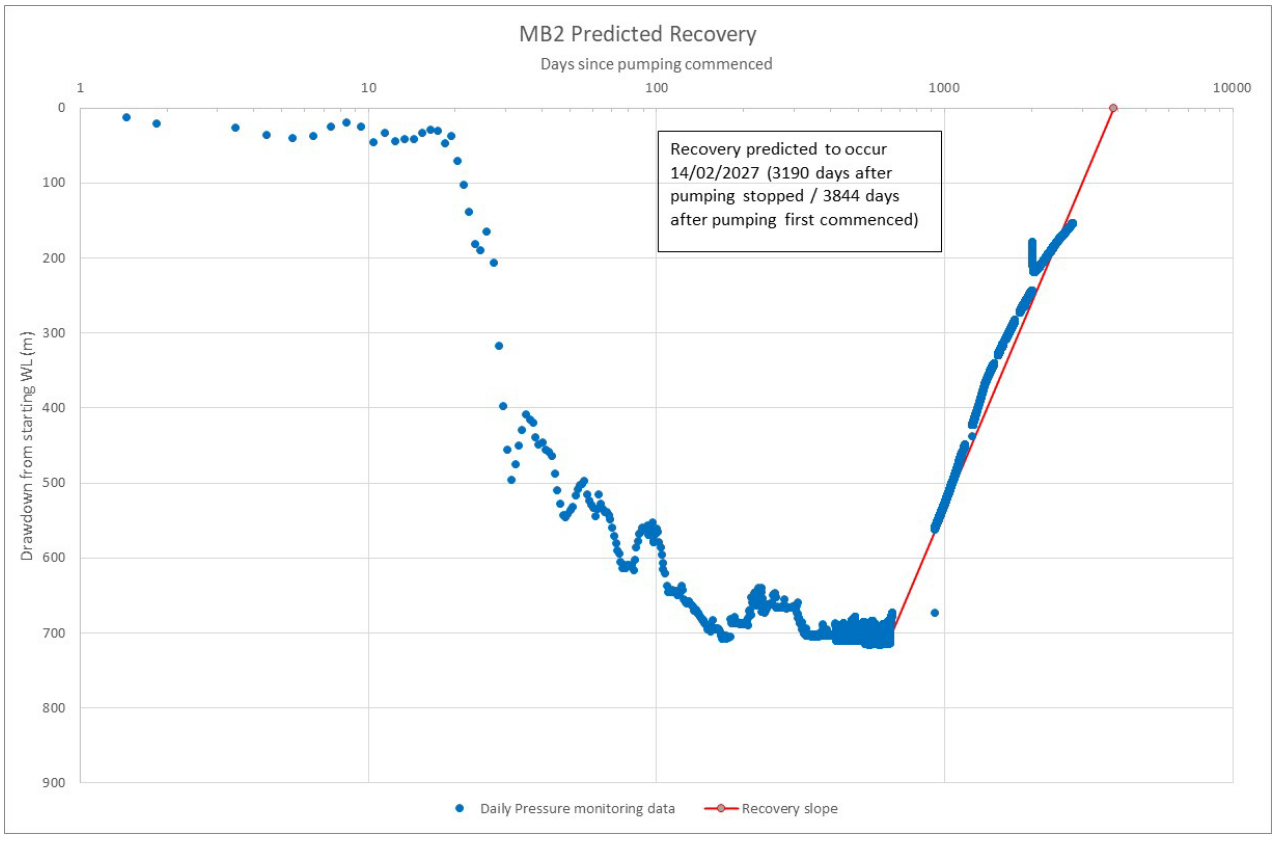


Figure 7: MB2 recovery data

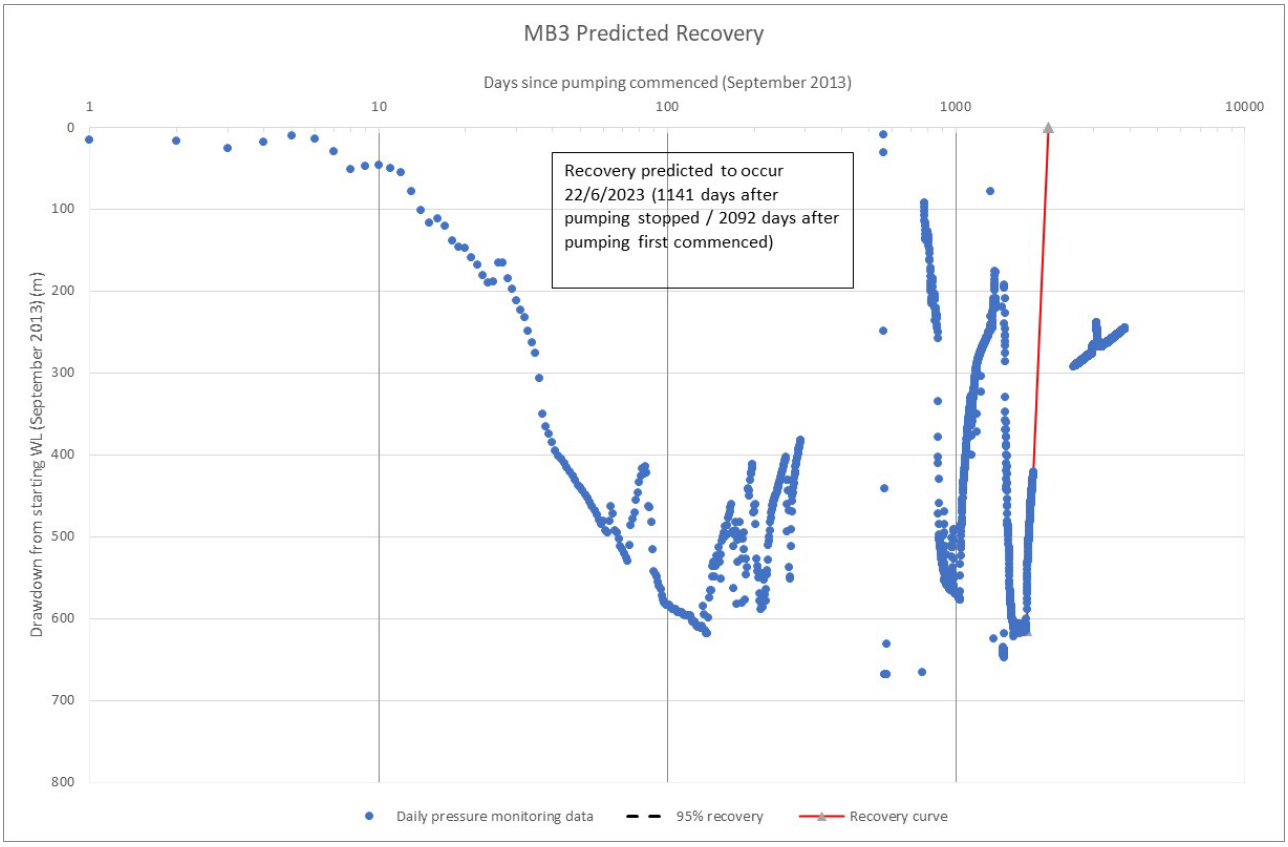


Figure 8: MB3 recovery data

While the MCM's water levels are undergoing long-term recovery following CSG testing, as observed from the water levels in the appraisal (pilot) production wells MB1, MB2, and MB3 (Figure 9), FCCM's water levels are experiencing a long-term decline, as depicted in MB1-I and GW007B water levels (Figure 10). It should be noted that GW007B water levels have been recovering during the current reporting period.

This initial decline in water levels in the FCCM at MB1-I (10.45 m) can be attributed to the workover conducted on MB1 to equip the borehole for multi-zone monitoring. During the workover process, a slug of water was introduced to 'kill' the well and due to the low permeability of the FCCM and to a lesser extent the MCM, a decline in water level was observed. For the FCCM at MB1-I water levels having remained relatively stable since commencement of CSG production in PL486, with a decline of 0.78 m. Similar to MB1-I, GW007B's water levels have experienced a long-term decline, but they have remained below the trigger threshold and have been recovering during the current reporting period. Decline in water levels noted for the FCCM are observed to correlate to the water abstraction in CSG wells and consequential drawdown in the underlying MCM. This suggests that there is some transmission of impacts from the MCM to the shallower FCCM.

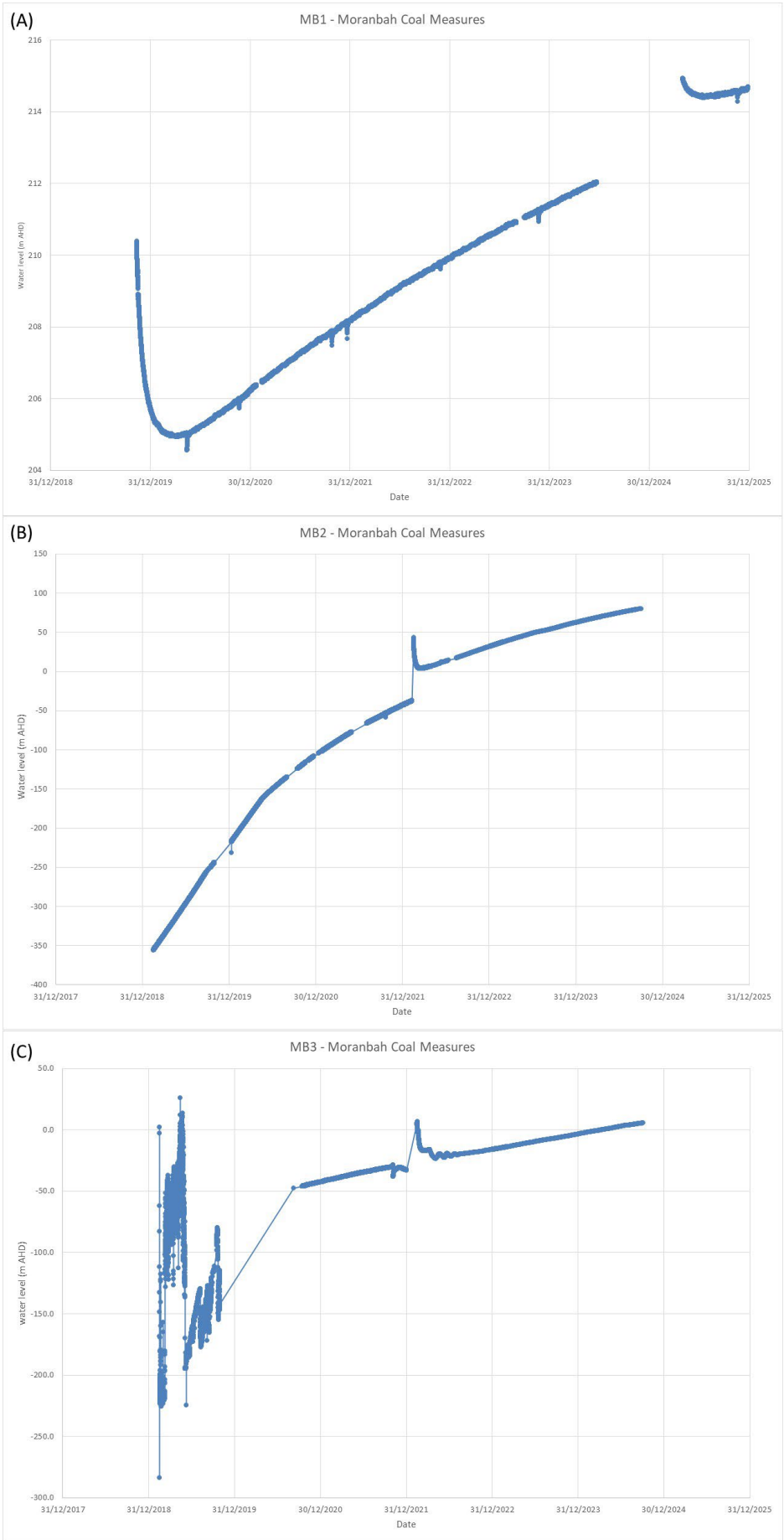


Figure 9: Deep bores with a long-term recovery of water level

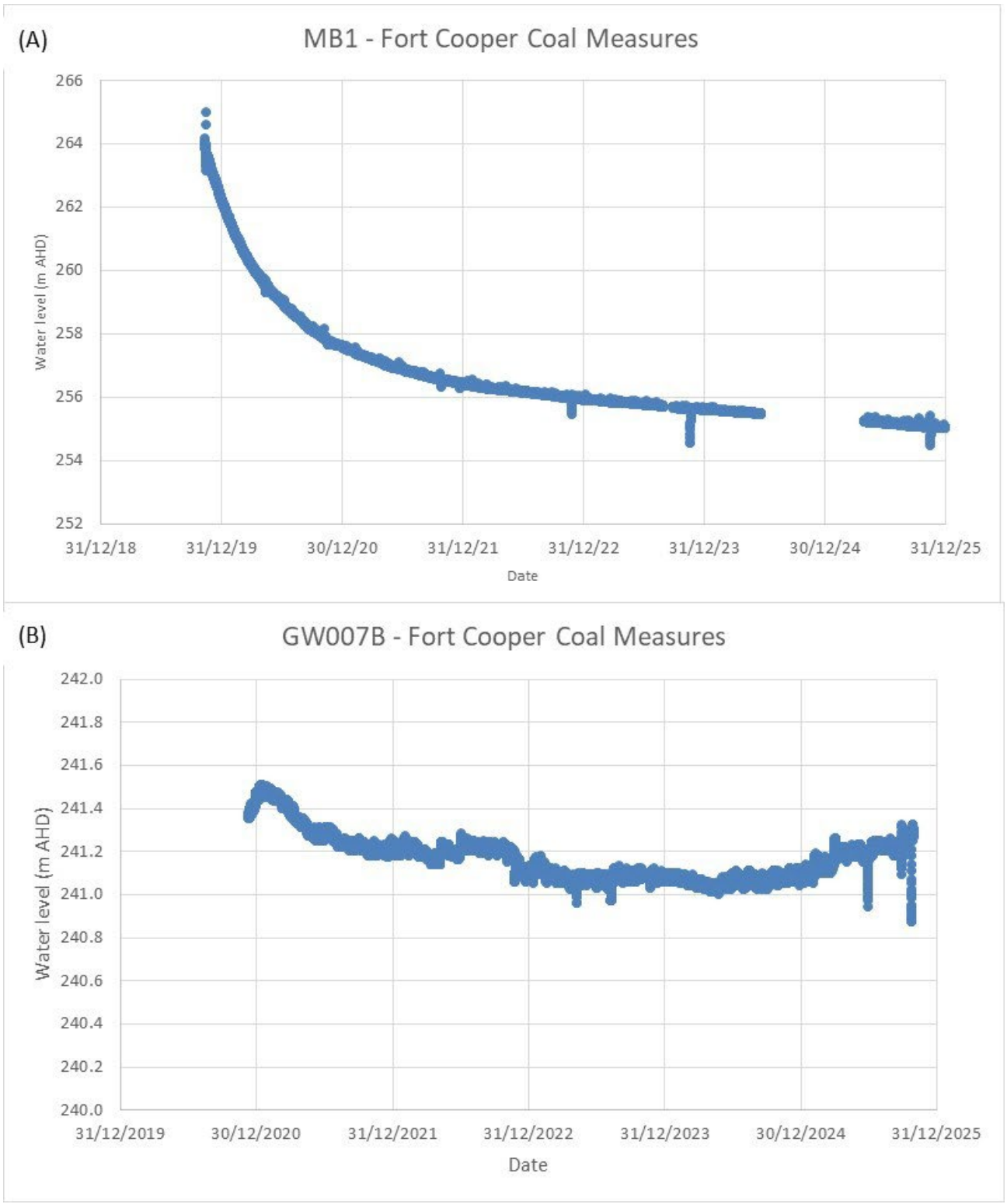


Figure 10: Deep bores with a long-term declining water level

4.2.3 Groundwater Flow

A review of vertical gradients was undertaken for one monitoring location (MB1) with three monitoring points, which includes three monitoring points: MCM, FCCM, and FCCM (Girrah seam), in the BGP area.

Figure 11 shows the vertical gradients for MB1 and based on the presented data, an initial decrease in water levels in the MCM is visible, with a smaller decrease seen in the FCCM. Prior to this decrease, the FCCM displayed similar water levels to the Quaternary Alluvium. This decline in water levels can be attributed to the workover conducted on MB1 to equip the borehole for multi-zone monitoring. During the workover process, a slug of water was introduced to 'kill' the well and due to the low permeability of the FCCM and MCM, a decline in water level was observed. As of the end of 2025, the water levels in all three zones were stabilised, with the MCM zone displaying an increase in water levels.

The sharp pressure increases in the data can be attributed to sampling events of MB1, where the gas pressure is bled off the borehole during sampling.

Ongoing monitoring at this site will provide further information on the interconnectivity of aquifers at these sites.

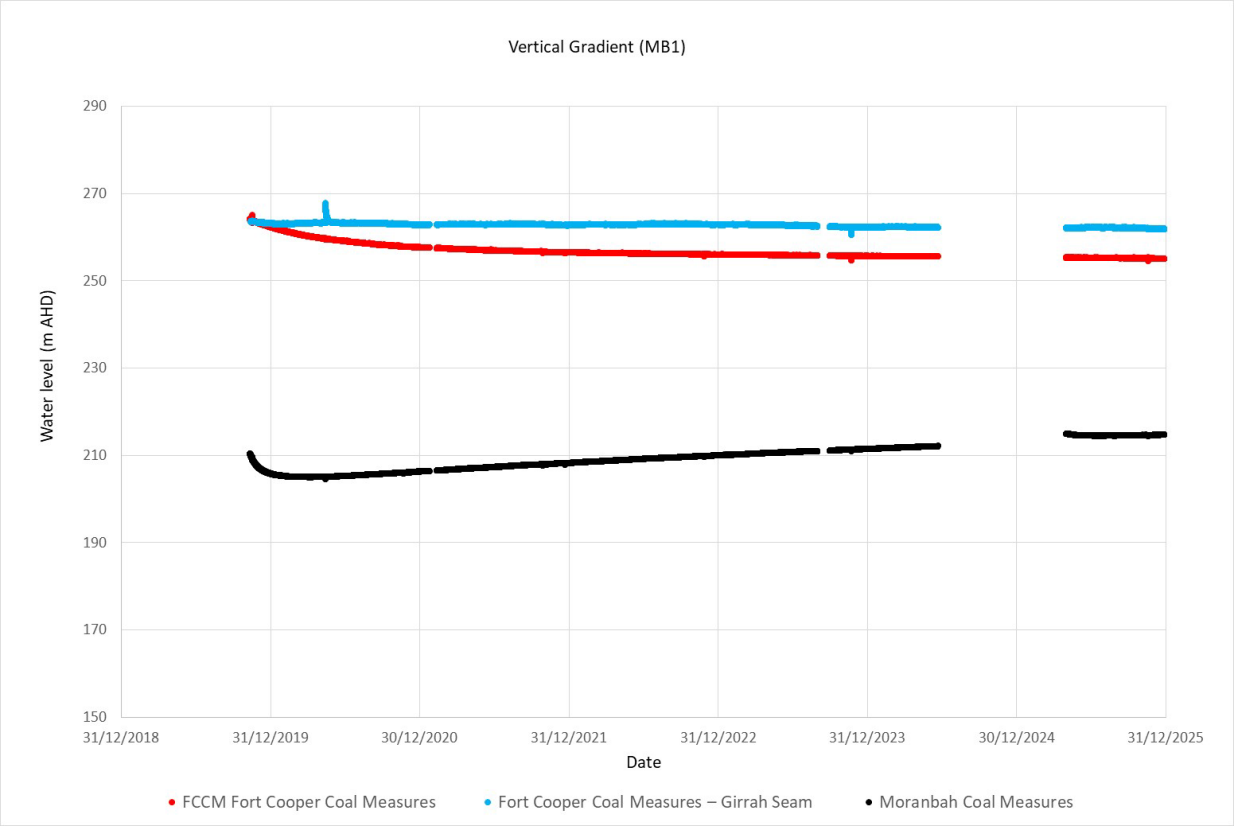


Figure 11: Review of vertical gradients for MB1

4.3 Groundwater Quality Monitoring

4.3.1 Shallow aquifer water quality

There is no requirement for monitoring the water quality of the shallow bores in the BGP, and as such, no water quality data pertaining to the shallow aquifer is presented here.

4.3.2 Deep aquifer water quality

The 2025 Bowen UWIR outlines the water quality monitoring requirements for the deep bores in the BGP. For any future WMS bores in the BGP area, groundwater quality monitoring is proposed to be conducted every six months for the first 12 months. Following this period, monitoring will occur annually for the remainder of the CSG operations.

Biannual sampling for MB1-D, installed in Moranbah Coal Measures, was completed in the first year, with annual monitoring required thereafter.

Table 7 presents a summary of water quality results obtained from MB1-D targeting the deep aquifer (Moranbah Coal Measures). This provides an indication of water quality ranges for each parameter analysed based on the water quality samples collected from this bore (Appendix C). A review of this data indicates that there are no notable trends. Based on the data presented in Table 7, it can be concluded that the groundwater quality of the Moranbah Coal Measures at the location of MB1-D is saline (EC > 4800 µS/cm) (Government of South Australia, Department for Environment and Water, 2021).

Table 7: Background water quality – deep monitoring bore (MB1-D)

Parameters	Unit	Moranbah Coal Measures	
		Min	Max
Field pH		7.78	8.31
Electrical Conductivity	µS/cm	8600	9370
Total Dissolved Solids	mg/L	5030	5320
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	40	242
Bicarbonate Alkalinity as CaCO3	mg/L	817	1870
Total Alkalinity as CaCO3	mg/L	817	1940
Sulphate, SO4	mg/L	11	11
Chloride, Cl	mg/L	1790	2560
Calcium - Dissolved	mg/L	4	14
Magnesium - Dissolved	mg/L	5	12
Sodium - Dissolved	mg/L	1900	2410
Potassium - Dissolved	mg/L	16	24
Arsenic-Dissolved	mg/L	0.001	0.003
Beryllium-Dissolved	mg/L	<0.001	<0.001
Barium-Dissolved	mg/L	2.29	4.29
Chromium-Dissolved	mg/L	0.002	0.002
Cobalt-Dissolved	mg/L	0.001	0.002
Copper-Dissolved	mg/L	0.002	0.005
Lead-Dissolved	mg/L	0.001	0.008
Manganese-Dissolved	mg/L	0.007	0.049
Molybdenum	mg/L	0.011	0.02
Nickel-Dissolved	mg/L	0.01	0.131

Selenium	mg/L	<0.01	<0.01
Vanadium-Dissolved	mg/L	<0.01	<0.01
Zinc-Dissolved	mg/L	0.008	0.045
Boron	mg/L	1.04	1.8
Iron	mg/L	0.44	1.53
Fluoride, F	mg/L	2	2.3
Phosphate as P in water	mg/L	0.45	1.35

5 RESEARCH

A list of research and reports produced in this reporting period are described below:

- The 2025 Bowen UWIR (Arrow Energy, 2025) was approved by DETSI on 12 January 2026. The present report includes results from updated 2025 Bowen groundwater model, as well as identification of Immediately Affected Areas (IAAs; where the predicted drawdown within the next three years exceeds the bore trigger threshold) and the Long-term Affected Areas (LAAs; where the predicted drawdown exceeds the bore trigger threshold at any time). In accordance with the requirements of Approval Condition 21(f), and consistent with the UWIR, the GMMP has been reviewed to determine its ongoing suitability, adequacy and effectiveness as part of the release of the 2025 UWIR during the reporting period. The 2025 UWIR model is an update of the GMMP model, with the following changes:
    - extension of the model calibration period from January 2018 to January 2024;
    - update the MODFLOW well (WEL) package based on actual historic CSG related water extraction data;
    - refinement of model mesh around monitoring bores and within PL486 around the production area;
    - update the MODFLOW recharge (RCH) package based on updated historic actual climate records from Bureau of Meteorology; and
    - generate revised predictions based on revised calibrated model parameters and BGP field development plans (removal of Mavis Downs development, delay in commencement of remainder of FDP from 2030 to 2045).

  Magnitude and location of impacts predicted from the 2025 UWIR model remain in line with the GMMP model, with some delay in timing of these impacts. The groundwater monitoring network identified as part of the water monitoring strategy of the 2025 UWIR remains the same as that provided in the GMMP, and there is no additional impact to MNES identified. Therefore the management framework of the GMMP did not require amendment and the GMMP has not been updated as part of the review. The next review will be conducted in 2028 alongside the 2028 UWIR.

- A copy of 2025 Bowen UWIR can be found on Arrow Energy's website at https://www.arrowenergy.com.au/wp-content/uploads/2025/08/BGP-Underground-Water-Impact-Report.pdf

6 CONCLUSION

- Seven (7) production wells have been installed as heel intersects wells on multi-branch laterals, less than the 1408 authorised operational wells for Stage 1 of the BGP. The seven production wells were installed in 2019 in the Red Hill Central Petroleum Lease (within PL486).
- There is no apparent influence of CSG production to the Tertiary Sediment, Fort Cooper Coal Measures (FCCM) and Rewan aquifers in the installed monitoring network for the BGP.
- A review of the groundwater quality data indicates that there are no notable trends for both the shallow and deep aquifers.
- Production from Red Hill Central Petroleum Lease (within PL486) commenced in 2022.
- No non-compliances were recorded for the BGP GMMP bores and therefore no remedial actions were undertaken.
- All monitoring obligations have been met and no exceedances under the GMMP early warning system (EWS) recorded across the monitoring network.
- The 2025 Bowen UWIR was approved with conditions by DETSI on 12 January 2026. This report includes results from 2025 Bowen UWIR and updated 2025 Bowen groundwater model. The 2025 Bowen UWIR concluded that the data obtained to date is in support of the existing conceptual hydrogeological model, and the 2025 groundwater model is considered to be suitable for predicting depressurisation impacts as a result of CSG operations for the Project Areas. Magnitude and location of impacts predicted from the 2025 UWIR model remain in line with the GMMP model, with some delay in timing of these impacts. The groundwater monitoring network identified as part of the water monitoring strategy of the 2025 UWIR remains the same as that provided in the GMMP, and there is no additional impact to MNES identified.
- No out of cycle UWIR was submitted.

7 REFERENCES

Arrow Energy, Underground Water Impact Report for PLs 191, 196, 223, 224, 486 and ATPs 742, 1031 and 1103 (Arrow Energy 2022)

Arrow Energy, Annual Review of Underground Water Impact Report for PLs 191, 196, 223, 224, 486 and ATPs 742, 1031 and 1103 (Arrow Energy 2023)

Arrow Energy, Underground Water Impact Report for PL486 and ATPs 742, 1031 and 1103 (Arrow Energy 2025)

Government of South Australia, Department for Environment and Water (2021), Water Data SA – Available Data. https://www.waterconnect.sa.gov.au/Content/Water%20Data%20SA/Water%20Data%20SA-Available%20Data.pdf [Accessed 6/02/2025]

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

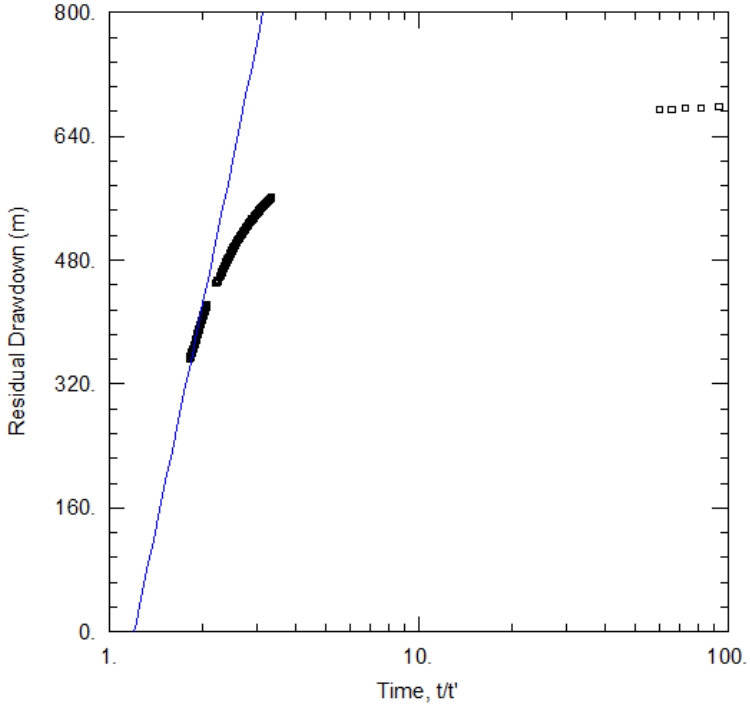
APPENDIX A GROUNDWATER LEVEL RESULTS – SHALLOW MONITORING BORES

Bore Name	SWL (mAHD)											
	12/11/2019	22/11/2020	24/05/2021	30/10/2021	9/06/2022	29/11/2022	23/05/2023	21/11/2023	28/05/2024	21/03/2025	3/06/2025	17/11/2025
GW004A	235.16	234.69	234.54	234.44	234.54	234.44	234.20	234.03	234.07	233.95	234.56	234.48
GW007A					dry							
MB1S	263.51	262.72	262.75	262.70	262.75	262.79	262.62	262.18	262.16		262.09	261.88
GW004B	232.09	230.95	231.80	231.74	232.74	231.67	231.45	231.59	231.49	231.52	231.58	231.57
AEN1214		215.12	217.32	215.32		216.18	217.69	215.59	210.89	213.13	217.30	214.72
AEN1234		185.34	185.44	185.35	185.45	185.35	185.60	185.64	185.57	185.67	185.76	185.86
AEN1063		143.12	142.85	142.53	142.64	142.97	143.36	142.89	143.02	143.07		143.09
MB12	294.26	296.01	298.28	298.51	298.62	298.65	299.00	298.87	298.71	299.62	299.52	298.48

APPENDIX B THEIS RECOVERY ANALYSIS

MB2

Aqtesolv Output using BHP data (gas and water).



WELL TEST ANALYSIS

Data Set:
Date: 07/23/20 Time: 09:44:17

PROJECT INFORMATION

Test Well: RH60

AQUIFER DATA

Saturated Thickness: 775. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
RH60	0	0

Observation Wells

Well Name	X (m)	Y (m)
RH60	0	0

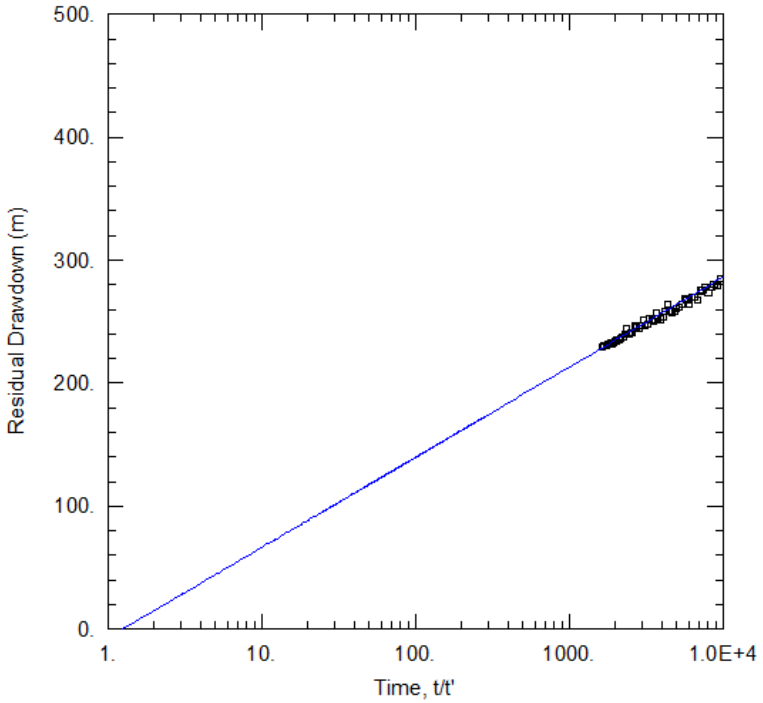
SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)
T = 0.000366 m^2/day S/S' = 1.205

Time axis intercept (t/t') =		1.205		
Pumping start day =		1 days		6/08/2016
Pumping stop day =		649 days		16/05/2018
extrapolating out t/t' in the Water Level Data tab until t/t' = 1.205				
	t' t		t/t'	
	789	1443	1.828897	2401
	3190	3844	1.2050	
t' (time since pumping stopped) =		3190 days		8/02/2027
t (total time since pumping started) =		3844 days		14/02/2027
100% recovery =		14/02/2027		
	x	y		
recovery curve	649	704.6038	BHP monitoring point at start of recovery	
	3844	0	100% recovery as determined above	

MB3

Using latest monitoring period (29/9/17 to 17/10/18) - Aqtesolv Output - using measured bottom hole pressure (gas and water)



WELL TEST ANALYSIS

Data Set:
Date: 07/23/20 Time: 07:43:33

PROJECT INFORMATION

Test Well: RH50

AQUIFER DATA

Saturated Thickness: 665. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (m)	Y (m)
RH50	0	0

Observation Wells

Well Name	X (m)	Y (m)
RH50	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 0.001962 m^2/day S/S' = 1.247

Time axis intercept (t/t') =	1.247		
Pumping start day =	1 days	29/09/2017	
Pumping stop day =	283 days	8/07/2018	
extrapolating out t/t' in the RH30_all_data tab until t/t' = 1.247			
t' (time since pumping stopped) =	1141 days	22/08/2021	
t (total time since pumping started - analysis period) =	1423 days	22/08/2021	
t (total time since pumping started - all mon data) =	2092		
100% recovery =	22/06/2023		

	x	y	
recovery curve	1757.5	614.4019	BHP monitoring point at start of recovery
	2092	0	100% recovery as determined above

t'	t	t/t'
1141	1423	1.247152

APPENDIX C WATER QUALITY RESULTS

Monitoring Bore ID	Sample Date	Field pH	Electrical Conductivity	Total Dissolved Solids (grav)	Hydroxide Alkalinity (OH-) as $CaCO_3$	Carbonate Alkalinity as $CaCO_3$	Bicarbonate Alkalinity as $CaCO_3$	Total Alkalinity as $CaCO_3$	Sulphate, SO_4	Chloride, Cl	Calcium - Dissolved	Magnesium - Dissolved	Sodium - Dissolved	Potassium - Dissolved	Arsenic-Dissolved	Beryllium-Dissolved	Barium-Dissolved	Chromium-Dissolved	Cobalt-Dissolved	Copper-Dissolved	Lead-Dissolved	Manganese-Dissolved	Molybdenum	Nickel-Dissolved	Selenium	Vanadium-Dissolved	Zinc-Dissolved	Boron	Iron	Fluoride, F	Phosphate as P in water
			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MB1-D	17/11/2019	7.95	8790	5110	<1	<1	817	817	<1	2550	14	12	1900	16	0.002	<0.001	4.29	<0.001	0.001	0.005	0.008	0.049	0.018	0.036	<0.01	<0.01	0.045	1.04	1.53	2.2	0.45
MB1-D	14/05/2020	8.26	9370	5210	<1	<1	1390	1390	<1	2560	9	10	2050	20	0.003	<0.001	3.89	<0.001	<0.001	0.002	0.006	0.015	0.011	0.032	<0.01	<0.01	0.024	1.11	1.14	2.0	0.87
MB1-D	20/11/2020	7.82	8930	5190	<1	<1	1600	1600	<1	2390	14	9	2410	24	0.003	<0.001	4.12	<0.001	<0.001	<0.001	0.005	0.013	0.017	0.031	<0.01	<0.01	0.013	1.68	1.08	2.0	0.97
MB1-D	21/12/2021	7.9	8600	5320	<1	<1	1870	1870	<1	1970	12	6	2010	21	0.002	<0.001	2.72	<0.001	<0.001	<0.001	0.004	0.007	0.014	0.010	<0.01	<0.01	<0.005	1.19	0.56	2.0	1.28
MB1-D	27/11/2022	7.86	8670	5230	<1	40	1550	1590	11	1940	6	6	2020	21	0.002	<0.001	2.97	0.002	0.001	<0.001	0.002	0.009	0.015	0.050	<0.01	<0.01	0.008	1.39	0.68	2.1	1.31
MB1-D	22/11/2023	7.78	8610	5040	<1	48	1760	1810	<1	1790	4	5	2120	20	0.001	<0.001	2.41	<0.001	<0.001	<0.001	0.001	0.008	0.018	0.014	<0.01	<0.01	<0.005	1.80	0.48	2.2	1.18
MB1-D	05/03/2025	8.31	9030	5030	<1	242	1700	1940	<1	1850	8	5	1950	19	<0.001	<0.001	2.29	0.002	0.002	<0.001	<0.001	0.009	0.020	0.131	<0.01	<0.01	0.010	1.51	0.44	2.3	1.35