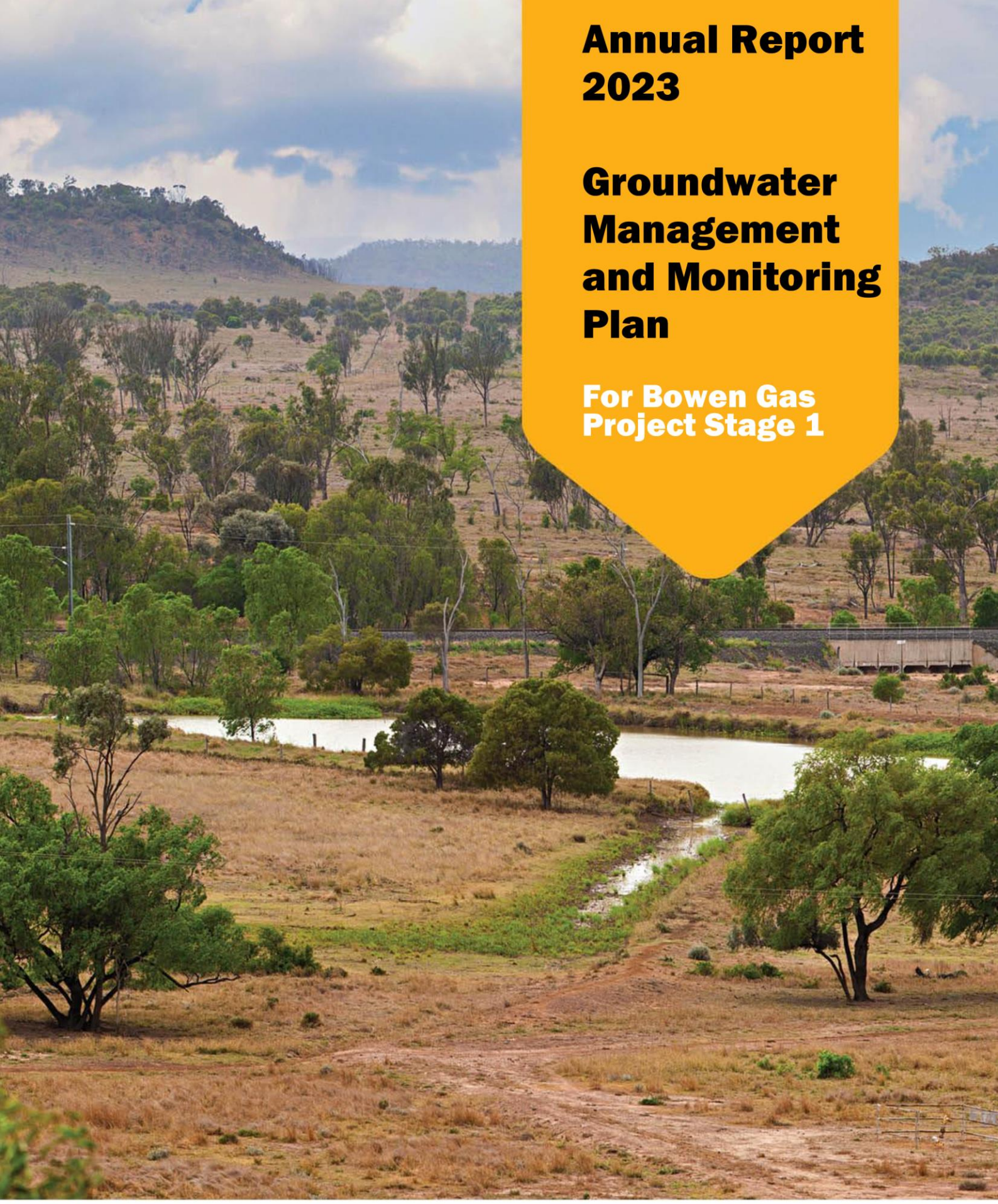

Annual Report 2023

Groundwater Management and Monitoring Plan

For Bowen Gas Project Stage 1

arrow energy
go further

May 2023

REVISION HISTORY

Revision	Revision Date	Revision Summary
0	May 2023	Final report for release

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EXECUTIVE SUMMARY

This report forms the fourth annual review of the Groundwater Monitoring and Management Plan (GMMP) for the Bowen Gas Project (BGP) Stage 1 and includes baseline data from Arrow's existing Moranbah Gas Project (MGP) operations (PL 191, 196, 223, and 224).

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) wells have been installed, less than the 1408 authorised operational wells. The seven wells were installed in 2019. A total of nine (9) locations are now monitored in this reporting period as part of the BGP monitoring network to supplement the existing monitoring network established for Arrow's MGP.

- 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.

- With the exception of M250W (not monitored in Q4 2022 however will be monitored in Q2 2023), all monitoring obligations have been met, with no exceedances under the GMMP early warning system (EWS) recorded across the monitoring network. There were, however, a number of data loss issues identified:
    - M314W and M325W: Data loss due to hardware issues was experienced between 01 January 2022 to 01 February 2022, 24 May 2022 to 24 June 2022 and 26 October 2022 to 31 December 2022;
    - M313W and M324W: Data loss due to hardware issues was experienced between 30 January 2022 and 29 April 2022; and
    - AN019: Data loss due to hardware issues was experienced between 14 April 2022 and 22 August 2022.
- One report was completed – the 2022 Bowen UWIR was submitted to the Department of Environment and Science (DES) and was approved with conditions on 2 August 2022. This report includes results from the updated 2021 Bowen groundwater model.

- No out of cycle Underground Water Impact Report (UWIR) was submitted. As above, the 2022 Bowen UWIR was approved by DES on 2 August 2022.

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

1 INTRODUCTION

This report forms the fourth 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 groundwater related impacts potentially resulting from the development of Stage 1 and contains details of:

- A groundwater monitoring network to provide for 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 required Bowen UWIR; and
- Provisions to make monitoring results publicly available.

This report also includes data from Arrow's existing MGP operations (within Petroleum Leases (PLs) 191, 196, 223, and 224) which was previously described in the GMMP for baseline groundwater purposes and also supplements the GMMP monitoring network. Full analysis of the monitoring network, water production, groundwater levels and groundwater quality for the MGP is available in the 2022 Bowen UWIR and available on Arrow Energy's website.

The location of Arrow Energy's tenure in the Bowen Basin is displayed in Figure 1, with the project area for Stage 1 displayed in Figure 2.

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 2022 to 31 Dec 2022) and include groundwater data for both Arrow's existing production area, the MGP and the BGP.

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, the number of operational wells, the number of non-operational wells, and the number of decommissioned or failed wells; 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 review of water production and forecast water production for the MGP and BGP is presented in the 2022 Bowen UWIR. This was submitted to DES and was approved with conditions on 2 August 2022.

Table 1 below displays the current status of production wells within the BGP. Production does not exceed the 1,408 authorised operational wells.

Table 1: BGP well status

		Approximate number of anticipated production wells[1]	Wells installed	Operational wells	Non-operational wells	Decommissioned or failed wells
Project Stage 1 FDP	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	0	0	0

Note 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.

The following changes to the field development plan (FDP) have occurred since the 2022 Annual Review:

- Red Hill Central Petroleum Lease (within PL486) production commenced in 2022; and
- the remainder of the field development plan (FDP) area presented in the 2022 Bowen UWIR (ATP1103, ATP742 and ATP1031) commencing 2030.

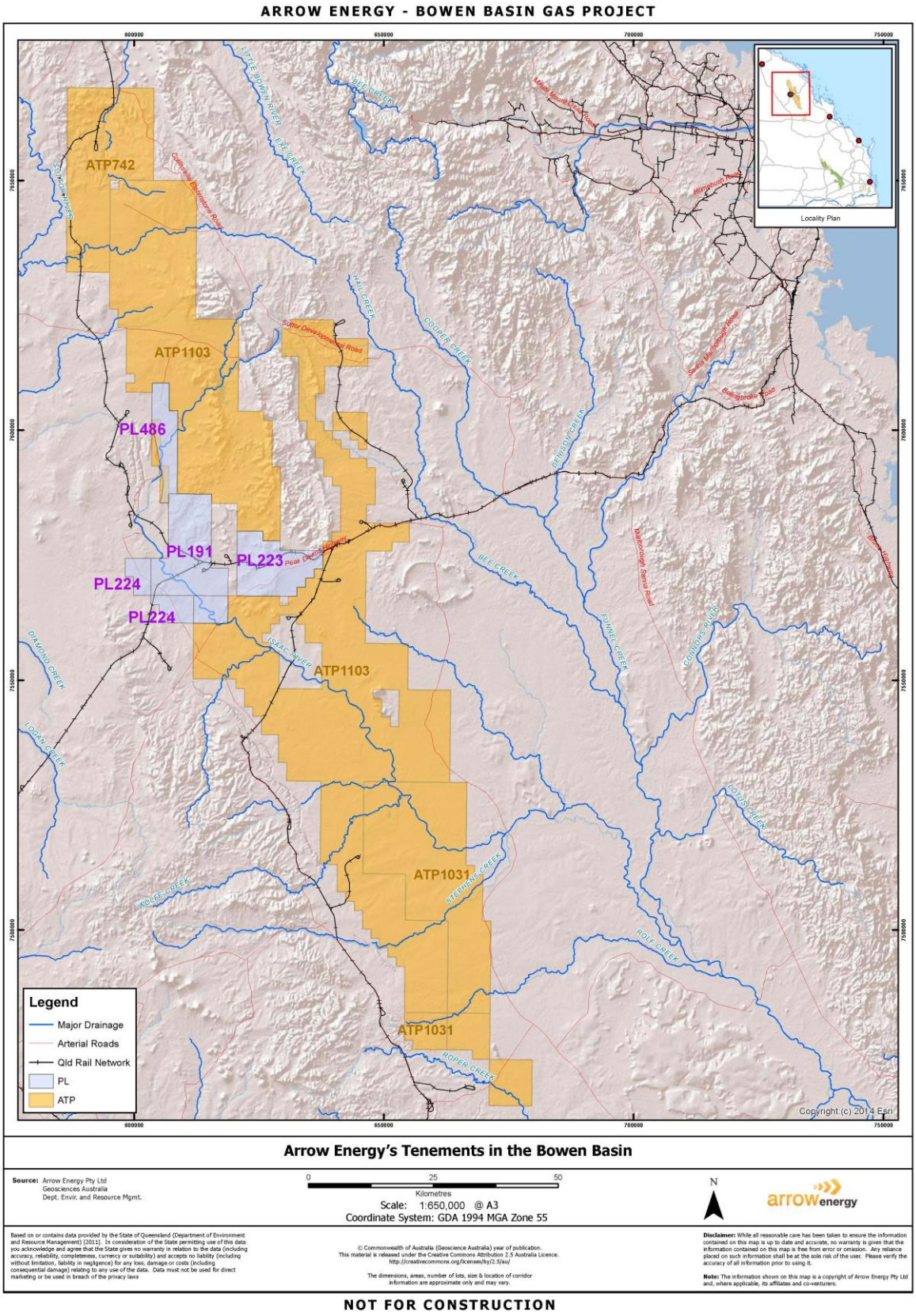


Figure 1: Arrow Energy's Tenements in the Bowen Basin

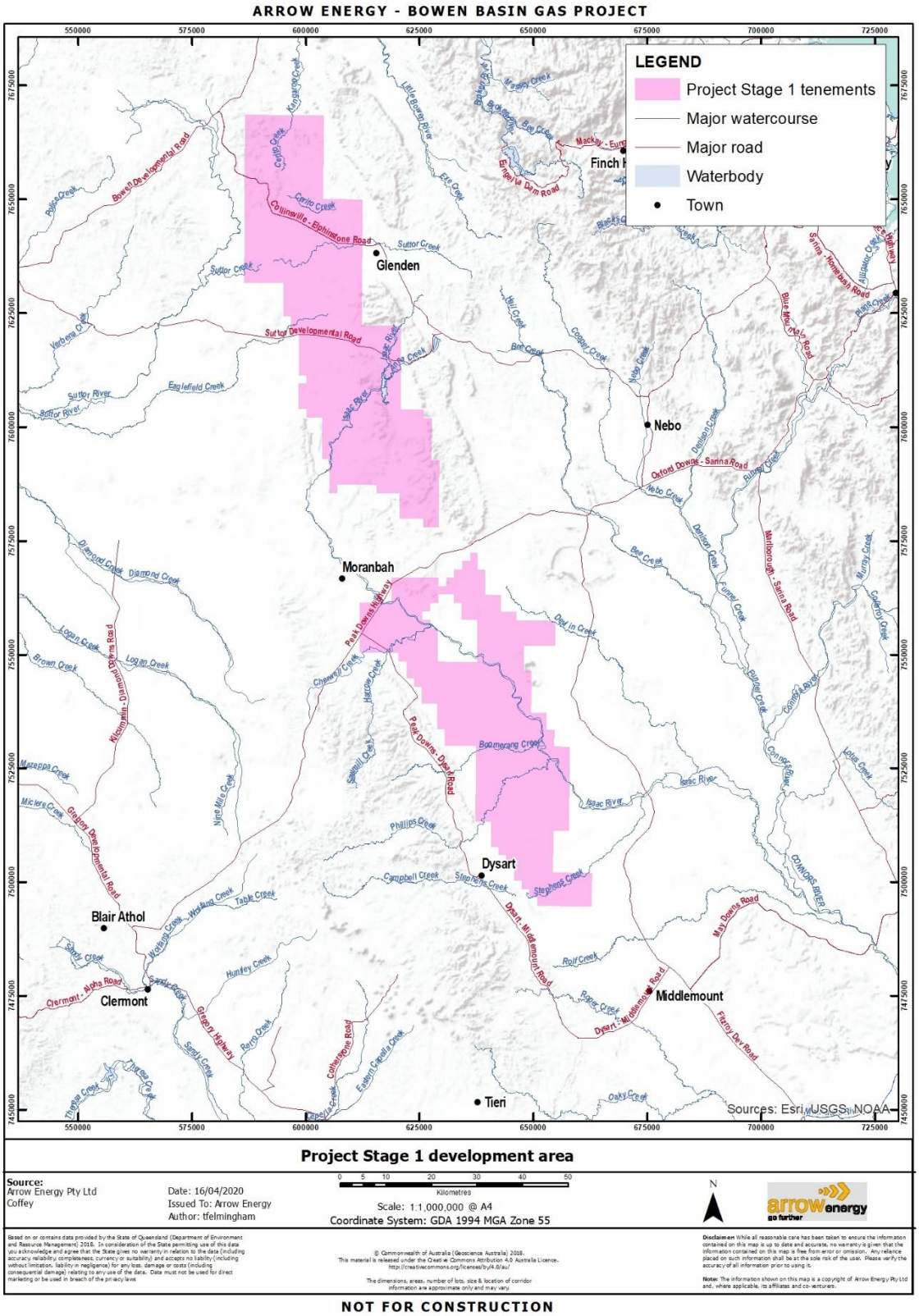


Figure 2: Stage 1 development area

3 WATER MONITORING STRATEGY (WMS)

3.1 MGP Area Groundwater Monitoring Network

A total of 16 groundwater monitoring bores form the groundwater monitoring network for the MGP Area. Figure 3 provides an overview of the spatial distribution of the groundwater monitoring network. Groundwater monitoring is being undertaken in these bores in accordance with the WMS in the approved 2022 Bowen UWIR. The data collected from this monitoring network is being used to supplement baseline data from the BGP groundwater monitoring network. Full discussion of the MGP groundwater monitoring network for the MGP is available in the 2022 Bowen UWIR and available on Arrow Energy's website.

M250W was not monitored in Q4 2022 however is scheduled to be monitored, and sampled if sufficient water is present, by 31 May 2023. Additionally, M324W was not sampled in Q4 2022 due to equipment issues and access due to weather and is scheduled to be sampled in Q2 2023.

Data loss due to hardware issues was experienced at some of the bores including bores M314W and M325W between 01 January 2022 to 01 February 2022, 24 May 2022 to 24 June 2022 and 26 October 2022 to 31 December 2022, bores M313W and M324W between 30 January 2022 and 29 April 2022 and bore AN019 between 14 April 2022 and 22 August 2022.

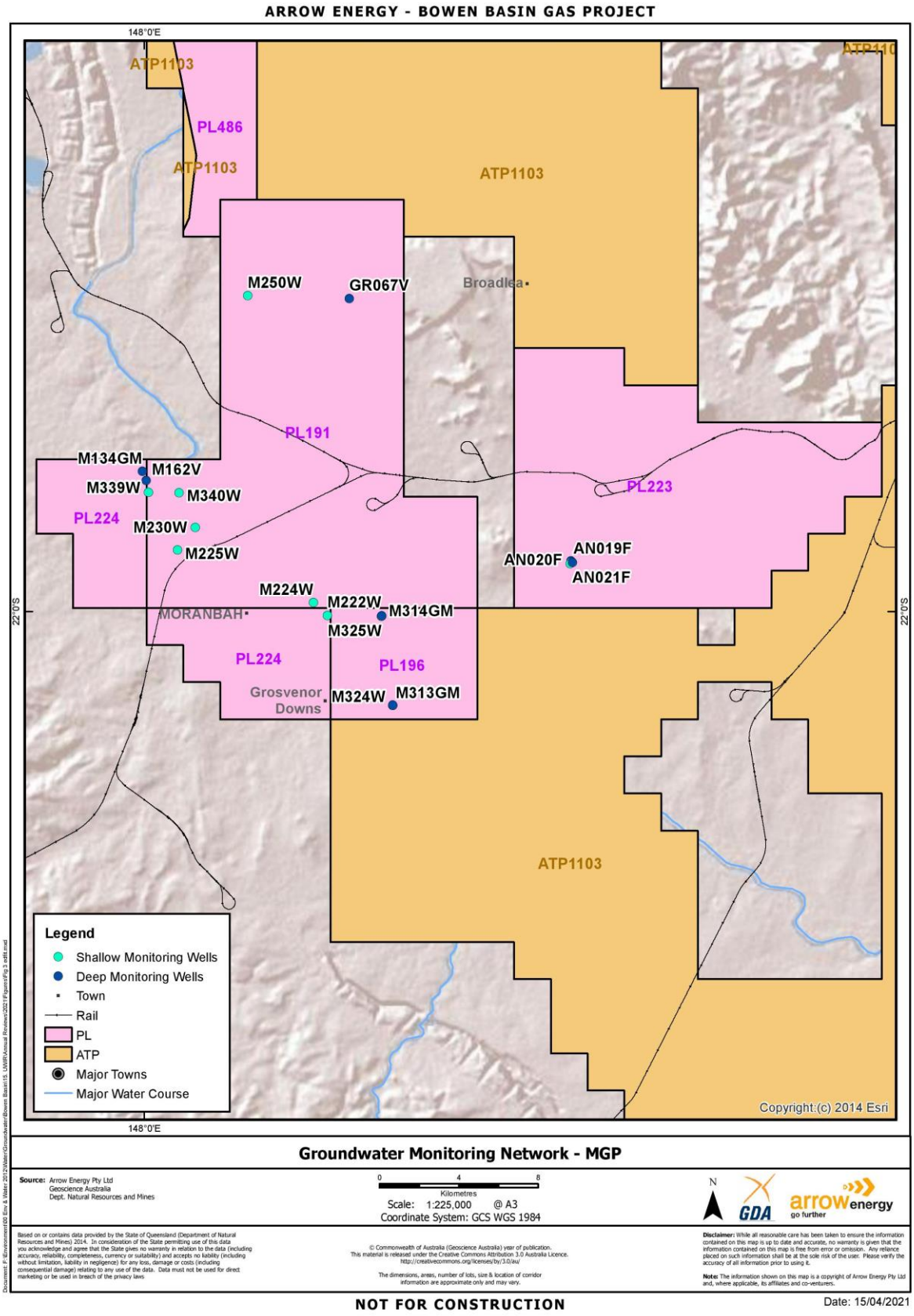


Figure 3: Groundwater Monitoring Network for MGP

3.2 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 4 provides an overview of the spatial distribution of the groundwater monitoring network. Table 2 below displays the monitoring requirements of the BGP, along with the status of each location. Note that Table 2 displays the monitoring location name as per the 2019 Bowen Groundwater Monitoring and Management Plan (GMMP) which was approved by the then Department of the Environment and Energy (now DCCEEW) to comply with Arrow Energy's approval for the BGP. All subsequent reporting is based off this nomenclature.

At present, nine monitoring points have been installed at seven locations as a part of the monitoring network; MB1-S/I/D, MB2, MB3, MB12, GW004, GW007 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 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 to enable additional monitoring from the intermediate and shallow intervals to take place. Groundwater level data has been collected from all three intervals in MB1 since 11 November 2019. Drilling information for MB1 identified sufficient Quaternary / Tertiary Sediment or Rangal Coal Measures were not encountered at this location, and, the shallow and intermediate monitoring points are instead located within the Fort Cooper Coal Measures. This monitoring location is within 10 kilometres of the Red Hill Central development area.

Pressure spikes at the time of 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 data don't represent actual changes in pressure.

MB2

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), October 2017 to May 2018 (8 months). The well was converted to a permanent monitoring well using the existing downhole pressure gauge in February 2019 with twice daily groundwater level observations collected from February 2019 to October 2019 (7 months) and, following 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 on why this occurred identified that the route cause 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.

Logged casing pressure between September 2019 and August 2020 displayed frozen values and is not likely real data. In this period, manually obtained pressure readings have been used.

Pumping (intermittently) from the well (for the pilot) was undertaken between 2012 and 2018. The well was converted to a monitoring well using the existing downhole pressure gauge in February 2019.

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.

Data loss due to hardware issues was observed between 14 July 2022 and 14 August 2022.

This monitoring location is within 10 kilometres of the Red Hill Central development area.

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. 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 time period, there is a chance the data is not reliable for this time period.

Data loss was observed from 1 January 2022 to 13 February 2022 due to skid communication issues.

This monitoring location is within 10 kilometres of the Red Hill Central development area.

MB12

MB12 was installed as a mine monitoring bore (originally named EFGW5D) by Fitzroy Mining in June 2008. 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.

This monitoring location is within 10 kilometres of the Red Hill Central development area.

Supplementary monitoring bores

These monitoring locations comprise existing third-party monitoring bores and landholder bores and are included in 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. Arrow commenced monitoring of GW001 and GW007 in November 2019.

GW004 was chosen as a replacement of GW001 from November 2020 due to 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.

These monitoring locations are within 10 kilometres of the Red Hill Central development area.

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 all bores on the property, with this bore being more suitable for long term monitoring than the original choice of AEN1036.

The following bore locations discussed below (AEN1214 and AEN1234), have been visited and assessed as suitable for long term monitoring and are awaiting execution of agreements with the landholders before logging equipment is installed. These bores are intended as part of the supplementary monitoring network and are currently visited for manual water level monitoring every six months.

AEN1214

AEN1214 is a private water bore owned by a landholder. Manual measurements every 6-months will be collected, which started from November 2020. Arrow is currently awaiting an access and monitoring agreement to be signed by the landholder for deployment of a logger.

AEN1234

AEN1234 is a private water bore owned by a landholder. Manual measurements every 6-months will be collected, which started from November 2020. Arrow is currently awaiting an access and monitoring agreement to be signed by the landholder for deployment of a logger.

Table 2: 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. Online date is 16 February 2019 however data was lost between 30 October 2019 and 9 January 2020.
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. Online date is 16 February 2019 however data was lost between 30 October 2019 and 9 January 2020, and 1 January 2022 to 13 February 2022.
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 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. Awaiting access and monitoring agreement for deployment of logger. No readings were recorded for Q2 2022 due to the landholder denying access to the property.
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	Manual measurements recorded every 6-months. Awaiting access and monitoring agreement for deployment of logger.
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.

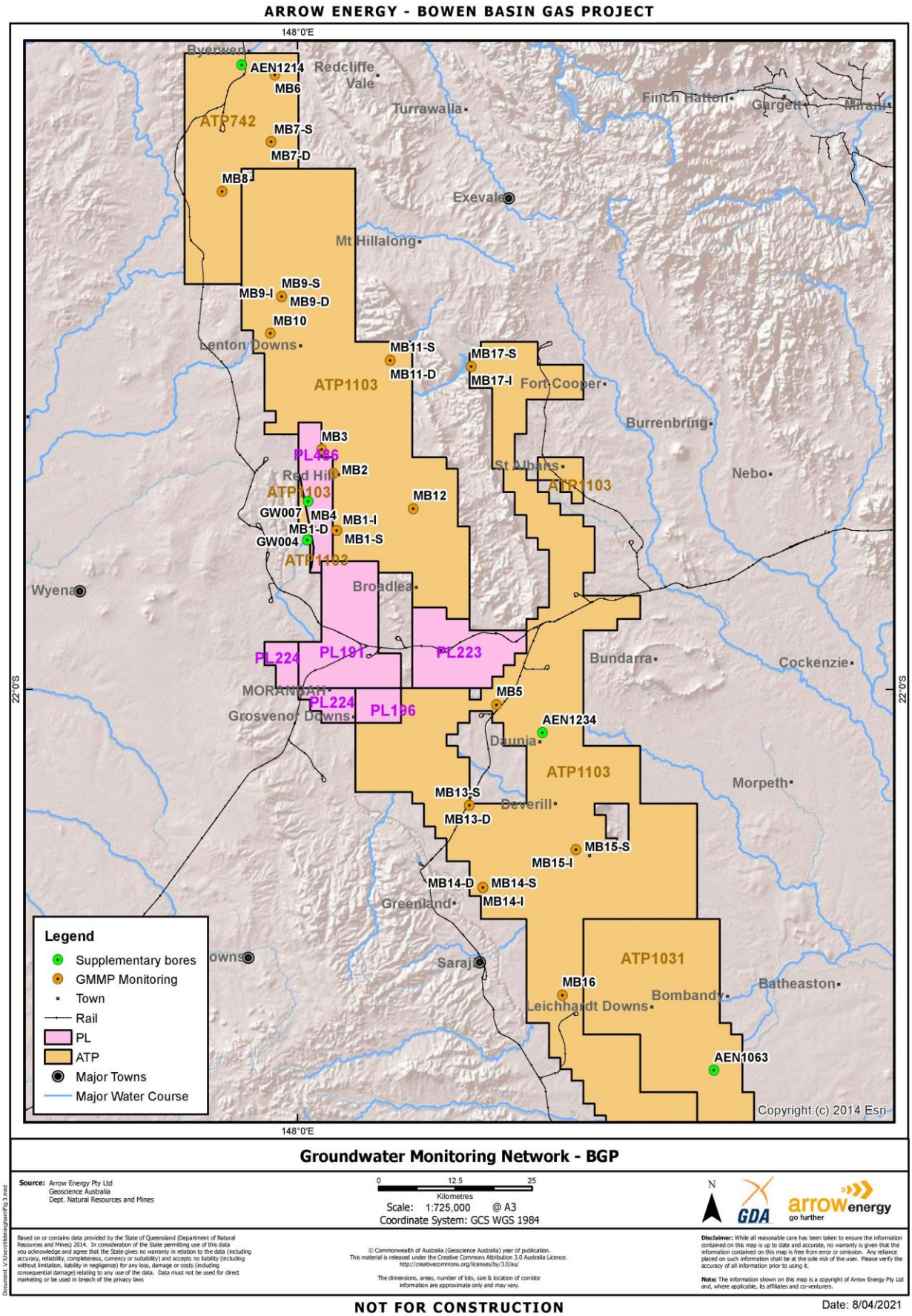


Figure 4: Groundwater Monitoring Network for BGP

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 2022 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

In-depth analysis of the groundwater levels for the MGP is available in the 2023 Annual Review of the Bowen UWIR (Appendix A). Findings for the MGP groundwater levels are summarised in the below sections.

4.2.1 Shallow Monitoring Bores

4.2.1.1 MGP

The groundwater levels in the MGP range from:

- 200.1 to 209.2 m Australian Height Datum (AHD) in the weathered Tertiary Basalt aquifer;
- 233.2 to 242.7 m AHD in the Tertiary Sediment aquifer;
- 207.8 to 211.7 m AHD in the Quaternary Alluvium aquifer;
- 202.4 to 206.3 m AHD in the Fort Cooper Coal Measures aquifer; and
- 236.6 to 238.6 m AHD in the Rewan Formation.

All bores located within close proximity to the Isaac River display similar depths to groundwater, as discussed in the 2022 Bowen UWIR. It should be noted that bore M250W was not monitored in Q4 2022; however it is scheduled to be monitored and sampled if sufficient water is present by 31 May 2023.

The groundwater levels for bores M250W, AN021F and AN020F are higher due to the respective surface elevation in the areas being approximately 30 to 95 m above the other bores. M250W and AN021F are installed in the Tertiary Sediment and located approximately 10 km north and east (respectively) of the other groundwater monitoring sites along the Isaac River, while MB12 is constructed within the Rewan Formation and located approximately 26km northeast of the other groundwater monitoring sites along the Isaac River.

A comparison of modelled drawdown predictions made in the 2022 Bowen UWIR with monitoring data to date has been undertaken. This was undertaken to review the 2022 Bowen UWIR model performance and it is not to check if the bore trigger threshold has been exceeded.

There is no predicted IAA or LAA for unconsolidated aquifers for the MGP and BGP as modelled drawdown does not exceed the bore trigger threshold of 2 metres. The monitoring data to date supports this modelled prediction in the 2022 Bowen UWIR.

Groundwater level monitoring indicates:

- Actual groundwater levels monitored in bore M339W have remained steady over the monitoring period.
- The water levels in M222W and M225W have continued to steadily rise since monitoring began in 2012.
- Figure 7 displays cumulative rainfall departure and groundwater levels at groundwater monitoring bores M225W, M222W and M224W. Recharge to shallow aquifers due to above mean rainfall has contributed to the trend in groundwater levels noted in M222W and M225W with a peak at the end of 2017;
- There is no predicted IAA or LAA for any aquifer underlying PL 223; hence modelled drawdown greater than the bore trigger threshold at the end of 2019 was not predicted in the 2022 Bowen UWIR to occur at the location of bores AN020F and AN021F. AN021F is installed in the Tertiary Sediment and has increased in water level since monitoring began. AN020F is installed in the Rewan Formation which is considered to be a regional aquitard. Groundwater levels monitored at AN020F have remained steady over the monitoring period.
- A decline in groundwater level by greater than the bore trigger threshold was noted at bore M224W between November 2017 and November 2019. As discussed in the 2022 Bowen UWIR, the water levels in this bore indicate a possible hydraulic link to the river level fluctuations. This is in-line with the conceptual hydrogeological model report in the 2022 Bowen UWIR, where there is linkage between rainfall events and river level flow periods to groundwater level. This decline is not considered to be due to the effects of CSG production; and
- A decline in groundwater level by greater than the bore trigger threshold was noted at bore M230W between November 2017 and November 2019. The water levels observed in this bore are considered to have been influenced by nearby mining operations; a review of mine plan schedules indicated that "drive Number-1" traversed the area in proximity to M230W between Q3 and Q4-2017 indicating that the SWL decline were expected to be a result of the Anglo underground mine development. This was similar to the decline seen in M340W (as discussed in the 2017 Annual Review of the 2016 Bowen UWIR) where a decline in groundwater level has made this monitoring borehole dry. Both monitoring bores are in the same area, as shown in Figure 3. Accordingly, the decline is not considered to be due to the effects of CSG production. Due to the impact of mining operations, this monitoring bore has been replaced by M300W but is included in this report for historical analysis.

Based on the graphically presented monitoring data in Figure 5, it is clear that there is no apparent influence of CSG production to the Quaternary alluvium, weathered Tertiary basalt, Tertiary sediment, weathered Fort Cooper coal measures and Rewan aquifers in which these bores are installed. This data supports the groundwater modelling predictions in the 2021 Bowen groundwater model.

4.2.1.2 BGP

Groundwater level monitoring has been undertaken in the following shallow groundwater monitoring bores which form part of the BGP monitoring network.

Table 3 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 3: BGP Shallow Groundwater Monitoring Bores

Bore ID	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation
MB1-S	60	45.0 – 50.0	Fort Cooper Coal Measures – Girrah Seam
MB12	59.1	56.0 – 59.0	Rewan Formation
GW004A	13.5	7.5 – 13.5	Tertiary Sediment
GW004B	59	23.0 – 59.0	Fort Cooper Coal Measures
GW007A	7.5	1.5 – 7.5	Tertiary Sediment
AEN1214	37.32	-[1]	Rangal Coal Measures
AEN1234	102	48.2 – 102.0	Blackwater Group
AEN1063	52.6	39.6 – 45.7	Blackwater Group

[1]Screened interval could not be determined due to pumping infrastructure

The groundwater level monitoring results are shown in Appendix B. Groundwater levels, as is shown in Figure **6**, range from:

- 234.44 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, and
- 286.31 to 298.65 m AHD in the Rewan Formation.

Groundwater level monitoring indicates:

- Groundwater levels are stable in the shallow bores;
- GW007A was recorded as dry. An alternate location may be required if GW007A is shown to be continually dry; and
- Water level decline and recovery in MB12 is due to water quality sampling (pumping) being undertaken in the bore. The frequency of water quality sampling was decreased in H2 2019 where subsequent water level data show water level recovery between monitoring events.

Based on the presented monitoring data in Figure **6**, 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 no water production has commenced in the BGP.

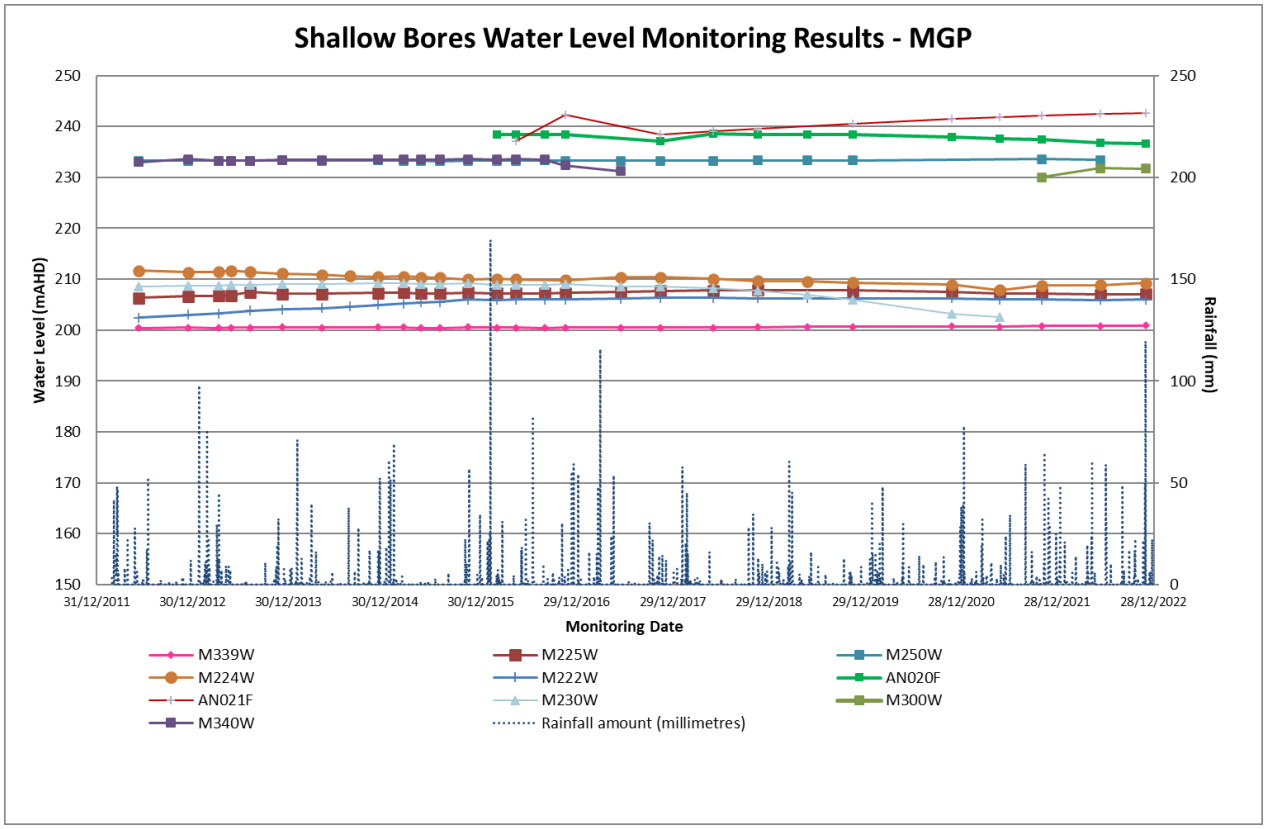


Figure 5: Shallow Bores Water Level Monitoring Results - MGP

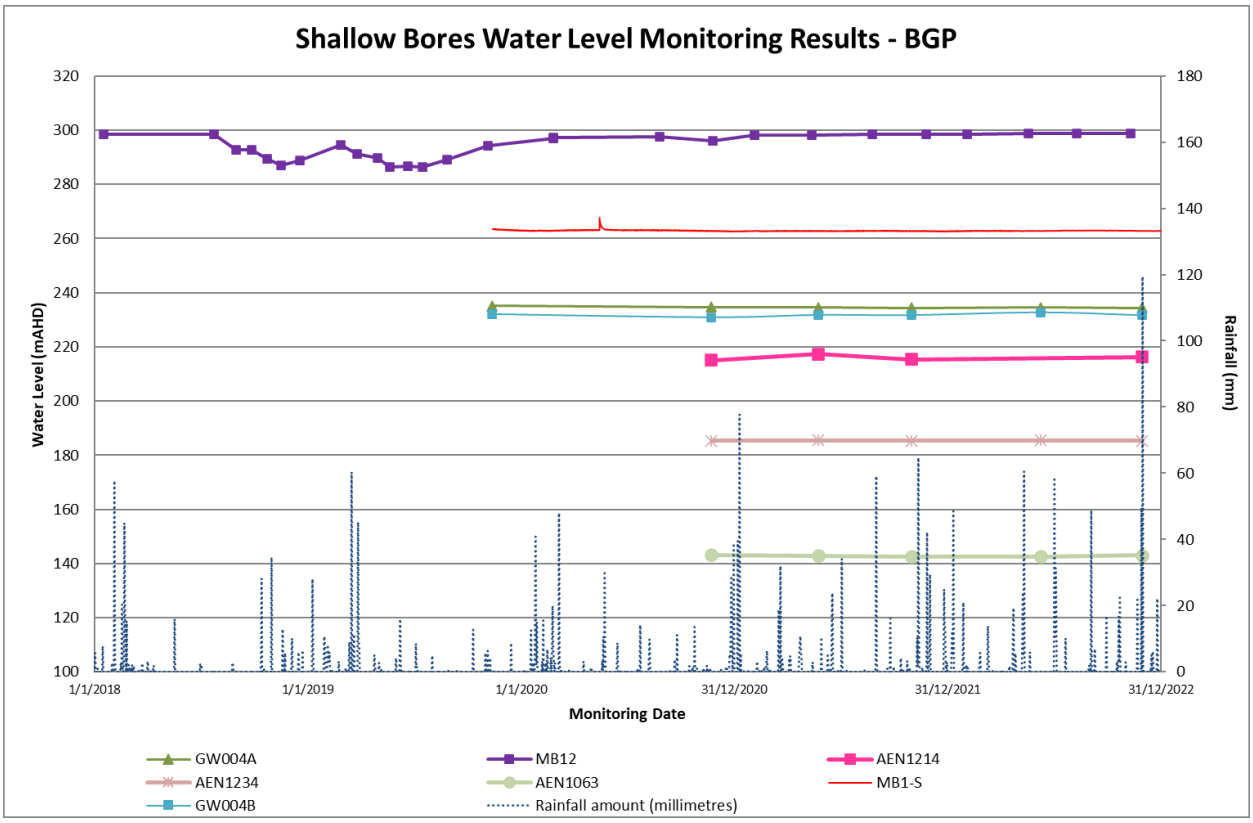


Figure 6: BGP Shallow Bores Water Level Monitoring Results

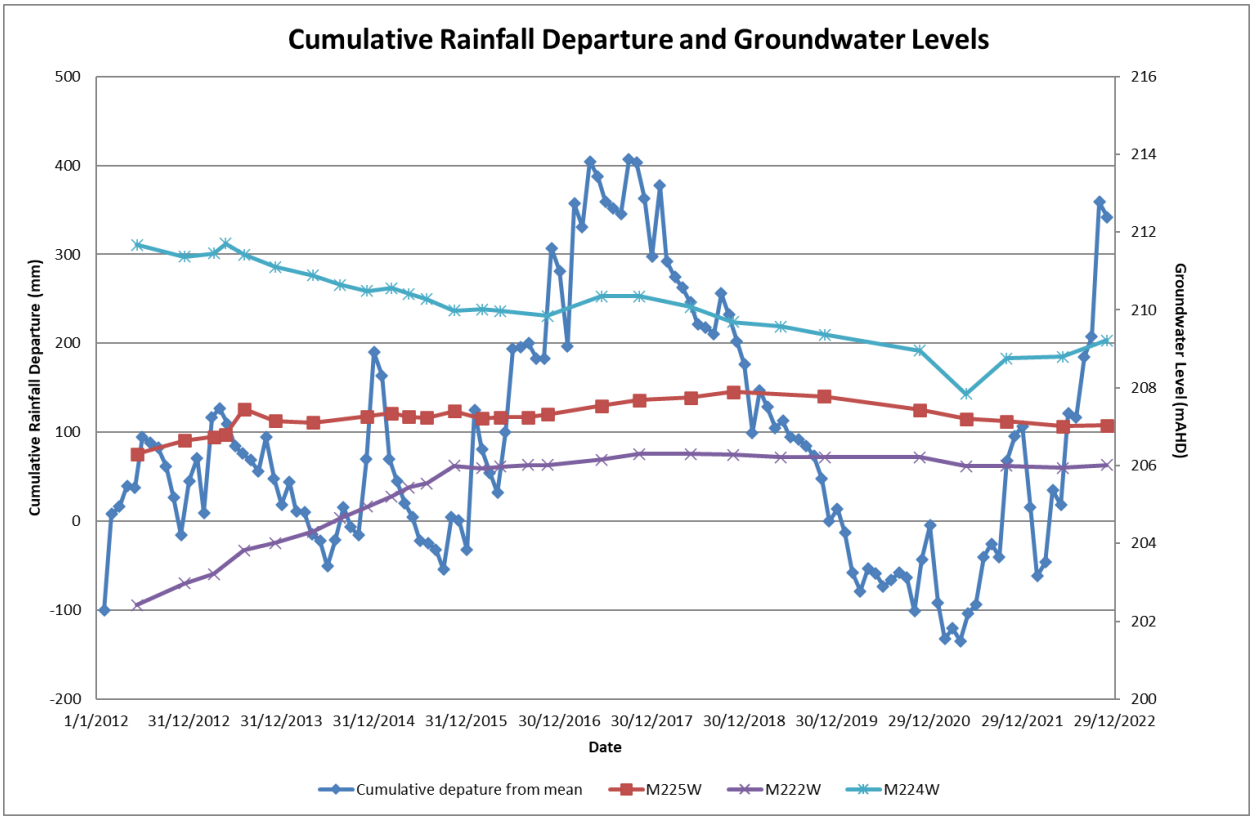


Figure 7: Cumulative Rainfall Departure and Groundwater Levels

4.2.2 Deep Monitoring Bores

4.2.2.1 MGP

The groundwater level monitoring results are shown in Figure 11. Observed groundwater levels or calculated potentiometric water levels ranged from:

- 208.1 to 216.8m AHD in the BCG;
- 49.6 to 207.7m AHD in the FCCM; and
- -129.1 to 204.5m AHD in the MCM.

Groundwater level monitoring, indicated:

- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M314W was predicted in the model to be approximately 196.35 m. Actual groundwater levels monitored for the MCM at M314W indicate a decline in levels of approximately 4.02 m;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M313W was predicted in the model to be approximately 31.30 m. Actual groundwater levels monitored for the MCM at M313W shows the maximum decline in the water level of 74.53 m, as measured in March 2017. Since March 2017 the water level has recovered by 57.85 m which represents approximately 94% recovery of the original water level prior to the drawdown and as indicated in Figure 11. The graphically displayed water level curve indicates the recovery will continue;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M324W was predicted in the model to be approximately 31.38 m. Actual groundwater levels monitored at M324W show a maximum decline in levels by 6.63 m in March 2017. Since March 2017, the water level has recovered by 3.47 m which represents a 53% recovery of the water level prior to the drawdown as indicated in Figure 11. This groundwater monitoring bore is located in the southern part of PL 196 and approximately 350 m from production well GM052V. The total amount of water actually produced from GM052V during this annual review data capture period was 0 ML. Since production ceased, the water level has continued to recover;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M162V was predicted to be approximately 26.06 m. Actual groundwater levels monitored at this site show a steady groundwater level decrease of approximately 31.43 m;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of GR067V was predicted to be approximately 1.64 m. Decreases in water levels of up to 150 metres, noted in April and August 2016, are due to depressurisation activities in this bore associated with monitoring events. The recovery curve has subsequently stabilised and no drawdown is evident;
- Modelled drawdown in the FCCM aquifer at the end of 2022 at the location of M324W was predicted to be 0.3 m. Actual groundwater levels monitored for the FCCM at M324W shows a decline of approximately 1.7 m;
- Modelled drawdown in the FCCM aquifer at the end of 2022 at the location of AN019F was predicted to be 0.04 m. Actual groundwater levels monitored indicates a smaller decline of approximately 0.98 m; and
- Modelled drawdown in the BCG aquifer at the end of 2022 at the location of M313W and M314W was not predicted to occur in the model. Actual groundwater levels monitored for the BCG at M313W and M314W indicate a decline of approximately 3.45 m and 7.74 m respectively.

Based on the monitoring data, it is concluded that observations of drawdown were generally consistent with the drawdown predictions made in the 2022 Bowen UWIR.

4.2.2.1 BGP

The groundwater level monitoring results are shown in Figure 12. Observed groundwater levels or calculated potentiometric water level ranged from:

- 244.1 to 269.1 m AHD in the FCCM; and
- -356.3 to 209.9 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 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 D displays the curve analysis and graphs, with Figure 8 to Figure 10 showing the water level recovery of these wells compared to the calculated recovery. These figures show:

- MB1 water level has fully recovered.
- MB2 water level is recovering in-line with the calculated recovery.
- 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 4 displays the predicted recovery year for each bore. As discussed in Section 3.2, the location of MB3 was changed due to a failure in a pressure gauge.

Table 4: 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

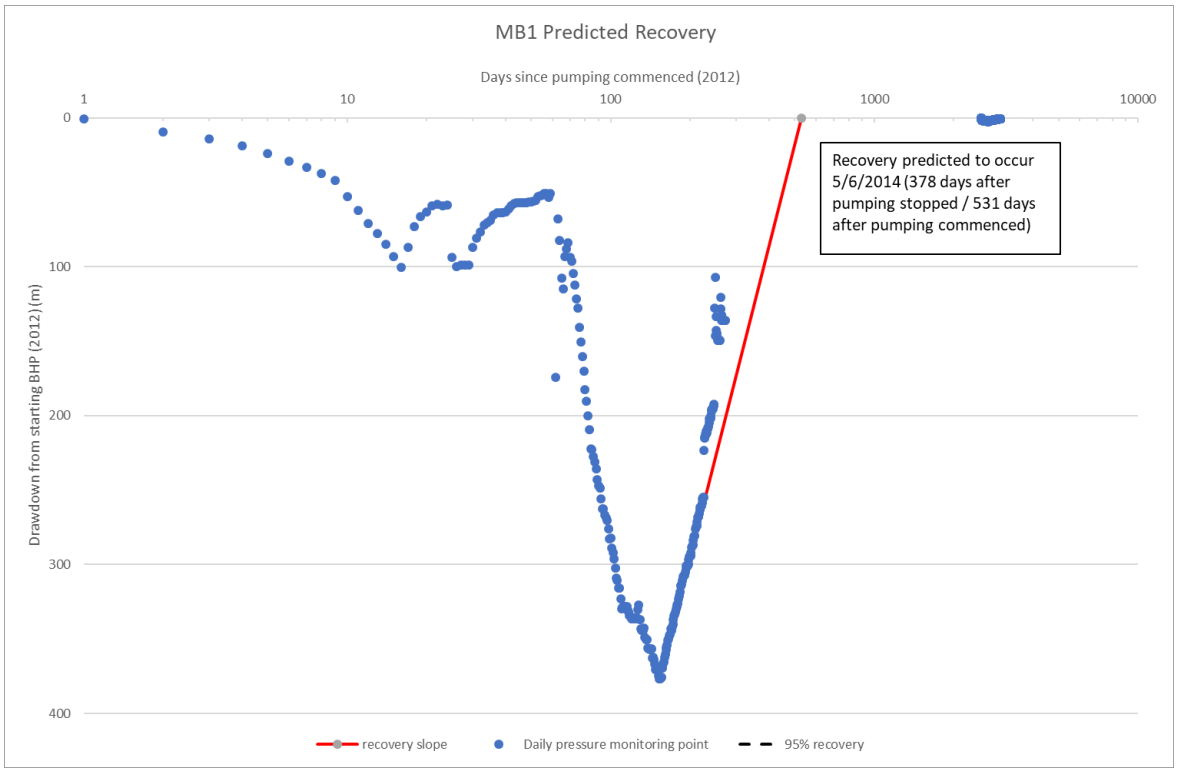


Figure 8: MB1-D recovery data

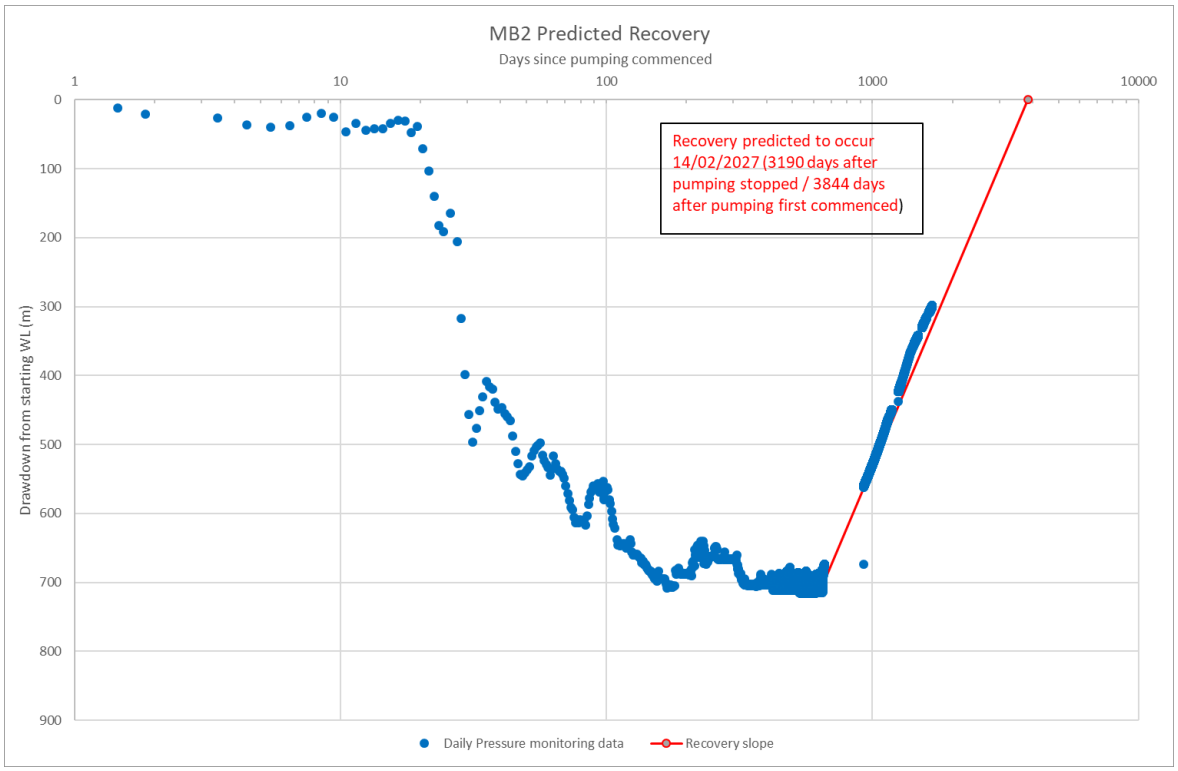


Figure 9: MB2 recovery data

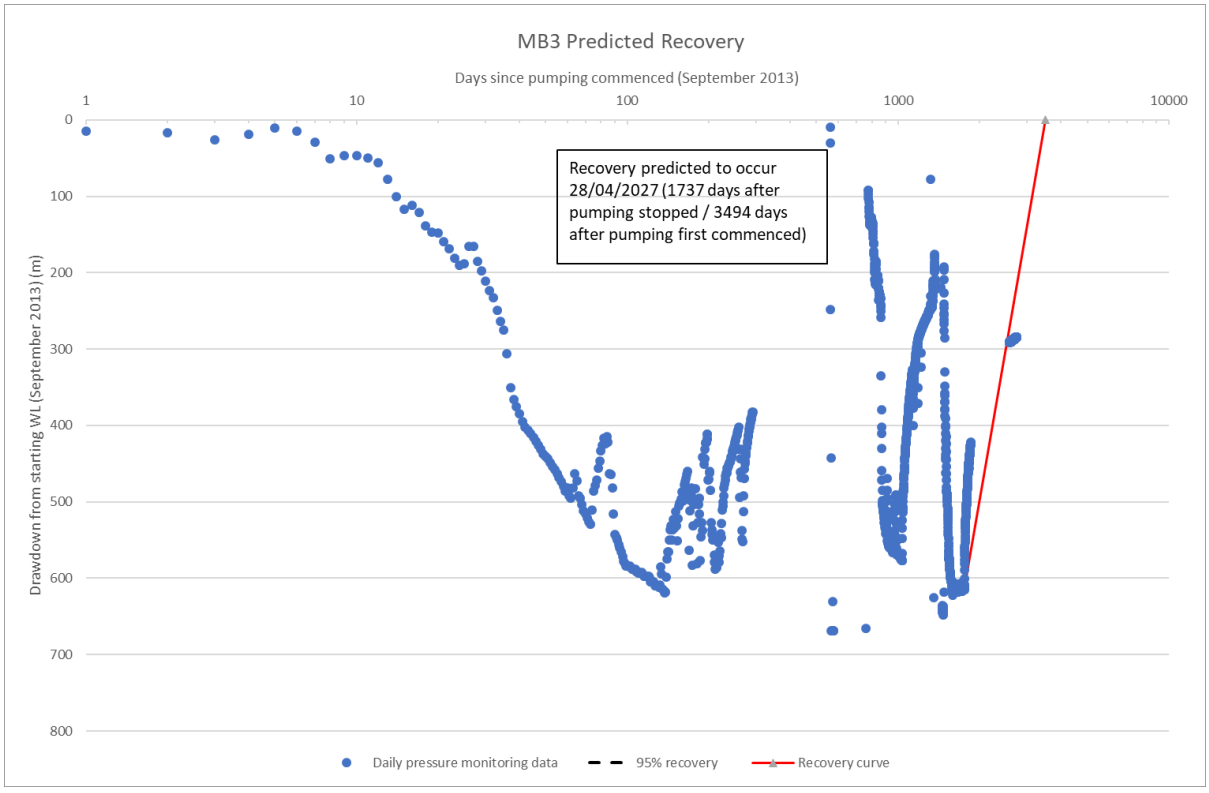


Figure 10: MB3 recovery data

A comparison of modelled drawdown predictions modelled in the 2022 Bowen UWIR with monitoring data to date has been undertaken and indicates:

- Drawdown in the MCM aquifer at the end of 2022 at the location of MB1 was not predicted to occur in the model. Actual groundwater levels monitored indicate a small increase of 0.35 m. There was a decline in water levels in

2019 as a result of equilibration due to the workover of the well in late 2019 to equip the borehole with multiple pressure sensors and is not related to CSG activities;

- Drawdown in the MCM aquifer at the end of 2022 at the location of MB2 was not predicted to occur in the model. Actual groundwater levels monitored indicate an increase of 324.89 m. The water level in this bore is recovering from production;
- Drawdown in the MCM aquifer at the end of 2022 at the location of MB3 was predicted to be 6.94 m. Actual groundwater levels monitored indicate an increase of 181.9 m from the recovery, which started in June 2019;
- Drawdown in the FCCM aquifer at the end of 2022 at the location of MB1 and GW007B was predicted to be 0 m. Actual water level monitored indicates a decline of 7.37 in MB1 and 1.06 in GW007B. The observed decline, which appears to be flattening in MB1, is likely due to equilibration of pressure within the bore and the formation following the workover when the well was topped up with water; and
- MB2 and MB3 display recovering water levels. MB2 and MB3 are prior appraisal wells.

Based on the monitoring data, it is concluded that observations of drawdown were generally consistent with the drawdown predictions made in the 2022 Bowen UWIR.

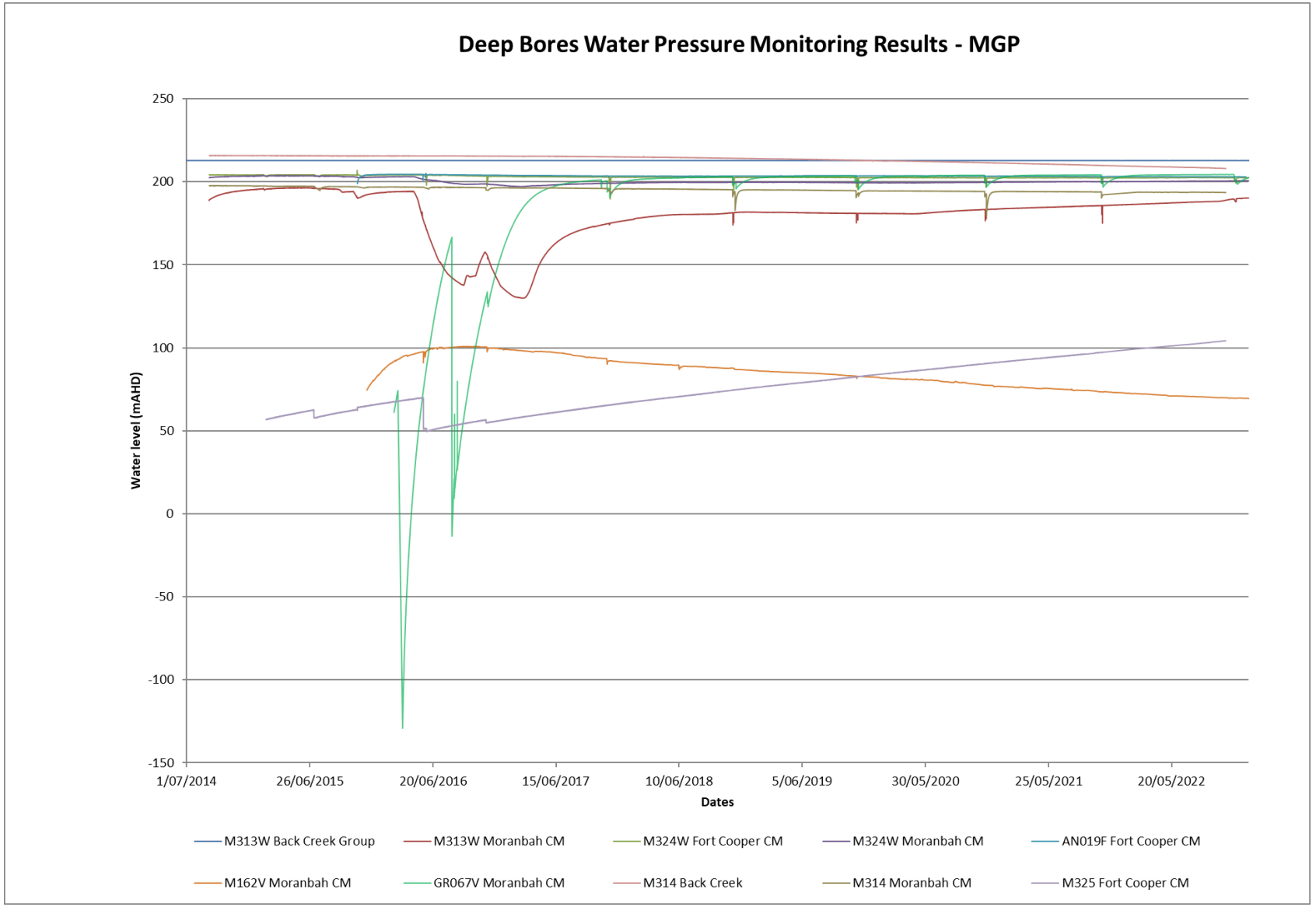


Figure 11: Deep Bores Water Level Monitoring Results - MGP

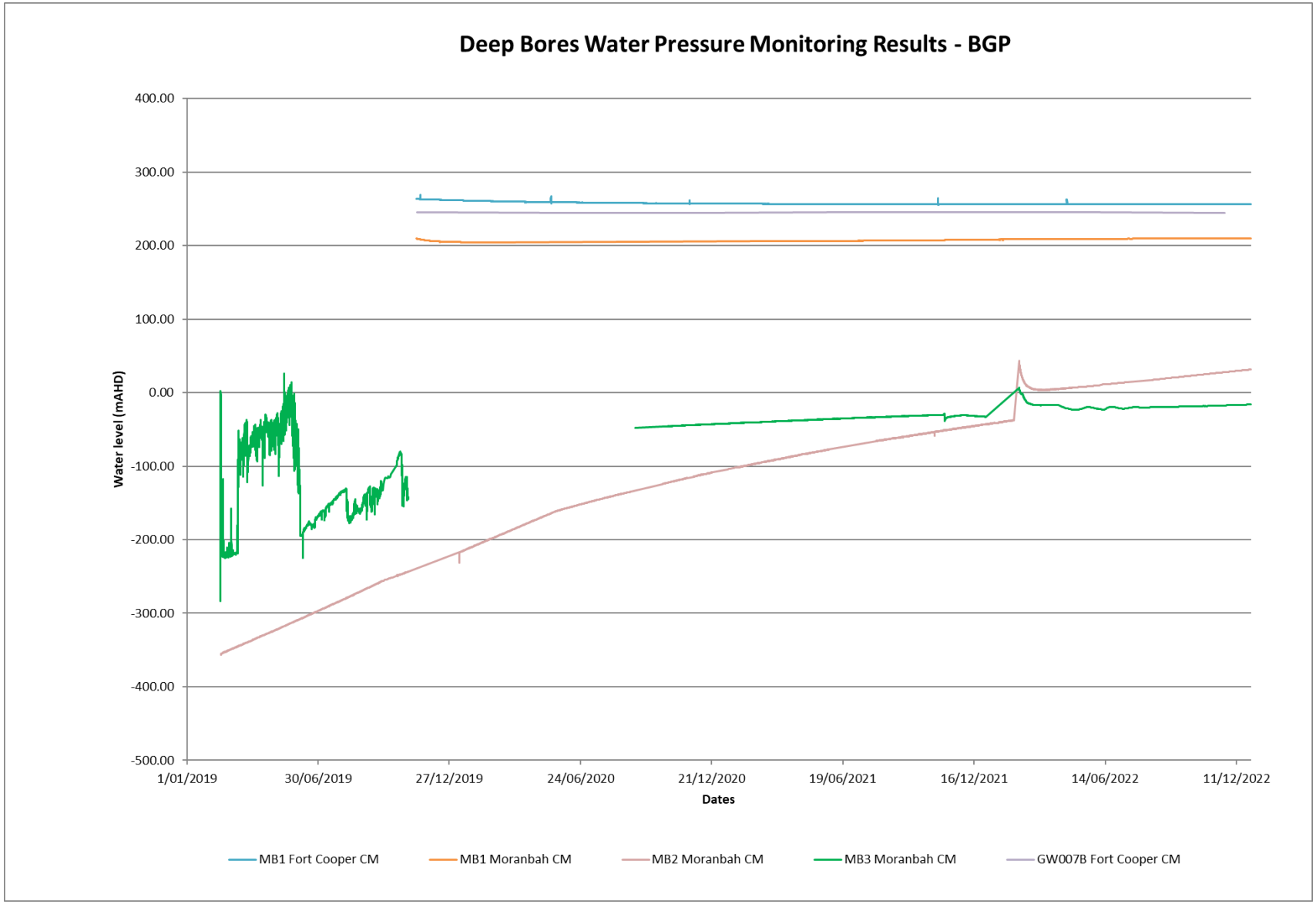


Figure 12: Deep Bores Water Level Monitoring Results - BGP

4.2.3 Groundwater Flow

A review of vertical gradients was undertaken for two monitoring locations in the MGP Area and one monitoring location in the BGP area. Monitoring at each site included:

- Site 1: From deepest to shallowest; Back Creek Group (M314W), Moranbah Coal Measures (M314W), Fort Cooper Coal Measures (M325W) as well as data from monitoring approximately 3 km north west in the weathered Fort Cooper Coal Measures (M222W) and Quaternary Alluvium (M224W).
- Site 2: From deepest to shallowest; Back Creek Group (M313W), Moranbah Coal Measures (M313W), Moranbah Coal Measures (M324W) and Fort Cooper Coal Measures (M324W);and
  Site 3. From deepest to shallowest, Moranbah Coal Measures, Fort Cooper Coal Measures and Fort Cooper Coal Measures (Girrah seam), in MB1.

Figure 13 below shows the vertical gradients for Site 1 and the latest data indicates the FCCM aquifer, at bore M325W, has the lowest water level. The collected and graphically displayed data indicate a very steady and continued recovery. With the exception of M325W there is an apparent gradient toward the MCM (the target coal seams for CSG production from the MGP) i.e. upward from the BCG and downward from the Quaternary Alluvium, to the FCCM and then to the MCM.

Water levels in monitoring bore M222W which is constructed into the FCCM show a rising trend in response to above average rainfall recharge. Water levels in M224W constructed in the Quaternary Alluvium show that trends in water levels are linked to flows in the nearby Isaac River.

A decline in water levels have been observed in M314W within MCM and the BCG. The water level trends between the MCM and shallow aquifer seem to indicate no vertical hydraulic links exist at this location.

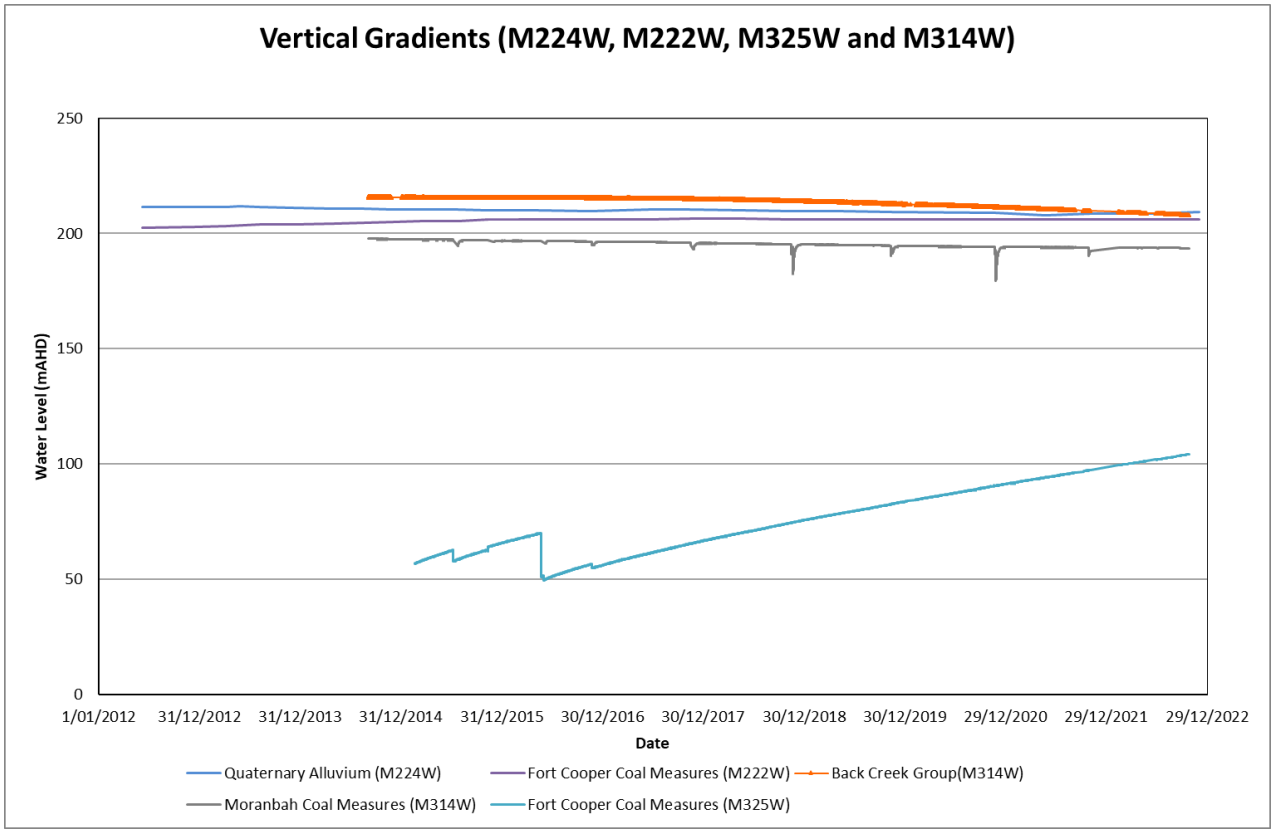


Figure 13: Site 1 - Review of Vertical Gradients (M224W, M222W, M325W and M314W)

Figure 14 shows the graphically displayed vertical gradients for Site 2 and based on the presented data, water levels in the MCM monitoring bores have continued to recover following cessation of production in GM052V.

Drawdown as a result of water production in CSG wells to the MCM aquifer is evident at site M313W and M324W but since the production ceased in April 2017, the water level recovery is evident in both monitoring boreholes. Monitoring data for the FCCM and BCG at this site indicates a slight decline in water levels. Decline in water levels noted for the FCCM are observed to correlate to the water production 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. Whilst there is some decline in

water levels in the deeper Back Creek Group aquifer, it does not clearly correlate to the water production in the CSG wells and ongoing monitoring will confirm this. Based on this, monitoring data suggests that impacts are contained within the MCM and FCCM and no vertical hydraulic links exist at this location.

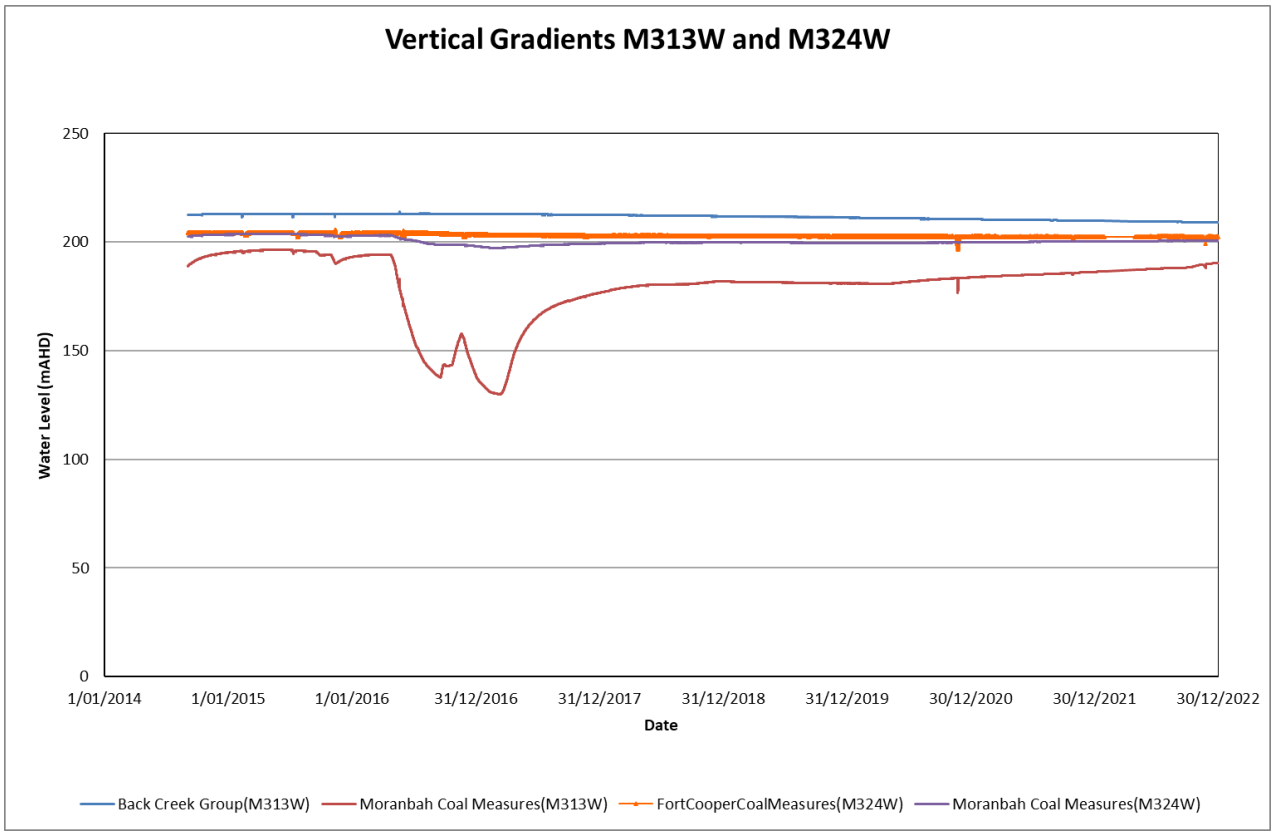


Figure 14: Site 2 - Review of Vertical Gradients (M324W and M313W)

A review of vertical gradients was undertaken for one monitoring location in the BGP (MB1 – denoted Site 3). Figure 15 shows the graphically displayed vertical gradients for Site 3 and based on the presented data, a decrease in water levels in the Moranbah Coal Measures is visible, with a smaller decrease seen in the Fort Cooper Coal Measures. Prior to this decrease, the Fort Cooper Coal Measures 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 seen. As of the end of 2022 the water levels in all three zones are stabilising, with the MCM zone displaying an increase in water levels.

As discussed in Section 3.2, pressure spikes at the time of sampling from the lower zone from MB1-D are likely associated with spikes in temperature in the Fairhill pressure gauge.

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

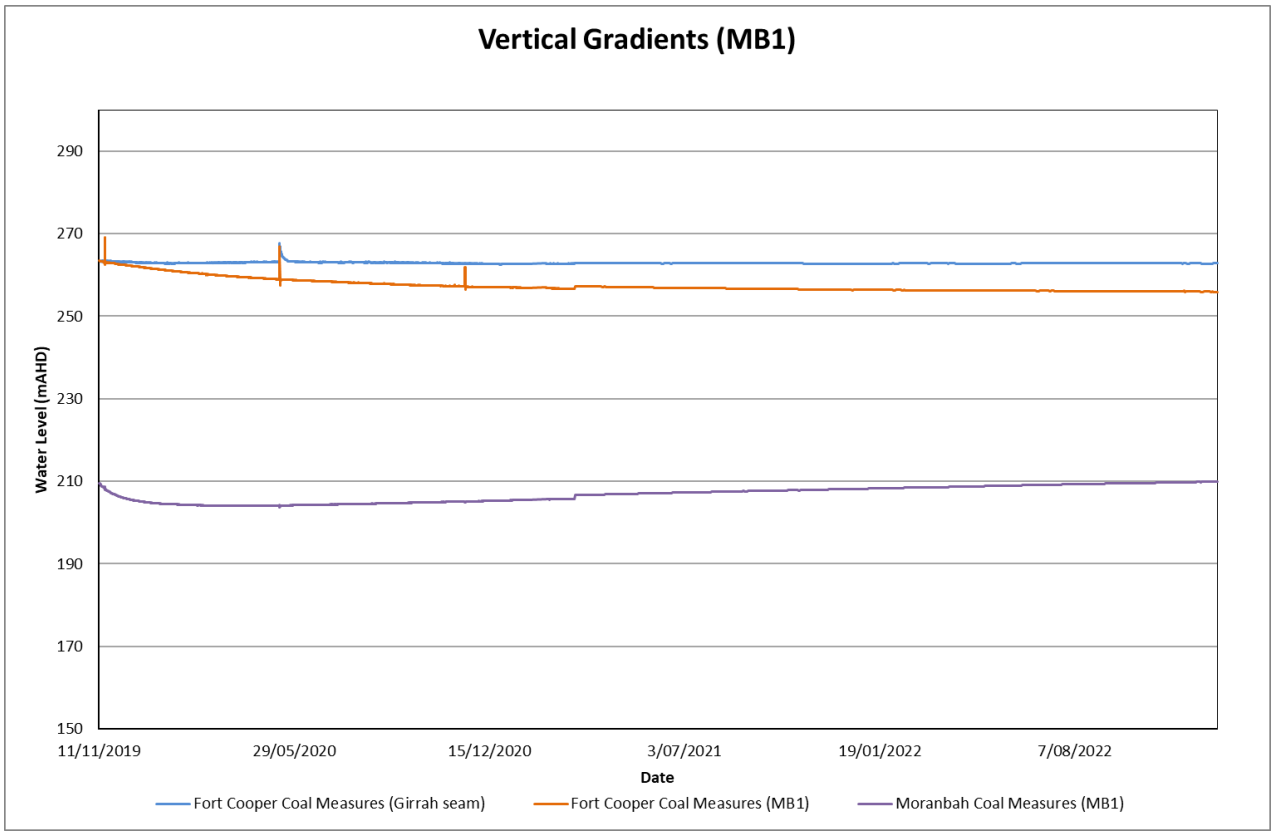


Figure 15: Site 3 - Review of Vertical Gradients (MB1)

4.3 Groundwater Quality Monitoring

The groundwater quality monitoring results are shown in Appendix C. A summary of these results is provided in the following sections.

4.3.1 Shallow aquifer water quality

4.3.1.1 MGP

The groundwater quality data indicated that there are no notable trends. In general, the data showed that:

- Groundwater quality of the quaternary alluvium varies from brackish to saline;
- Groundwater quality of the tertiary basalt aquifer varies from brackish to saline;
- Groundwater quality of the tertiary sediment aquifer is fresh to brackish to brackish;
- Groundwater quality of the weathered coal measures is saline; and
- Groundwater quality of the Rewan Formation is saline.

M250W was not monitored in Q4 2022 however is scheduled to be monitored, and sampled if sufficient water is present, by 31 May 2023.

4.3.1.2 BGP

No groundwater quality data was obtained for the shallow aquifer for the BGP. At present, no shallow groundwater quality data locations are required to be collected. As the project progresses, the following locations will require groundwater quality data to be collected:

- MB5;
- MB7-S;
- MB8;
- MB9-S;
- MB10;
- MB11-S;
- MB13-S (contingent);
- MB14-S;
- MB15-S & MB15-I (contingent);
- MB16; and
- MB17-S & MB17-I (contingent).

4.3.2 Deep aquifer background water quality

4.3.2.1 MGP

Table 5 provides a summary of water quality results obtained from bores targeting the deep aquifers (M313W, M314W, M324W, M325W, AN019F, GR067V, M162V, M134GMV and MB1-D. This provides an indication of water quality ranges for each parameter analysed based on aquifer type. Results for some parameters between different monitoring locations show high degree of variation which is likely to be attributable to the spatial heterogeneity and low permeability of the hydrogeological system. In addition to this, as displayed by the groundwater pressure data, groundwater recovery for some sites is slow and this is likely to result in variations in some parameters at the same monitoring location. Overall, a review of this data indicates that there are no notable trends. In general, this data shows that:

- Groundwater quality of the Fort Cooper Coal Measures aquifer is fresh to saline[2]; and
- Groundwater quality of the Moranbah Coal Measures is fresh to brackish to saline.

It should be noted that bore M324W was not sampled in Q4 2022 due to equipment issues and access due to weather. The bore is scheduled to be sampled in Q2 2023.

[2] Environmental Protection Agency (EPA) of South Australia

Table 5: Background Water Quality – Deep Monitoring Bores

Parameters	Units	Fort Cooper Coal Measures		Moranbah Coal Measures	
		Min	Max	Min	Max
Field pH		6.79	11.8	7.27	9.42
Electrical Conductivity	µS/cm	1170	15700	1710	16000
Total Dissolved Solids	mg/L	707	9910	1160	9810
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	<1	456	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	157	<1	456
Bicarbonate Alkalinity as CaCO3	mg/L	<1	1380	159	2380
Total Alkalinity as CaCO3	mg/L	223	1380	159	2420
Sulphate, SO4	mg/L	<1	68	<1	134
Chloride, Cl	mg/L	188	4920	198	5850
Calcium - Dissolved	mg/L	<1	276	6	209
Magnesium - Dissolved	mg/L	<1	256	<1	62
Sodium - Dissolved	mg/L	199	2590	212	3490
Potassium - Dissolved	mg/L	12	73	6	1450
Arsenic-Dissolved	mg/L	<0.001	0.005	<0.001	0.013
Beryllium-Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001
Barium-Dissolved	mg/L	0.005	12.2	0.236	23
Cadmium-Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Chromium-Dissolved	mg/L	<0.001	0.004	<0.001	0.018
Cobalt-Dissolved	mg/L	<0.001	0.004	<0.001	0.01
Copper-Dissolved	mg/L	<0.001	0.582	<0.001	7.08
Lead-Dissolved	mg/L	<0.001	0.459	<0.001	2.19
Manganese-Dissolved	mg/L	<0.001	0.304	0.007	0.446
Molybdenum	mg/L	0.006	0.114	0.001	0.091
Nickel-Dissolved	mg/L	<0.001	0.02	<0.001	0.05
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.639	8.18	1.18	10.8
Vanadium-Dissolved	mg/L	<0.01	<0.01	<0.01	0.02
Zinc-Dissolved	mg/L	<0.005	2.16	<0.005	0.568
Boron	mg/L	0.24	1.17	0.46	2.4
Iron	mg/L	<0.05	2.94	0.07	3
Mercury-Dissolved	mg/L	0.42	0.42	<0.0001	0.87
Fluoride, F	mg/L	0.2	4.5	0.4	2.6
Phosphate as P in water	mg/L	<0.01	0.59	<0.01	17.4

4.3.2.2 BGP

Table 6 provides a summary of water quality results obtained from bores targeting the deep aquifers (MB1-D and GW007B).

Overall, a review of this data indicates that there are no notable trends. In general, this data shows that:

- Groundwater quality of the Fort Cooper Coal Measures aquifer is brackish; and
- Groundwater quality of the Moranbah Coal Measures is brackish.

Currently, groundwater quality data is required to only be collected at MB1-D. Water quality sampling was required at MB1-D at biannual frequency for the first year, which was achieved, and sampling will continue annually going forward.

A sample was collected from GW0007B at the same visit as a water level logger download from GW007B was undertaken in November 2019. Although it is not required by the GMMP, it is included into Table 6 for analysis.

For the BGP, deep groundwater quality data will be required to be collected at the following monitoring locations as the project progresses:

- MB7-D;
- MB9-I & MB9-D;
- MB11-D; and
- MB14-I & MB14-D.

Table 6: Background Water Quality – Deep Monitoring Bores

Parameters	Units	Fort Cooper Coal Measures	Moranbah Coal Measures	
		GW007B	MB1-D	
			Min	Max
Field pH		6.79	7.86	8.26
Electrical Conductivity	µS/cm	15700	8600	9380
Total Dissolved Solids	mg/L	9910	5110	5460
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	<1	40
Bicarbonate Alkalinity as CaCO3	mg/L	1380	817	1870
Total Alkalinity as CaCO3	mg/L	1380	817	1870
Sulphate, SO4	mg/L	<1	<1	11
Chloride, Cl	mg/L	4920	1940	2560
Calcium - Dissolved	mg/L	276	6	14
Magnesium - Dissolved	mg/L	256	6	12
Sodium - Dissolved	mg/L	2330	1900	2410
Potassium - Dissolved	mg/L	64	16	24
Arsenic-Dissolved	mg/L	0.005	0.002	0.003
Beryllium-Dissolved	mg/L	<0.001	<0.001	<0.001
Barium-Dissolved	mg/L	12.2	2.72	4.29
Cobalt-Dissolved	mg/L	0.001	<0.001	0.001
Copper-Dissolved	mg/L	<0.001	<0.001	0.005
Lead-Dissolved	mg/L	<0.001	0.002	0.008
Manganese-Dissolved	mg/L	0.12	0.009	0.049
Molybdenum	mg/L	0.006	0.014	0.018
Nickel-Dissolved	mg/L	0.02	0.01	0.05
Vanadium-Dissolved	mg/L	<0.01	<0.01	<0.01
Zinc-Dissolved	mg/L	2.16	<0.005	0.045
Boron	mg/L	0.24	1.04	1.68
Iron	mg/L	2.94	0.56	1.53
Fluoride, F	mg/L	0.2	2	2.2
Phosphate as P in water	mg/L	0.02	1.31	1.31

5 RESEARCH

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

- 2022 Bowen UWIR submitted to the DES and was approved with conditions on 2 August 2022. This report incorporates an update to the groundwater model, with associated impacts and includes results from the updated 2021 Bowen groundwater model.

A copy of the 2022 Bowen UWIR can be found on Arrow Energy's website at https://www.arrowenergy.com.au/__data/assets/pdf_file/0016/31156/Arrow-Energy_2019-UWIR_Bowen.pdf

6 CONCLUSION

- Seven (7) wells have been installed, less than the 1408 authorised operational wells. The seven wells were installed in 2019.A total of nine (9) locations are now monitored in this reporting period as part of the BGP monitoring network to supplement the existing monitoring network established for Arrow's MGP.

- 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.

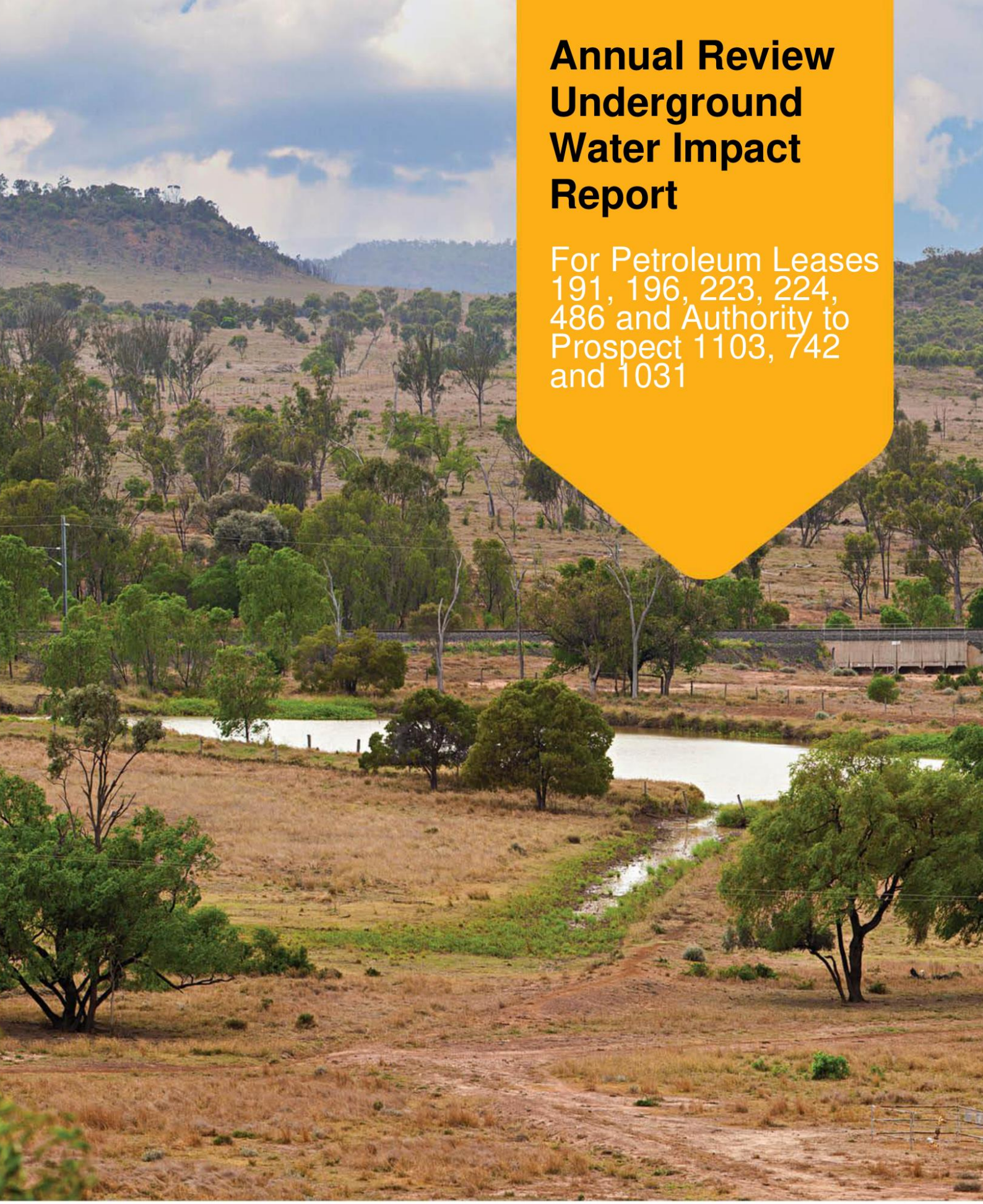
- Production from Red Hill Central Petroleum Lease (within PL486) commenced in 2022.

- No non-compliances were recorded for the BGP GMMP bores and therefore no remedial actions were undertaken.

- With the exception of M250W (not monitored in Q4 2022 however will be monitored in Q2 2023), all monitoring obligations have been met, with no exceedances under the GMMP early warning system (EWS) recorded across the monitoring network. There were, however, a number of data loss issues identified:
    - M314W and M325W: Data loss due to hardware issues was experienced between 01 January 2022 to 01 February 2022, 24 May 2022 to 24 June 2022 and 26 October 2022 to 31 December 2022;
    - M313W and M324W: Data loss due to hardware issues was experienced between 30 January 2022 and 29 April 2022; and
    - AN019: Data loss due to hardware issues was experienced between 14 April 2022 and 22 August 2022.
- One report was completed – the 2022 Bowen UWIR was submitted to the Department of Environment and Science (DES) and was approved with conditions on 2 August 2022. This report includes results from the updated 2021 Bowen groundwater model.

- No out of cycle Underground Water Impact Report (UWIR) was submitted. As above, the 2022 Bowen UWIR was approved by DES on 2 August 2022.

APPENDIX A: 2023 Annual Review of the Bowen UWIR



Annual Review Underground Water Impact Report

For Petroleum Leases 191, 196, 223, 224, 486 and Authority to Prospect 1103, 742 and 1031

arrow energy
go further

April 2023

REVISION HISTORY

Revision	Revision Date	Revision Summary
0	April 2023	Final report for release

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EXECUTIVE SUMMARY

The 2022 Bowen Underground Water Impact Report (2022 Bowen UWIR) for Authority to Prospect (ATP) 1103, 1031, 742 and Petroleum Leases (PL) 191, 196, 223, 224 and 486 was approved with conditions by the Department of Environment and Science (DES) on 2 August 2022. The 2022 Bowen UWIR included tenures for Arrow's domestic gas project in the Bowen Basin, referred to as the Moranbah Gas Project (MGP), and an expansion project referred to as the Bowen Gas Project (BGP). This review has been undertaken in line with the *Water Act (2000)* and conditions received in relation to the annual review.

This review includes:

- A review of the accuracy of the IAA and LAA maps;
- A description of how the Water Monitoring Strategy (WMS) has been implemented within the period of the annual review and that this update will be provided to the Office of Groundwater Impact Assessment (OGIA);
- Any new hydrogeological data that significantly alters the conceptual model;
- Whether new production testing or production has been undertaken or is planned; and
- Whether the predictions made in Section 8 have materially changed.

Key findings of the 2023 annual review for the MGP tenures consisting of PLs 191, 196, 223 and 224 are:

- Based on the observed water produced since the 2022 Bowen UWIR, there has been 19.4 ML less water produced than was forecasted in the 2022 UWIR;
- The updated water production forecast is 52% less than the modelled water production to the end of 2022;
- Given the updated water production forecast is less than what was modelled in the 2022 UWIR, the predicted impacts are expected to be less than originally modelled, an update of the of the 2022 UWIR is not proposed. Accordingly, a material change to the Immediately Impacted Area (IAA) or the Long-Term Affected Area (LAA) is not expected.
- The maps prepared under s.376(1)(b)(iv) and (v) do not require updating as there has not been a material change in the information or predictions used to prepare the maps.

Key findings of the 2023 annual review for the BGP tenures consisting of ATPs 1103, 1031, 742 and PL486 are:

- Water production for PL486 commenced in 2022 with a combined water production of 18.4 ML for the 2022 annual review data capture period. The updated water production was 45.4% less than modelled water production up to the end of 2022. As a result, there is no material change in the information or predictions made in the 2022 Bowen UWIR. Based on this, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR;
- Three production testing wells in ATP 1103 were active in 2020 (RH098A, RH099A and RH100A), with a combined water production of 5.3 ML since the 2022 Bowen UWIR. A total of 18.27 ML has been produced. This amount of water produced is below the Peak Downs reference pilot site, therefore, any IAA arising from production testing wells in the 2022 annual review data capture period will be smaller than that associated with the reference pilot site.
- No landholder bores are located within the 1-kilometre IAA radius from any production testing wells. Given the updated water production forecast is less than what was modelled in the 2022 UWIR, the predicted impacts are expected to be less than originally modelled, and an update of the of the 2022 UWIR is not proposed.
- The maps prepared under s.376(1)(b)(iv) and (v) do not require updating as there has not been a material change in the information or predictions used to prepare the maps.[1]

Based on the above, the predictions made in the 2022 UWIR have not materially changed. The next UWIR is due to be provided to DES on 4 April 2025, unless agreed otherwise with the regulator.

[1] For Authority to Prospect tenures (ATP), the LAA is taken to be the same as the IAA until such time as a PL is granted and production commences.

1 INTRODUCTION

This report forms the first annual review (2023 annual review) of the 2022 UWIR for Arrow Energy's MGP and BGP projects. As is required in Chapter 3, s376 (e) of the *Water Act (Qld) 2000*, the 2022 UWIR includes a program for:

i. Conducting an annual review of the accuracy of each map prepared under paragraph (b)(iv) and (v); and
ii. Giving the chief executive a summary of the outcome of each review, including a statement of whether there has been a material change in the information or predictions used to prepare the maps.

The 2022 Bowen UWIR was approved with conditions by the Department of Environment and Science (DES) and took effect on the 2 August 2022.

This report satisfies the requirements for the annual review outlined in the:

- *Water Act 2000* (Water Act);
- 2022 Bowen UWIR annual review commitments; and
- 2022 Bowen UWIR approval conditions.

In addressing the annual review requirements, Arrow has considered the following:

- A review of the accuracy of the IAA and LAA maps;
- A description of how the Water Monitoring Strategy (WMS) has been implemented within the period of the annual review and that this update will be provided to the OGIA;
- Any new hydrogeological data that significantly alters the conceptual model;
- Whether new production testing or production has been undertaken or is planned; and
- Whether the predictions made in Section 8 have materially changed.

Where practical, the results and analysis of the data contained in this report has been separated into each project (MGP and BGP). The spatial distribution of these projects is shown in Figure 1.

A copy of this report will be provided to the Office of Groundwater Impact Assessment (OGIA).

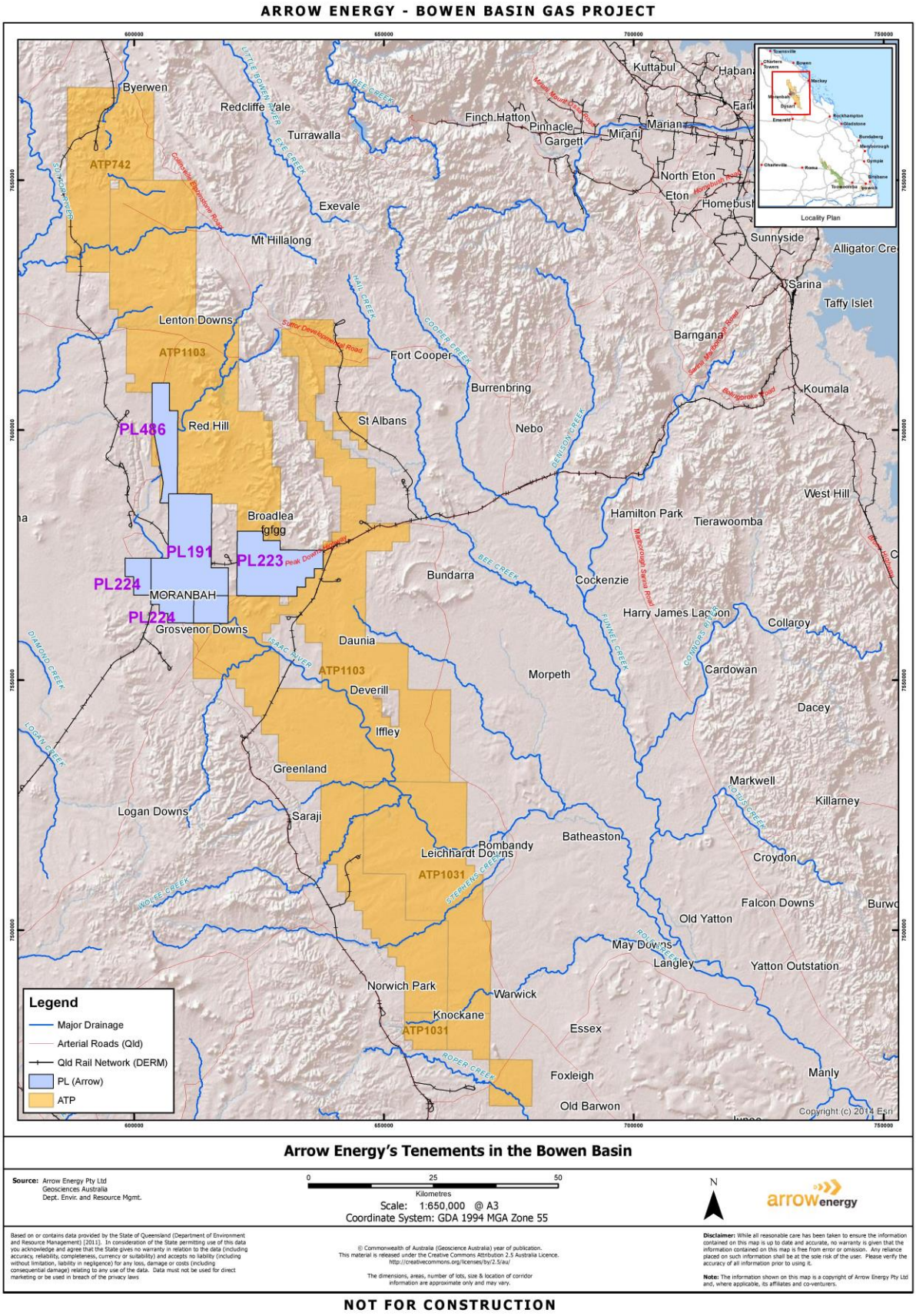


Figure 1: Location of ATP 1103, 1031, 742, 832 and PL 191, 196, 223, 224 and 486

2 WATER PRODUCTION REVIEW

A review of actual water production and forecast water production is presented in this section of this report for the MGP and BGP projects.

Review of water production from the ATP's and PL's is based on the following:

- 2022 Bowen UWIR data capture period from 1 January 2003 to 31 December 2021;
- 2022 Bowen UWIR water production forecast period from 1 January 2022 to 31 December 2026;
- 2023 Annual review data capture period from 1 January 2022 to 31 December 2022; and
- 2023 Annual review water production forecast period from 1 Jan 2023 to 31 December 2026.

Historical data from the Peak Downs (PD) production testing site on ATP 1103 (comprising production testing wells PD120V, PD122V, PD130V, and PD131V) was used as a reference pilot site to estimate the IAA for future production testing sites, specifically any new sites which commenced during the annual review period. Arrow has done this because the BGP is a phased expansion of production; therefore, only limited production testing has previously occurred and as a result only limited hydrogeological data exists for predicting impacts.

The annual review uses the following assessment approach outlined in the 2022 Bowen UWIR:

- Water produced at Peak Downs (part of ATP 1103 production testing site between 2013 and 2015) was 26.7 ML which resulted in an Immediately Affected Area (PD IAA) in the 2022 Bowen UWIR which extended approximately 1 km from the wells. This is termed the reference pilot site;
- Actual water production from any subsequent production testing site in the annual review data capture period was compared to that produced at the reference pilot site;
- If water produced at the production testing sites in the annual review data capture period was equal to or less than the reference pilot site, then it was concluded that any resultant Immediately Affected Area (IAA) would be equal to or less than the reference pilot site; and
- If water production in the production testing well in the annual review data capture period was greater than PD IAA site, then a review of the 1m drawdown contour was undertaken to identify any existing or abandoned but useable landholder water supply bores.

2.1 Moranbah Gas Project

Table 1 and Table 2 below provide a comparison between observed water production and forecasted water production in the 2022 Bowen UWIR and the updated observed water production for the 2023 annual review data capture period. It should be noted that whilst PLs 191, 196, 223 and 224 make up the Moranbah Gas Project (MGP), production has only been undertaken on PLs 191, 196 and 224. Table 1 shows the observed water production for 1 January 2003 to 31 December 2022 and the comparison of observed to forecasted production for the 2022 annual review data capture period.

Based on the observed water produced since the 2022 Bowen UWIR, there has been 19.4 ML less water produced than was forecasted in the 2022 Bowen UWIR.

Table 1: MGP Water Production

Report	Water Production (ML) 1 Jan 2003 - 31 Dec 2018	Water Production (ML) 1 Jan 2019 - 31 Dec 2021	Water Production (ML) 1 Jan 2022 - 31 Dec 2022	Total Water Production (ML) 1 Jan 2003 - 31 Dec 2022	Difference
2022 Bowen UWIR	5334.7	563.9	181.1*	6079.7	N/A -
2023 Annual Review	5334.7	563.9	161.7	6060.3	19.4 ML less (<1%)

* denotes forecast production

Table 2 below shows the updated water production forecast for 2023 to 2026. The forecast has been updated based on new data and a better understanding of the reservoir (obtained through drilling, testing and water production analysis). The updated forecast is less than that what was outlined in the 2022 Bowen UWIR.

Table 2: Forecast Water Production PL 191, 196, and 224

Year	2022 Bowen UWIR Forecast Water Production (ML)	2023 Annual Review Forecast Water Production (ML)	Difference
2023	179.3	86.1	93.2 ML less than the 2022 Bowen UWIR (52% less)
2024	161.5	131.7	29.8 ML less than the 2022 Bowen UWIR
2025	154.0	195.7	41.7 ML more than the 2022 UWIR
2026	148.6	148.6	N/A
Total	643.4	562.1	81.3 ML less than the 2022 Bowen UWIR (12.6% less)

2.1.1 Predicted Impacts

The impacts predicted in the 2022 Bowen UWIR define the IAA as occurring in the Moranbah Coal Measures and Rangal Coal Measures as shown in Figure 2 and Figure 3 below for the MGP area. The IAA is a prediction of water level decline where the drawdown is expected to exceed the bore trigger threshold of 5 metres drawdown for a 3-year period which commenced in January 2019. The LAA is a prediction of water level decline where the drawdown is expected to exceed the bore trigger threshold at any time (i.e. greater than the 3-year period).

Based on this, the prediction of the IAA is influenced by the water production from 2003 to 2022. As indicated in Table 1, the actual water production for the 2023 annual review data capture period is 19.4 ML less than the modelled water production in the 2022 Bowen UWIR. The updated water production forecast presented in Table 2 is 52% less than the modelled water production to the end of 2023.

This reduction in water production is due to updated reservoir information (obtained through drilling, testing and water production analysis) and changes in the field development plan (FDP) of the MGP.

It is expected that the modelled IAA and LAA in the 2022 Bowen UWIR overestimate impacts likely to occur. This is due to the updated water production forecast in this annual review is now less than the forecast in the 2022 Bowen UWIR (i.e. less water is now forecasted to be produced and therefore impacts are expected to be less).

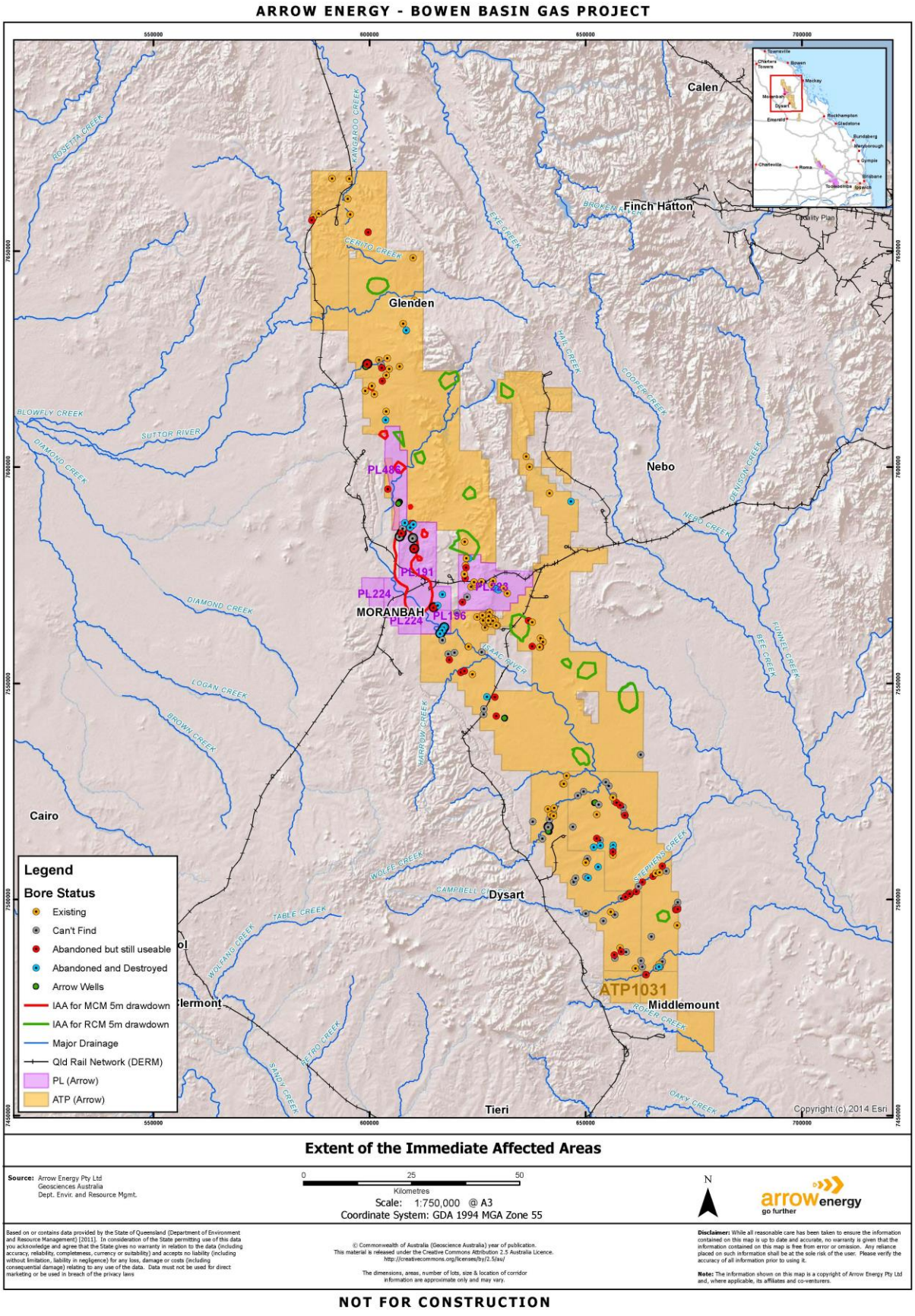


Figure 2: Extent of the IAA as per the 2022 UWIR

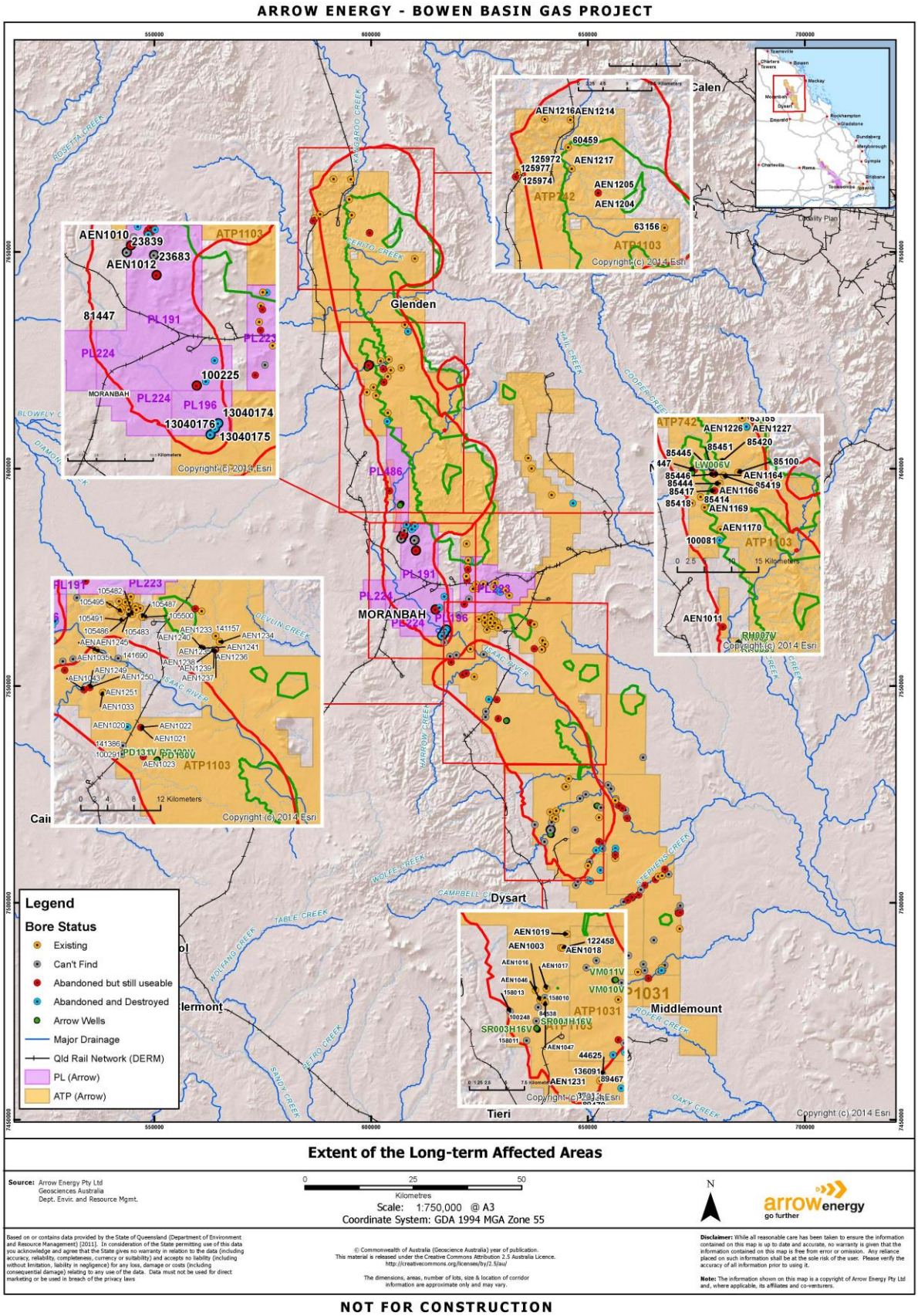


Figure 3: Extent of the LAA as per the 2022 UWIR

2.2 Bowen Gas Project

The Arrow Energy Bowen Gas Project (BGP) was approved by the Queensland Government on 8 September 2014 and the Commonwealth on 27 October 2014. Arrow's BGP involves a phased expansion of Arrow's Bowen Basin tenures. 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) with the addition of development in Mavis Downs (also located within ATP1103).

The Field Development Plan (FDP) as outlined in the 2022 Bowen UWIR was as follows:

- Red Hill Central (within PL486) to commence in 2022;
- The remainder of the field development plan (FDP) area presented in the 2016 Bowen UWIR (ATP1103, ATP742 and ATP1031) commencing 2030.

Figure 2 and Figure 3 display the IAA and LAA for the MGP and BGP projects.

2.2.1 ATP 1103

ATP 1103 is a large exploration tenure located to the North, East and South of the MGP. A total of 5.3 ML of water was produced as part of production testing on ATP 1103 since the 2022 Bowen UWIR. This water volume is from production testing wells (RH098A, RH099A and RH100A) on what was ATP 1103, which has now been converted to PL486 (Red Hill Central).

2.2.1.1 Predicted Impacts

A total of 18.27 ML has been produced in total from ATP1103. This amount of water produced is below the volume produced from the reference pilot site. Therefore, any IAA arising from production testing wells in the 2023 annual review data capture period will be smaller than that associated with the reference pilot site. A 1-kilometre IAA radius consistent with the methodology outlined in the 2022 Bowen UWIR showed that no landholder bores are located in proximity to the testing.

Based on the limited production, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR. Therefore, the maps in Figure 2 and Figure 3 do not require updating.

2.2.2 PL 486

PL 486 which incorporates the Red Hill Central (RHC) development is located approximately 30 km north of the township of Moranbah, and borders the MGP area to the South. Water production from PL 486 is currently forecast to occur from 2022 to 2026. The water production profile used in the 2022 Bowen UWIR indicated a total of 88.7 ML of water to be produced over that period.

Production from PL 486 commenced in 2022 and a total of 18.4 ML has been produced in the 2023 annual review data capture period. As noted in Section 2.2.1, production testing commenced in ATP 1103 prior to PL486 being granted. Therefore, the water volumes for the production testing (from wells RH098A, RH099A and RH100A) are included in ATP 1103 water volumes. That production testing does not form part of PL 486.

Table 3 below shows the current water production forecast for 2022 to 2026. Based on the observed water produced since the 2022 Bowen UWIR and the updated forecast used for the 2023 Annual Review, 28.5 ML less water is now forecasted to be produced for the period to 2026. This reduction in forecasted water production is due to updated reservoir information (e.g. testing and water production analysis) and an improved forecast for PL 486.

Table 3: Forecast Water Production PL486

Year	2022 Bowen UWIR Forecast Water Production (ML)	2023 Annual Review Forecast Water Production (ML)	Difference
2022	63.8	18.4	45.4 ML less than current forecast (71.2% less)
2023	11.8	26.1	14.3 ML more than current forecast
2024	6	7.8	1.8 ML more than current forecast
2025	4	4.8	0.8 ML more than current forecast
2026	3.1	3.1	N/A
Total	88.7	60.2	28.5 ML less than the 2022 Bowen UWIR (32.1% less)

2.2.2.1 Predicted Impacts

Water production for the 2023 annual review data capture period was 18.4 ML. As a result, there is no material change[2] in the information or predictions made in the 2022 Bowen UWIR. Based on this, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR. Therefore, the maps in Figure 2 and Figure 3 do not require updating.

2.2.3 2.2.4 ATP 1031

ATP 1031 lies approximately 100 km to the south of the MGP. A total of 0 ML of water has been produced as part of production testing on ATP 1031 for the annual review data capture period.

2.2.3.1 2.2.4.1 Predicted Impacts

No further production testing has been undertaken in any wells on ATP 1031 since the UWIR and therefore there is no material change in the information or predictions made in the 2022 Bowen UWIR. Based on this, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR. Therefore, the maps in Figure 2 and Figure 3 do not require updating.

[2] Arrow defines a material change as only occurring if water production increases above the original forecast used in the 2022 UWIR.

2.2.4 ATP 742

ATP 742 is located approximately 50 kilometres north of the MGP. A total of 0 ML of water has been produced as part of production testing on ATP 742 for the 2023 annual review data capture period.

2.2.4.1 Predicted Impacts

No further production testing has been undertaken in any wells on ATP 742 since the UWIR and therefore there is no material change in the information or predictions made in the 2022 Bowen UWIR. Based on this, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR. Therefore, the maps in Figure 2 and Figure 3 do not require updating.

3 WATER MONITORING STRATEGY (WMS)

A water monitoring strategy has been prepared. The strategy proposes the installation and monitoring of a total of 43 groundwater monitoring bores. The installation of 16 of these groundwater monitoring bores, located on PLs 191, 196, 223 and 224 has been completed and groundwater monitoring has been ongoing within the bores. Monitoring bores as a part of the larger Bowen Gas Project have been installed and additional bores a part of the project will be added as the project increases in area.

3.1 MGP Area Groundwater Monitoring Network

A total of 16 groundwater monitoring bores form the groundwater monitoring network for the MGP Area. Figure 4 provides an overview of the spatial distribution of the groundwater monitoring network. Groundwater monitoring is being undertaken in these bores in accordance with the WMS in the approved 2022 Bowen UWIR.

As discussed in Section 4.3 and the 2022 UWIR, drawdown observed in monitoring bore M162V has resulted in water level dropping below the pump intake and as a result water sampling could not be undertaken. Sampling has been undertaken at production well (M134GMV) since 2017, which is located approx. 480 m north of M162V. The well has been completed to approximately the same depth as M162V and intersects the MCM seam..

Sampling was conducted in M134GMV up to November 2020; however the water level had dropped below the well's pump intake for the November 2021 sampling round. A replacement sampling bore (GM031V) located 1.4 km south of M162V was selected to be used until water levels recover in M162V.

M250W was not monitored in Q4 2022 however is scheduled to be monitored, and sampled if sufficient water is present, by 31 May 2023. Additionally, M324W was not sampled in Q4 2022 due to equipment issues and access due to weather and is scheduled to be sampled in Q2 2023.

Data loss due to hardware issues was experienced at some of the bores including bores M314W and M325W between 01 January 2022 to 01 February 2022, 24 May 2022 to 24 June 2022 and 26 October 2022 to 31 December 2022, bores M313W and M324W between 30 January 2022 and 29 April 2022 and bore AN019 between 14 April 2022 and 22 August 2022.

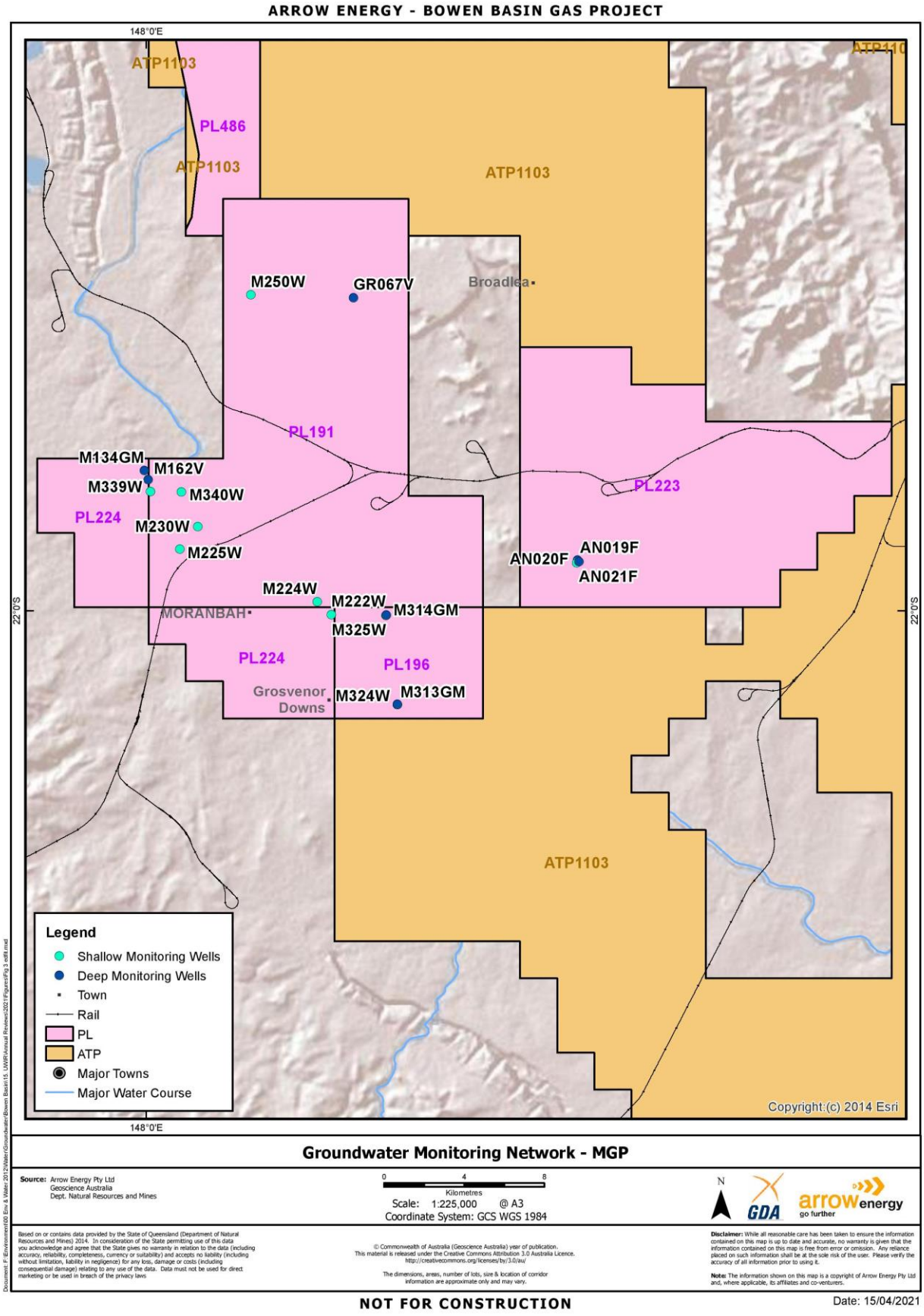


Figure 4: Groundwater Monitoring Network for MGP

3.2 BGP Area Groundwater Monitoring Network

The network is comprised of 35 monitoring intervals at 22 separate locations (comprising 12 single sites and 10 nested sites of 23 monitoring intervals) from the approved groundwater monitoring network for the BGP area. Figure 5 provides an overview of the spatial distribution of the groundwater monitoring network. Table 4 below displays the monitoring requirements of the BGP, along with the status of each location. Note that Table 4 displays the monitoring location name as per the 2019 Bowen Groundwater Monitoring and Management Plan (GMMP) which was approved by the Commonwealth Department of the Environment and Energy on 24 October 2019. All subsequent reporting is based off this nomenclature.

The network includes phased installation of the monitoring bores in advance of CSG development in the vicinity of the bores as detailed in Section 8.1.1.1 of the 2019 UWIR. At present, 9 monitoring points have been installed at seven locations as part of the monitoring network; MB1-S/I/D, MB2, MB3, MB12, GW004, GW007 and AEN1063 as detailed below. Bore locations for the remaining supplementary monitoring bores have been visited and assessed as suitable for long term monitoring and are awaiting execution of agreements with the landholders before logging equipment is installed. These bores are currently visited for manual water level monitoring every six months.

MB1-S/I/D

MB1 was originally 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 to enable additional monitoring from the intermediate and shallow intervals to take place. Groundwater level data has been collected from all three intervals in MB1 since 11 November 2019. Drilling information for MB1 identified sufficient Quaternary / Tertiary Sediment or Rangal Coal Measures were not encountered at this location, and the shallow and intermediate monitoring points are instead located within the Fort Cooper Coal Measures.

MB2

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), October 2017 to May 2018 (8 months). The well was converted to a permanent monitoring well using the existing downhole pressure gauge in February 2019 with twice daily groundwater level observations collected from February 2019 to October 2019 (7 months) and, following 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 on why this occurred identified that the route cause 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.

Additional data loss due to hardware issues was observed between 14 July 2022 and 14 August 2022.

MB3

MB3 was originally installed as an appraisal (pilot) production well (originally named Red Hill-51) in November 2011. 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 then converted to a monitoring well in September 2020 to fulfil monitoring requirements for MB3. Additional data loss was observed from 1 January 2022 to 13 February 2022 due to skid communication issues.

MB12

MB12 was installed as a mine monitoring bore (originally named EFGW5D) by Fitzroy Mining in June 2008. 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 which is still in operation.

Supplementary monitoring bores

These monitoring locations comprise existing third-party monitoring bores and landholder bores and are included in the monitoring network.

GW004 and GW007

GW001, GW004 and GW007 were installed as mine monitoring bores by BHP Mitsubishi Alliance (BMA) in 2011. Arrow commenced monitoring of GW001 and GW007 in November 2019.

GW004 was chosen as a replacement for GW001 from November 2020 due to 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.

AEN1063

A logger was deployed in 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, 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.

Table 4: 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. Online date is 16 February 2019 however data was lost between 30 October 2019 and 9 January 2020.
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. Online date is 16 February 2019 however data was lost between 30 October 2019 and 9 January 2020, and 1 January 2022 to 13 February 2022.
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 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. Awaiting access and monitoring agreement for deployment of logger. No readings were recorded for Q2 2022 due to the landholder denying access to the property.
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	Manual measurements recorded every 6-months. Awaiting access and monitoring agreement for deployment of logger.
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.

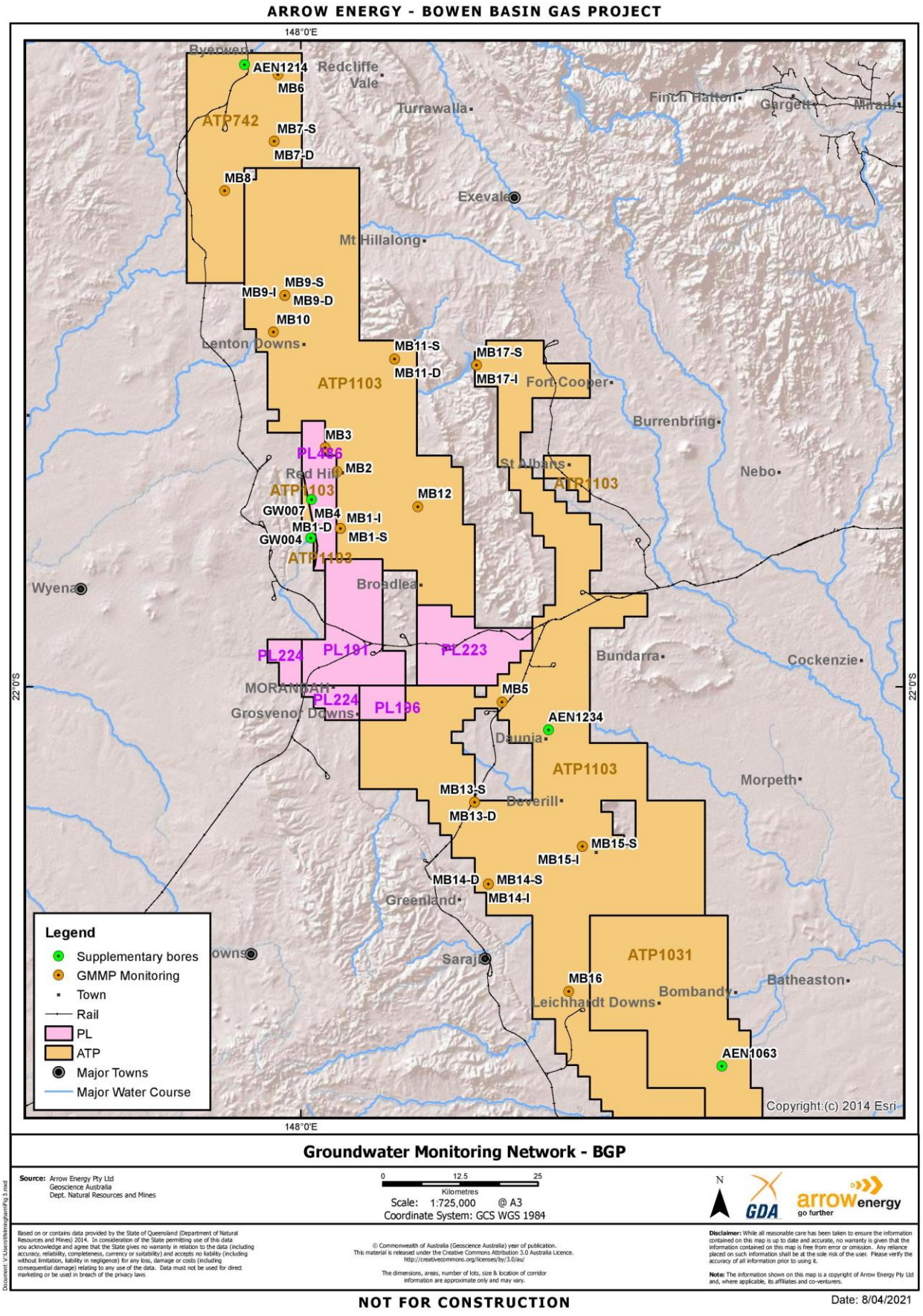


Figure 5: Groundwater Monitoring Network for BGP

4 GROUNDWATER ASSESSMENT UPDATE

4.1 Trigger Levels

The trigger levels associated with the 2022 Bowen UWIR are the bore trigger threshold as defined in the *Water Act (2000)*. Bore trigger threshold, for an aquifer, means a decline in the water level in the aquifer that is –

a) If a regulation prescribes the bore trigger threshold for an area in which the aquifer is situated – the prescribed threshold for the area; or
b) Otherwise –
    i. For a consolidated aquifer – 5m; or
    ii. For an unconsolidated aquifer – 2m.

Based on this, the applicable bore trigger threshold for the MGP and BGP is 5 m for a consolidated aquifer and 2 m for an unconsolidated aquifer. Consistent with the *Water Act (2000)*, no trigger thresholds are proposed for water quality.

4.2 Groundwater Level Monitoring

4.2.1 Shallow Monitoring Bores

Groundwater level monitoring has been undertaken in the following shallow groundwater monitoring bores which form part of the 2022 Bowen UWIR groundwater monitoring network for the MGP and BGP Area (Table 5 provides a summary of these bores).

- Monitoring since June 2012 for bores M339W, M225W, M340W, M230W, M250W, M224W, M222W;
- Monitoring since March 2016 for bores AN020F and AN021F;
- Monitoring since January 2018 for bore MB12;
- Monitoring since November 2019 for bores MB1-S and GW007A;
- Monitoring since November 2020 for bores GW004A, GW004B, AEN1214, AEN1234 and AEN1063; and
- Monitoring since November 2021 for bore M300W.

Table 5: Shallow Groundwater Monitoring Bores

Bore ID	Network	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation
M339W	MGP	41.0	35.0 – 41.0	Weathered Tertiary Basalt
M225W	MGP	34.0	23.0 – 34.0	Weathered Tertiary Basalt
M340W	MGP	27.3	19.3 – 27.3	Weathered Tertiary Basalt
M230W[1]	MGP	32.0	29.0 – 32.0	Weathered Tertiary Basalt
M250W	MGP	56.5	44.5 – 56.5	Tertiary Sediment
M300W	MGP	30.0	24.0 – 30.0	Weathered Tertiary Basalt
M224W	MGP	32.5	26.5 – 32.5	Quaternary Alluvium
M222W	MGP	30.2	20.0 – 26.0	Weathered Fort Cooper Coal Measures
AN020F	MGP	77.0	70.0 – 72.0	Rewan Formation
AN021F	MGP	27.0	20.0 – 22.0	Tertiary Sediment
MB1-S	BGP	60	45.0 – 50.0	Fort Cooper Coal Measures – Girrah Seam
MB12	BGP	59.1	56.0 – 59.0	Rewan Formation
GW004A	BGP	13.5	7.5 – 13.5	Tertiary Sediment
GW004B	BGP	59	53.0 – 59.0	Fort Cooper Coal Measures
GW007A	BGP	7.5	1.5 – 7.5	Tertiary Sediment
AEN1214	BGP	37.32	-[2]	Rangal Coal Measures
AEN1234	BGP	102	48.2 – 102.0	Blackwater Group
AEN1063	BGP	52.6	39.6 – 45.7	Blackwater Group

[1]M230W was replaced by M300W due to mining impact impacting the water level
[2]Screened interval could not be determined due to pumping infrastructure

The groundwater level monitoring results are shown in Appendix A. Groundwater levels, are shown in Figure 6 to Figure 8 and are discussed below for the MGP and BGP areas.

MGP:

The groundwater levels in the MGP range from:

- 200.1 to 209.2 m Australian Height Datum (AHD) in the weathered Tertiary Basalt aquifer;
- 233.2 to 242.7 m AHD in the Tertiary Sediment aquifer;
- 207.8 to 211.7 m AHD in the Quaternary Alluvium aquifer;
- 202.4 to 206.3 m AHD in the Fort Cooper Coal Measures aquifer; and
- 236.6 to 238.6 m AHD in the Rewan Formation.

All bores located within close proximity to the Isaac River display similar depths to groundwater, as discussed in the 2022 Bowen UWIR. It should be noted that bore M250W was not monitored in Q4 2022; however it is scheduled to be monitored and sampled if sufficient water is present by 31 May 2023.

The groundwater levels for bores M250W, AN021F and AN020F are higher due to the respective surface elevation in the areas being approximately 30 to 95 m above the other bores. As indicated in Table 5, M250W and AN021F are installed in the Tertiary Sediment and located approximately 10 km north and east of the other groundwater monitoring sites along the Isaac River, while MB12 is constructed within the Rewan Formation and located approximately 26km northeast of the other groundwater monitoring sites along the Isaac River.

A comparison of modelled drawdown predictions made in the 2022 Bowen UWIR with monitoring data to date has been undertaken. There is no predicted IAA or LAA for unconsolidated aquifers for the MGP and BGP as modelled drawdown does not exceed the bore trigger threshold of 2 metres. The monitoring data to date supports this modelled prediction in the 2022 Bowen UWIR.

Groundwater monitoring further indicates:

- Actual groundwater levels monitored in bore M339W have remained steady over the monitoring period;
- The water levels in M222W and M225W have continued to steadily rise since monitoring began in 2012;
- Figure 8 displays cumulative rainfall departure and groundwater levels at groundwater monitoring bores M225W, M222W and M224W. Recharge to shallow aquifers due to above mean rainfall has contributed to the trend in groundwater levels noted in M222W and M225W with a peak at the end of 2017;
- There is no predicted IAA or LAA for any aquifer underlying PL 223; hence modelled drawdown greater than the bore trigger threshold at the end of 2022 was not predicted in the 2022 Bowen UWIR to occur at the location of bores AN020F and AN021F. AN021F is installed in the Tertiary Sediment and has increased in water level since monitoring began. AN020F is installed in the Rewan Formation which is considered to be a regional aquitard. Groundwater levels monitored at AN020F have remained steady over the monitoring period;
- A decline in groundwater level by greater than the bore trigger threshold was noted at bore M224W between November 2017 and November 2019. As discussed in the 2022 Bowen UWIR, the water levels in this bore indicate a possible hydraulic link to the river level fluctuations. This is in-line with the conceptual hydrogeological model report in the 2022 Bowen UWIR, where there is linkage between rainfall events and river level flow periods to groundwater level. This decline is not considered to be due to the effects of CSG production; and
- A decline in groundwater level by greater than the bore trigger threshold was noted at bore M230W between November 2017 and November 2019. The water levels observed in this bore are considered to have been influenced by nearby mining operations; a review of mine plan schedules indicated that “drive Number-1” traversed the area in proximity to M230W between Q3 and Q4-2017 indicating that the SWL decline were expected to be a result of the Anglo underground mine development. This was similar to the decline seen in M340W (as discussed in the 2017 Annual Review of the 2016 Bowen UWIR) where a decline in groundwater level has made this monitoring borehole dry. Both monitoring bores are in the same area, as shown in Figure 4. Accordingly, the decline is not considered to be due to the effects of CSG production. Due to the impact of mining operations, this monitoring bore has been replaced by M300W but is included in this report for historical analysis.

Based on the graphically presented monitoring data in Figure 6, it is clear that there is no apparent influence of CSG production to the Quaternary alluvium, weathered Tertiary basalt, Tertiary sediment, weathered Fort Cooper coal measures and Rewan aquifers in which these bores are installed. This data supports the groundwater modelling predictions in the 2021 Bowen groundwater model.

BGP:

Groundwater level monitoring has been undertaken in the following shallow groundwater monitoring bores which form part of the BGP monitoring network. Table 6 provides a summary of these bores.

- Monitoring since January 2018 for bore MB12; and
- Monitoring since November 2019 for bores MB1-S, GW004A and GW007A.

Table 6: BGP Shallow Groundwater Monitoring Bores

Bore ID	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation
MB1-S	60	45 - 50	Fort Cooper Coal Measures – Girrah Seam
MB12	59.1	56 – 59	Rewan Formation
GW004A	6.5	6.5	Tertiary Sediment
GW007A	7.5	1.5 – 7.5	Tertiary Sediment

The groundwater level monitoring results are shown in Appendix A. Groundwater levels, as is shown in Figure 7 range from:

- 234.44 to 235.16 m Australian Height Datum (AHD) in the Tertiary Sediment aquifer;
- 262.7 m to 263.51 m AHD in the weathered Fort Cooper Coal Measures aquifer, and
- 286.31 m to 298.65 AHD in the Rewan Formation.

Groundwater level monitoring, as reported in the annual review for the Bowen Basin UWIR, (Appendix A) indicates:

- Groundwater levels are stable in the shallow bores;
- GW007A was recorded as dry. An alternate location may be required if GW007A is shown to be continually dry; and
- Water level decline and recovery in MB12 is due to water quality sampling (pumping) being undertaken in the bore. The frequency of water quality sampling was decreased in H2 2019 where subsequent water level data show water level recovery between monitoring events.

Based on the presented monitoring data in Figure 6, 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. This is expected given little water production has occurred in the BGP.

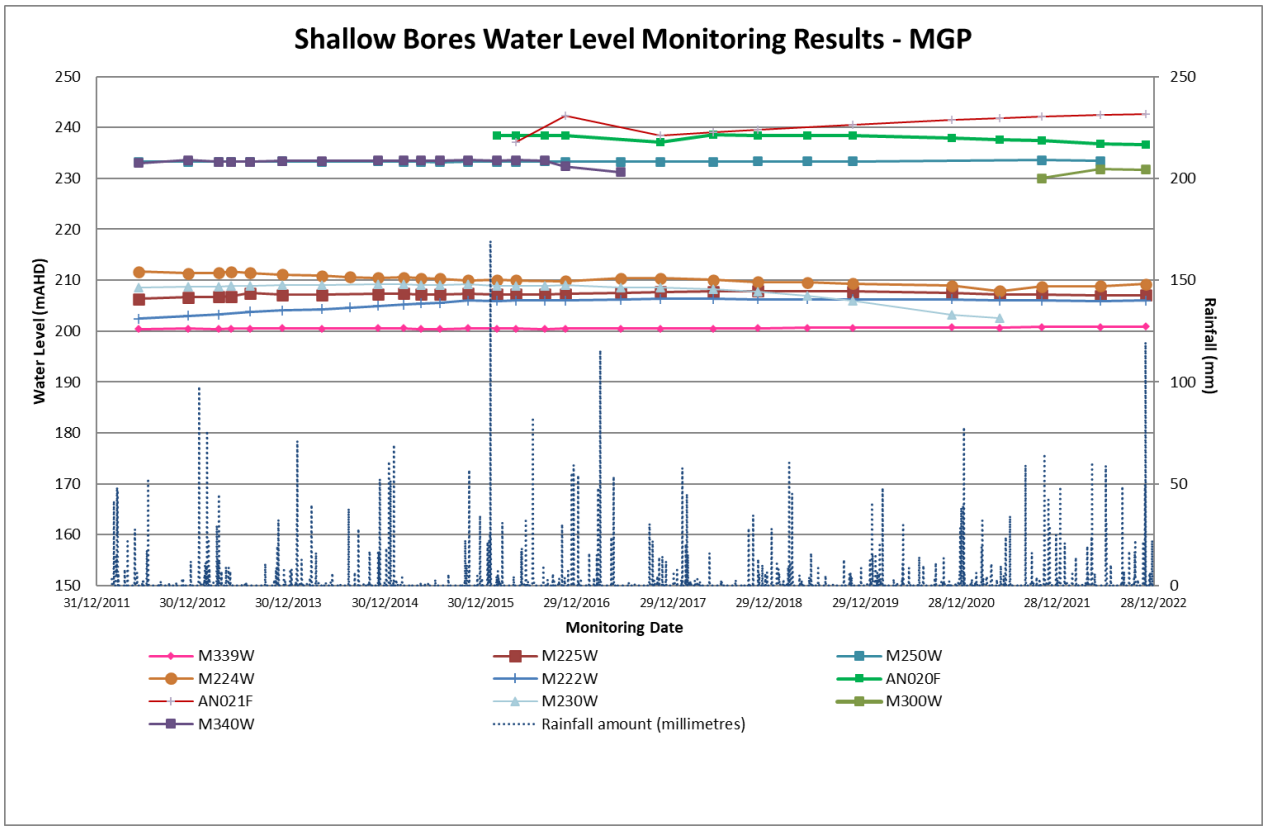


Figure 6: Shallow Bores Water Level Monitoring Results - MGP

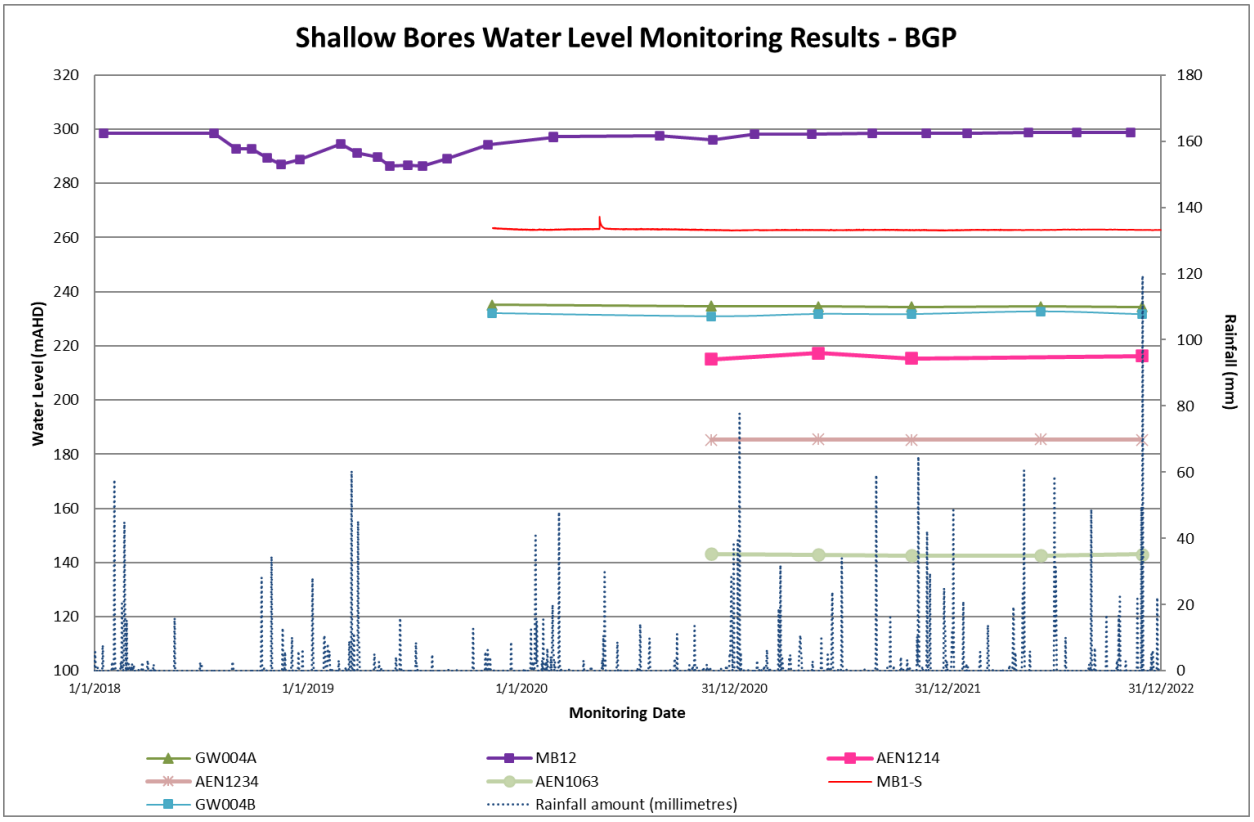


Figure 7: Shallow Bores Water Level Monitoring Results - BGP

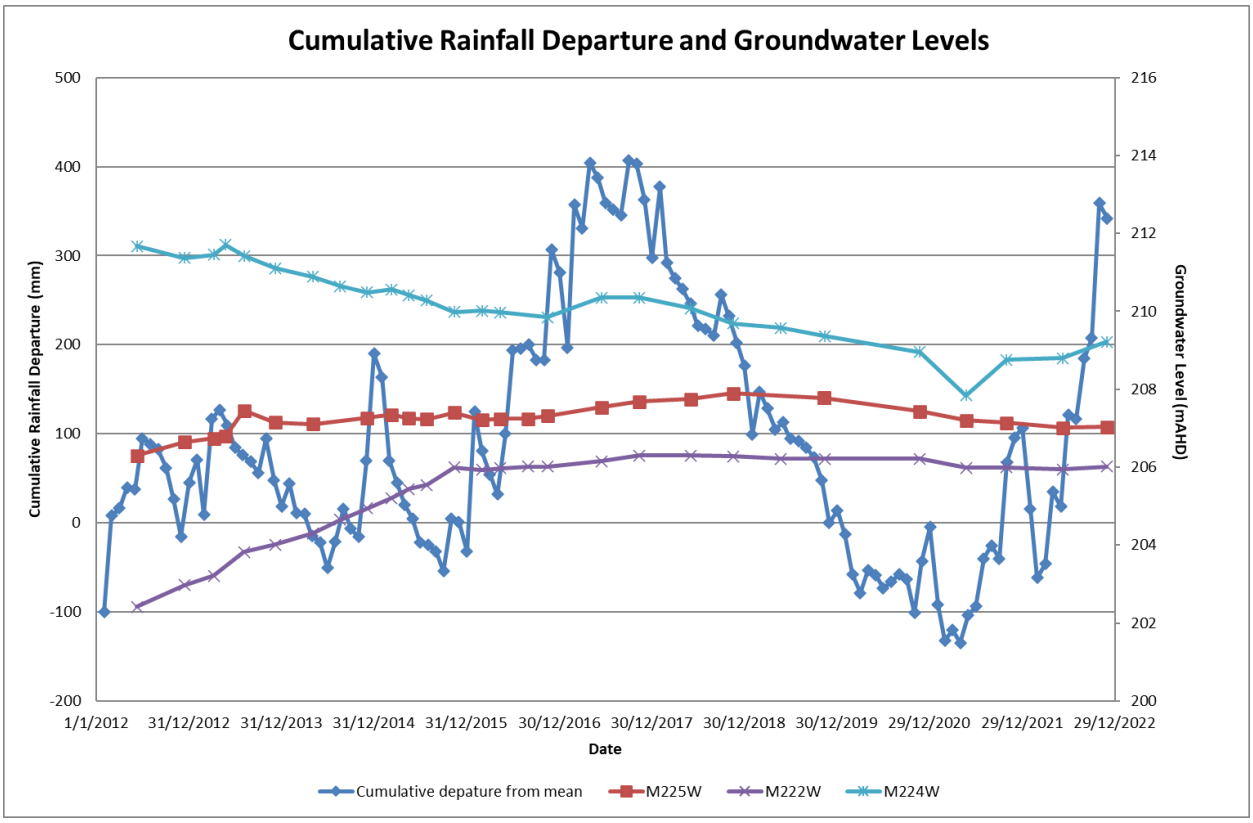


Figure 8: Cumulative Rainfall Departure and Groundwater Levels

4.2.2 Deep Monitoring Bores

Groundwater level monitoring has been undertaken in the following deep groundwater monitoring bores which form part of the 2022 Bowen UWIR groundwater monitoring network. Monitoring since November 2011 for MB1-D and since November 2019 for MB1-I (as detailed in Section 3.2);

- Monitoring since September 2015 for bore MB2 (as detailed in Section 3.2);
- Monitoring since September 2013 for bore MB3 (as detailed in Section 3.2);
- Monitoring since September 2014 for bores M313W, M314W, M324W;
- Monitoring since February 2015 for bore M325W;
- Monitoring since November 2015 for bores AN019F;
- Monitoring since December 2015 for bore M162V;
- Monitoring since February 2016 for bore GR067V; and
- Monitoring since November 2019 for bore GW007B (as detailed in Section 3.2).

Table 7 provides details for these bores. As previously indicated in the 2018 Annual Review for the 2016 Bowen UWIR, available data suggested that the permeability of the formation that M325W is installed into is so low that recovery of groundwater levels in the Fort Cooper Coal Measures would take a very long time. The updated water level data supports the previous statement and recovery of the bore continued during the Annual Review period.

Declines in groundwater levels greater than the bore trigger threshold have been observed at bores M324W (MCM), M313W (MCM) and M162V (MCM). Monitoring data suggests that there is influence of CSG production to the MCM.

No decline in groundwater levels greater than the bore trigger threshold is observed at bores M314W (MCM), M325W (MCM), M324W (FCCM), M313W (BCG), M314W (BCG), AN019F (FCCM), and GR067V (MCM).

Table 7: Deep Groundwater Monitoring Bores

Bore ID	Total Constructed Depth (m)	Screen Interval (mbgl)	Screened Formation
M313W	532.4	313.0 – 316.5 507.0 – 510.0	Moranbah Coal Measures (QA Seam) Back Creek Group
M314W	560.5	210.5 – 213.5 551.5 – 553.5	Moranbah Coal Measures (QA Seam) Back Creek Group
M324W	240.0	163.0 – 166.0 187.0 – 190.0	Fort Cooper Coal Measures Moranbah Coal Measures (QA Seam)
M325W	202.3	180.5 – 182.0	Fort Cooper Coal Measures
AN019F	290.0	269.0 – 271.0	Fort Cooper Coal Measures
M162V	276.0	252.0 – 256.0	Moranbah Coal Measures
GR067V	610.9	543.2 – 610.9	Moranbah Coal Measures
MB1	550	336 -340 423.9-506.6	Fort Cooper Coal Measures Moranbah Coal Measures
MB2	834	701.1-814.7	Moranbah Coal Measures
MB3	796.3	712.3 – 717.9	Moranbah Coal Measures
GW007B	181.5	175.5 – 181.5	Fort Cooper Coal Measures

It should be noted that bore M324W was not sampled in Q4 2022 due to equipment issues and access due to weather. The bore is scheduled to be sampled in Q2 2023.

Data loss due to hardware issues was experienced at some of the bores including bores M314W and M325W between 01 January 2022 to 01 February 2022, 24 May 2022 to 24 June 2022 and 26 October 2022 to 31 December 2022, bores M313W and M324W between 30 January 2022 and 29 April 2022 and bore AN019F between 14 April 2022 and 22 August 2022.

MGP:

The groundwater level monitoring results are shown in Figure 12. Observed groundwater levels or calculated potentiometric water levels ranged from:

- 208.1 to 216.8m AHD in the BCG;
- 49.6 to 207.7m AHD in the FCCM; and
- -129.1 to 204.5m AHD in the MCM.

A comparison of modelled drawdown predictions modelled in the 2022 Bowen UWIR with monitoring data to date has been undertaken and indicates:

- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M314W was predicted in the model to be approximately 196.35 m. Actual groundwater levels monitored for the MCM at M314W indicates decline in levels of approximately 4.02 m;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M313W was predicted in the model to be approximately 31.30 m. Actual groundwater levels monitored for the MCM at M313W shows the maximum decline in the water level of 74.53 m, as measured in March 2017. Since March 2017 the water level has recovered by 57.85 m which represents approximately 94% recovery of the original water level prior to the drawdown and as indicated in Figure **12**. The graphically displayed water level curve indicates the recovery will continue;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M324W was predicted in the model to be approximately 31.38 m. Actual groundwater levels monitored at M324W show a maximum decline in levels by 6.63 m in March 2017. Since March 2017, the water level has recovered by 3.47 m which represents a 53% recovery of the water level prior to the drawdown as indicated in Figure **12**. This groundwater monitoring bore is located in the southern part of PL 196 and approximately 350 m from production well GM052V. The total amount of water actually produced from GM052V during this annual review data capture period was 0 ML. Since production ceased, the water level has continued to recover;

- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of M162V was predicted to be approximately 26.06 m. Actual groundwater levels monitored at this site show a steady groundwater level decrease of approximately 31.43 m;
- Modelled drawdown in the MCM aquifer at the end of 2022 at the location of GR067V was predicted to be approximately 1.64 m. Decreases in water levels of up to 150 metres, noted in April and August 2016, are due to depressurisation activities in this bore associated with monitoring events. The recovery curve has subsequently stabilised and a standing water level of 202 m AHD is evident;
- Modelled drawdown in the FCCM aquifer at the end of 2022 at the location of M324W was predicted to be 0.3 m. Actual groundwater levels monitored for the FCCM at M324W shows a decline of approximately 1.7 m;
- Modelled drawdown in the FCCM aquifer at the end of 2022 at the location of AN019F was predicted to be 0.04 m. Actual groundwater levels monitored indicates a small decline of approximately 0.98 m; and
- Modelled drawdown in the BCG aquifer at the end of 2022 at the location of M313W and M314W was not predicted to occur in the model. Actual groundwater levels monitored for the BCG at M313W and M314W indicate a decline of approximately 3.45 m and 7.74 m respectively.

Based on the monitoring data, it is concluded that observations of drawdown were generally consistent with respect to predicted exceedances of the bore trigger threshold as follows:

- Modelled drawdown greater than the bore trigger threshold was not predicted to occur at bores AN019F (FCCM), M324W (FCCM), which is confirmed by the monitoring data;
- Modelled drawdown greater than the bore trigger threshold was predicted to occur at bore M314W (MCM), however monitoring data shows that the water level in this bore is less than the bore trigger threshold;
- Monitoring data shows that drawdown greater than the bore trigger threshold was detected at monitoring bores M313W (MCM), M324W (MCM), M162V (MCM) and M314W (BCG). There are no existing or useable landholder bores within a 2 km radius of these locations in the IAA aquifer.
- Modelled drawdown in the MCM aquifer at sites M313W and M324W predicted drawdown greater than the bore trigger threshold, which was confirmed in the monitoring data, however drawdown detected at M313W is significantly less than that predicted.

BGP:

The groundwater level monitoring results are shown in Figure 13. Observed groundwater levels or calculated potentiometric water levels ranged from:

- 244.1 to 269.1 m AHD in the FCCM; and
- -356.3 to 209.9 m AHD in the MCM.

A comparison of modelled drawdown predictions modelled in the 2022 Bowen UWIR with monitoring data to date has been undertaken and indicates:

- Drawdown in the MCM aquifer at the end of 2022 at the location of MB1 was not predicted to occur in the model. Actual groundwater levels monitored indicate a small increase of 0.35 m. There was a decline in water levels in 2019 as a result of equilibration due to the workover of the well in late 2019 to equip the borehole with multiple pressure sensors and is not related to CSG activities. This is further discussed in Section 4.2.3.3;
- Drawdown in the MCM aquifer at the end of 2022 at the location of MB2 was not predicted to occur in the model. Actual groundwater levels monitored indicate an increase of 324.89 m. The water level in this bore is recovering from production;
- Drawdown in the MCM aquifer at the end of 2022 at the location of MB3 was predicted to be 6.94 m. Actual groundwater levels monitored indicate an increase of 181.9 m from the recovery started in June 2019;
- Drawdown in the FCCM aquifer at the end of 2022 at the location of MB1 and GW007B was predicted to be 0 m. Actual water level monitored indicates a decline of 7.37 in MB1 and 1.06 in GW007B. The observed decline, which appears to be flattening in MB1, is likely due to equilibration of pressure within the bore and the formation following the workover when the well was topped up with water; and
- MB2 and MB3 display recovering water levels. MB2 and MB3 are prior production wells.

Analysis of MB1, 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 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 C displays the curve analysis and graphs, with Figure 9 to Figure 11 showing the water level recovery of these wells compared to the calculated recovery. These figures show:

- MB1 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, analysis will be undertaken in future reports.

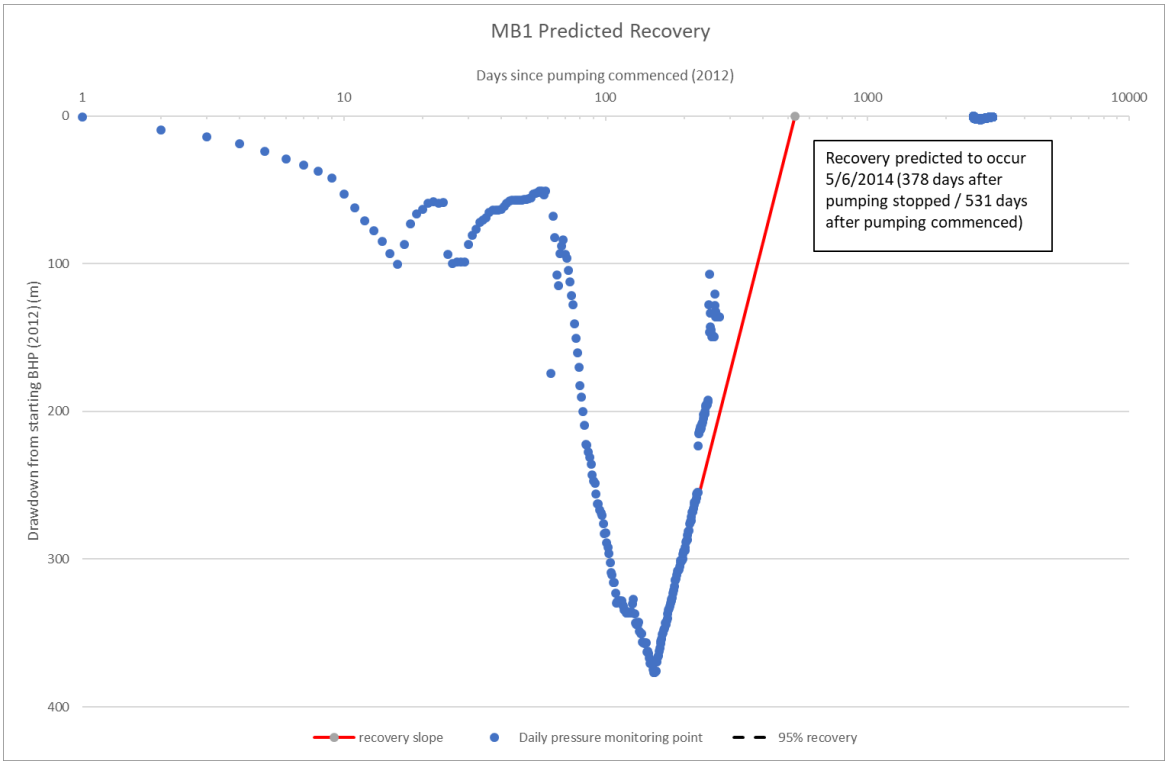


Figure 9: MB1 recovery data

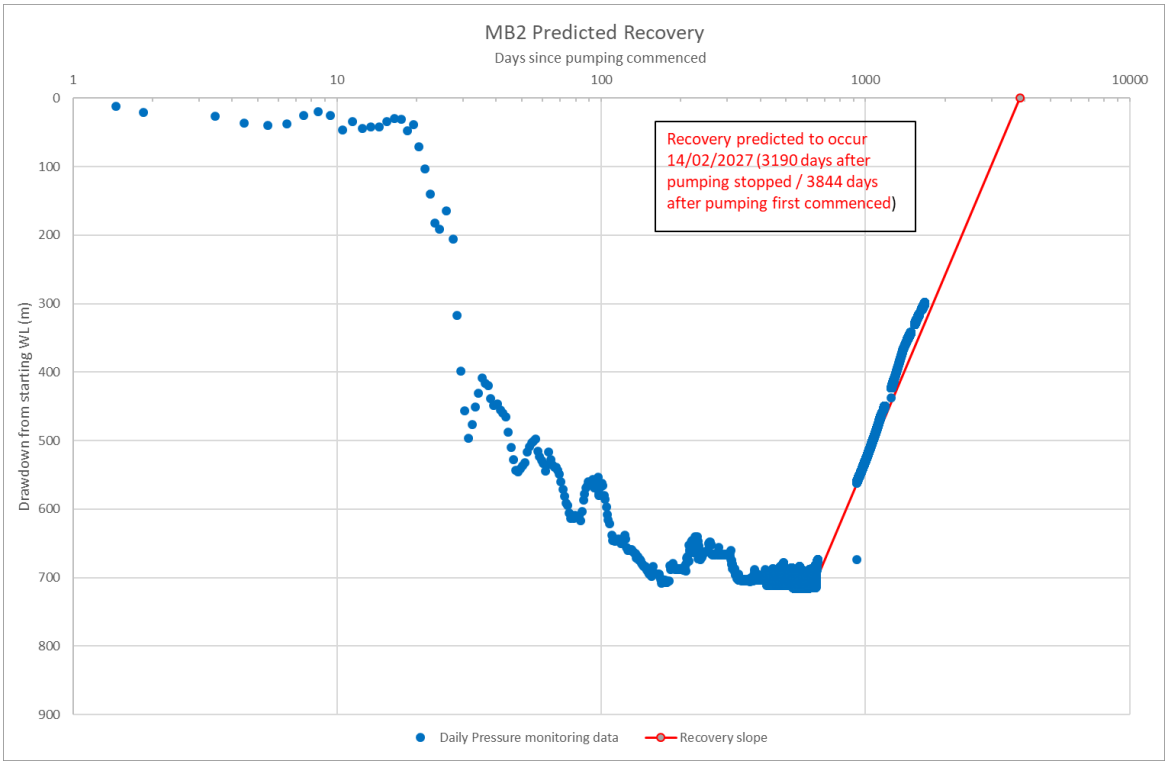


Figure 10: MB2 recovery data

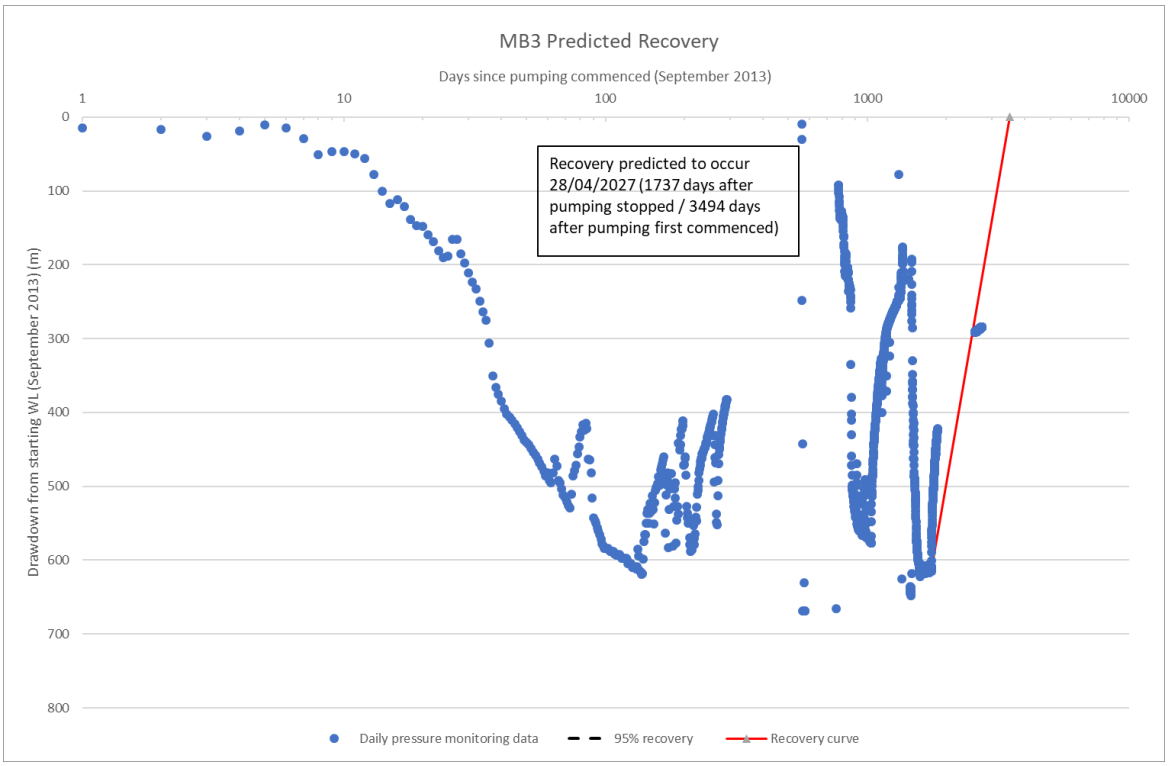


Figure 11: MB3 recovery data

Table 8 displays the predicted recovery year for each bore. As discussed in Section 3.2, the location of MB3 was changed due to a failure in a pressure gauge.

Table 8: 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

Based on the monitoring data, it is concluded that observations of drawdown were generally consistent with respect to predicted exceedances of the bore trigger threshold as follows:

- Monitoring data shows that drawdown greater than the bore trigger threshold was detected at monitoring bores MB1. This was due to equilibration due to the workover of the well in late 2019 to equip the borehole with multiple pressure sensors and is not related to CSG activities There are no existing or useable bores within a 2 km radius at this location in the IAA aquifer; and
- MB2 and MB3 display recovering water levels.

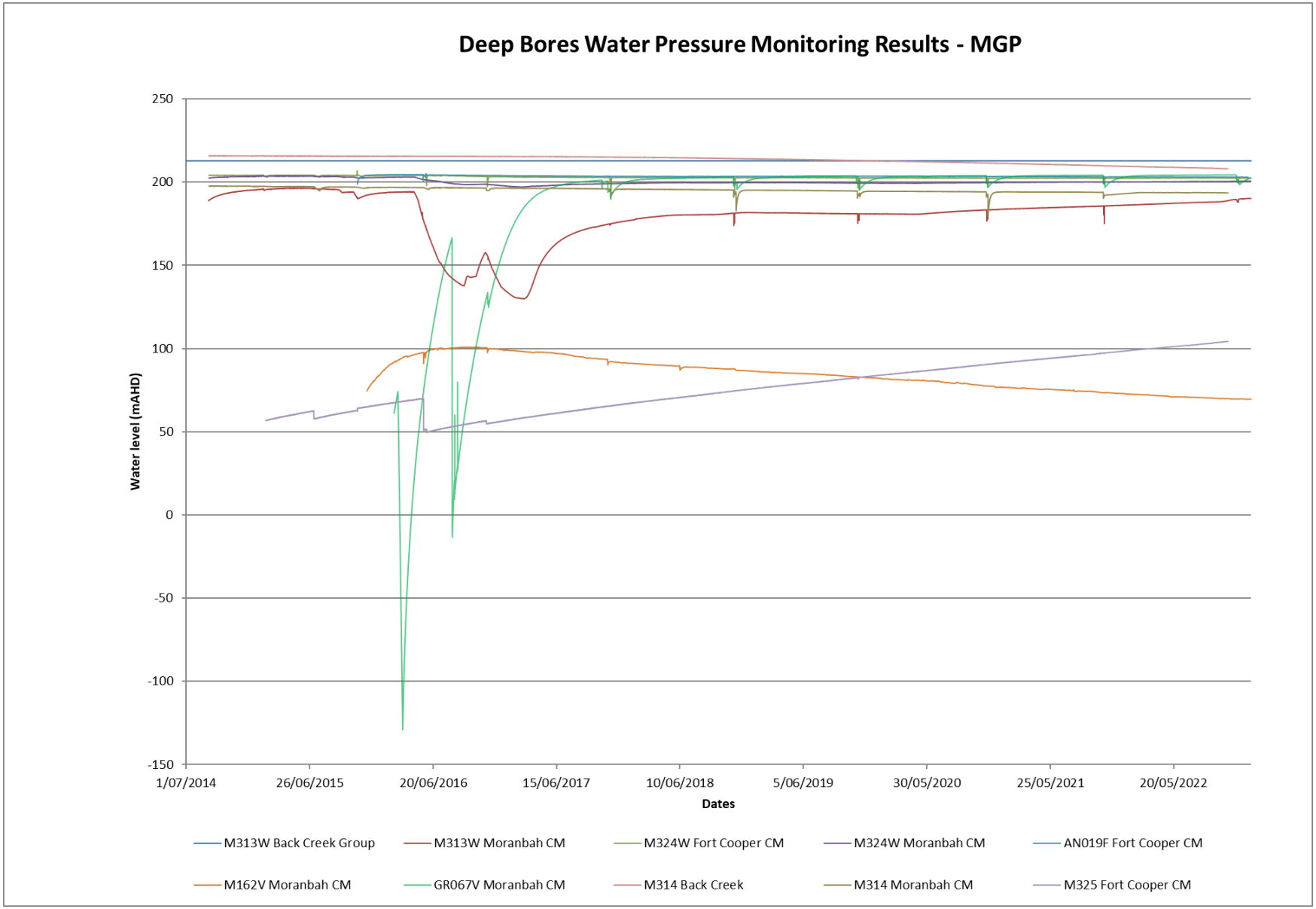


Figure 12: Deep Bores Water Level Monitoring Results - MGP

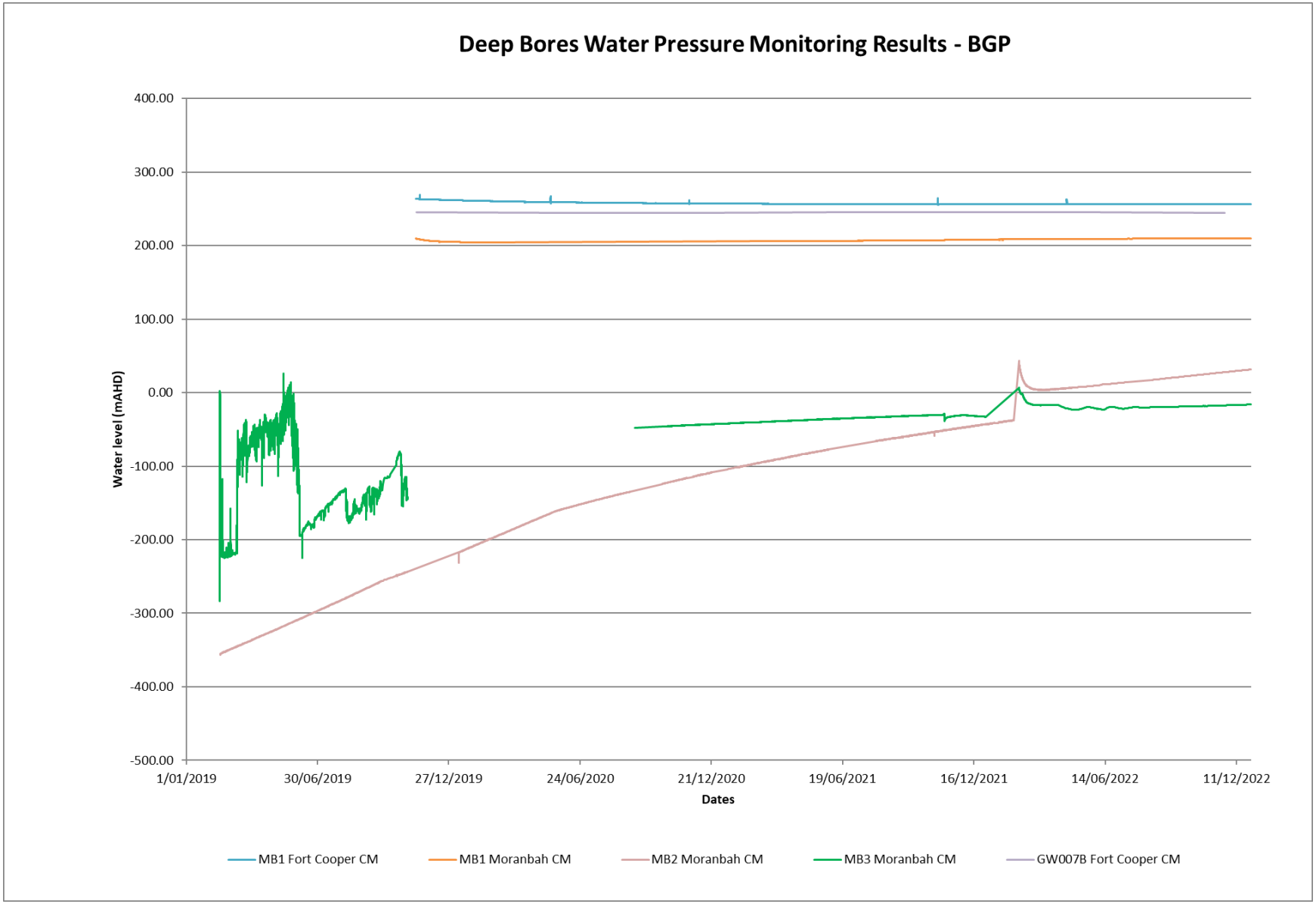


Figure 13: Deep Bores Water Level Monitoring Results - BGP

4.2.3 Groundwater Flow

A review of vertical gradients was undertaken for two monitoring locations in the MGP area and one monitoring location in the BGP area. Monitoring at each site included:

- Site 1: From deepest to shallowest; Back Creek Group (M314W), Moranbah Coal Measures (M314W), Fort Cooper Coal Measures (M325W) as well as data from monitoring approximately 3 km north west in the weathered Fort Cooper Coal Measures (M222W) and Quaternary Alluvium (M224W).
- Site 2: From deepest to shallowest; Back Creek Group (M313W), Moranbah Coal Measures (M313W), Moranbah Coal Measures (M324W) and Fort Cooper Coal Measures (M324W);and
- Site 3. From deepest to shallowest, Moranbah Coal Measures, Fort Cooper Coal Measures and Fort Cooper Coal Measures (Girrah seam), in MB1.

4.2.3.1 Site 1

Figure 14 below shows the vertical gradients for Site 1 and the latest data indicates the FCCM aquifer, at bore M325W, has the lowest water level. The collected and graphically displayed data indicate a very steady and continued recovery of approximately 54m. With the exception of M325W there is an apparent gradient toward the MCM (the target coal seams for CSG production from the MGP) i.e. upward from the BCG and downward from the Quaternary Alluvium, to the FCCM and then to the MCM.

As discussed in Section 4.2.1, water levels in monitoring bore M222W which is constructed into the FCCM show a rising trend in response to above average rainfall recharge. Water levels in M224W constructed in the Quaternary Alluvium show that trends in water levels are linked to flows in the nearby Isaac River.

As discussed in Section 4.2.2, a decline in water levels have been observed in M314W within MCM and the BCG. The water level trends between the MCM and shallow aquifer seem to indicate no vertical hydraulic links exist at this location.

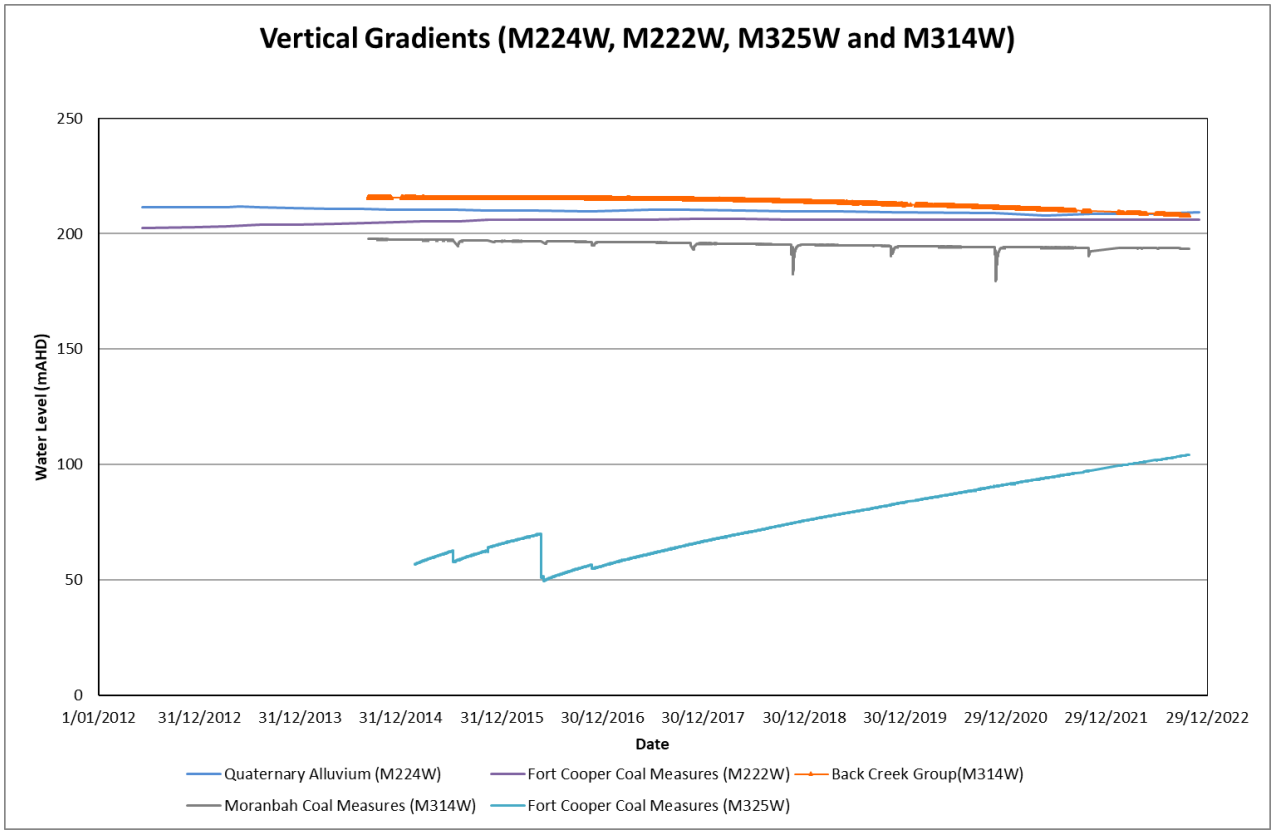


Figure 14: Site 1 - Review of Vertical Gradients (M224W, M222W, M325W and M314W)

4.2.3.2 Site 2

Figure 15 shows the graphically displayed vertical gradients for Site 2 and based on the presented data, water levels in the MCM monitoring bores have continued to recover following cessation of production in GM052V.

As discussed in Section 4.2.2, drawdown as a result of water production in CSG wells to the MCM aquifer is evident at site M313W and M324W but since the production ceased in April 2017, the water level recovery is evident in both monitoring boreholes. Monitoring data for the FCCM and BCG at this site indicates a slight decline in water levels. Decline in water levels noted for the FCCM are observed to correlate to the water production 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. Whilst there is some decline in water levels in the deeper Back Creek Group aquifer, it does not clearly correlate to the water production in the CSG wells and ongoing monitoring will confirm this. Based on this, monitoring data suggests that impacts are contained within the MCM and FCCM.

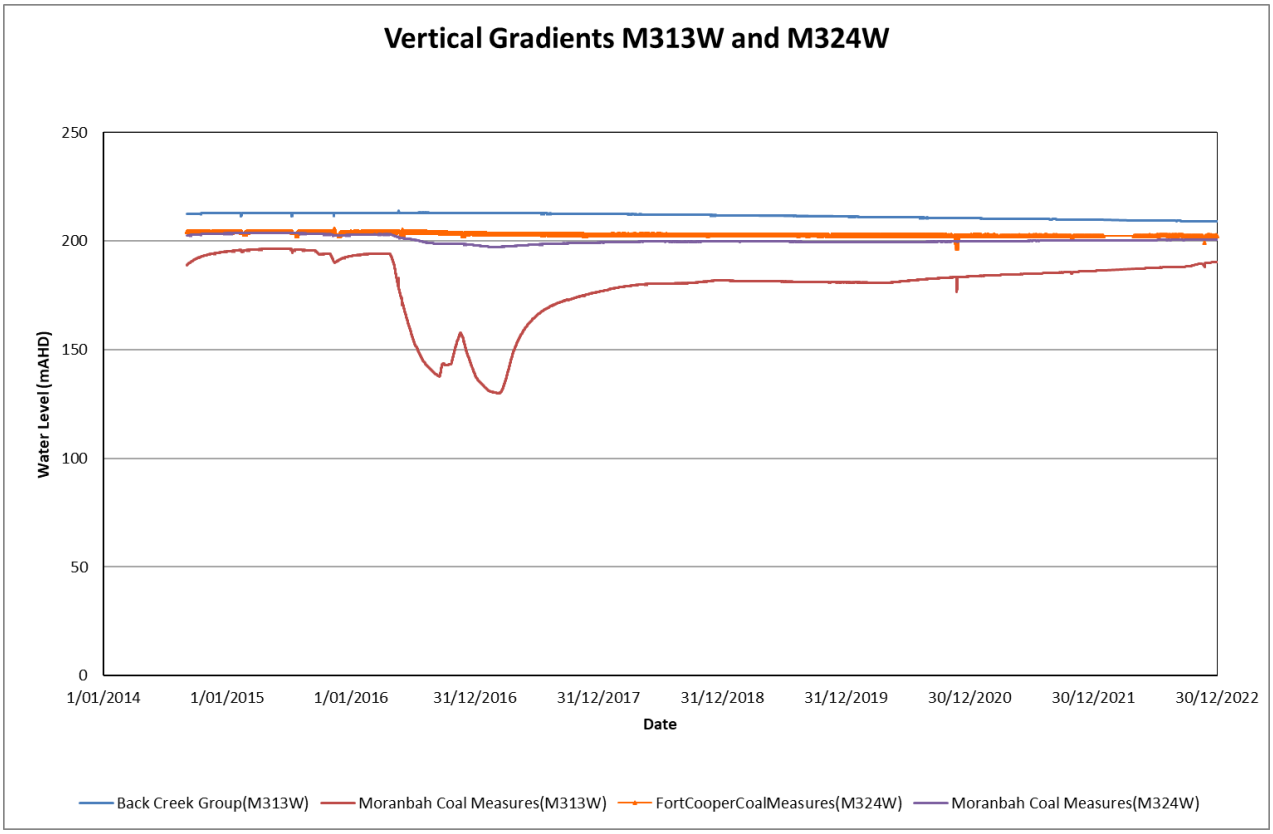


Figure 15: Site 2 - Review of Vertical Gradients (M324W and M313W)

4.2.3.3 Site 3

Figure 16 shows the graphically displayed vertical gradients for Site 3 (MB1) and based on the presented data, a decrease in water levels in the Moranbah Coal Measures is visible, with a smaller decrease seen in the Fort Cooper Coal Measures. 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 seen. As of the end of 2022, the water levels in all three zones are stabilising, 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 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.

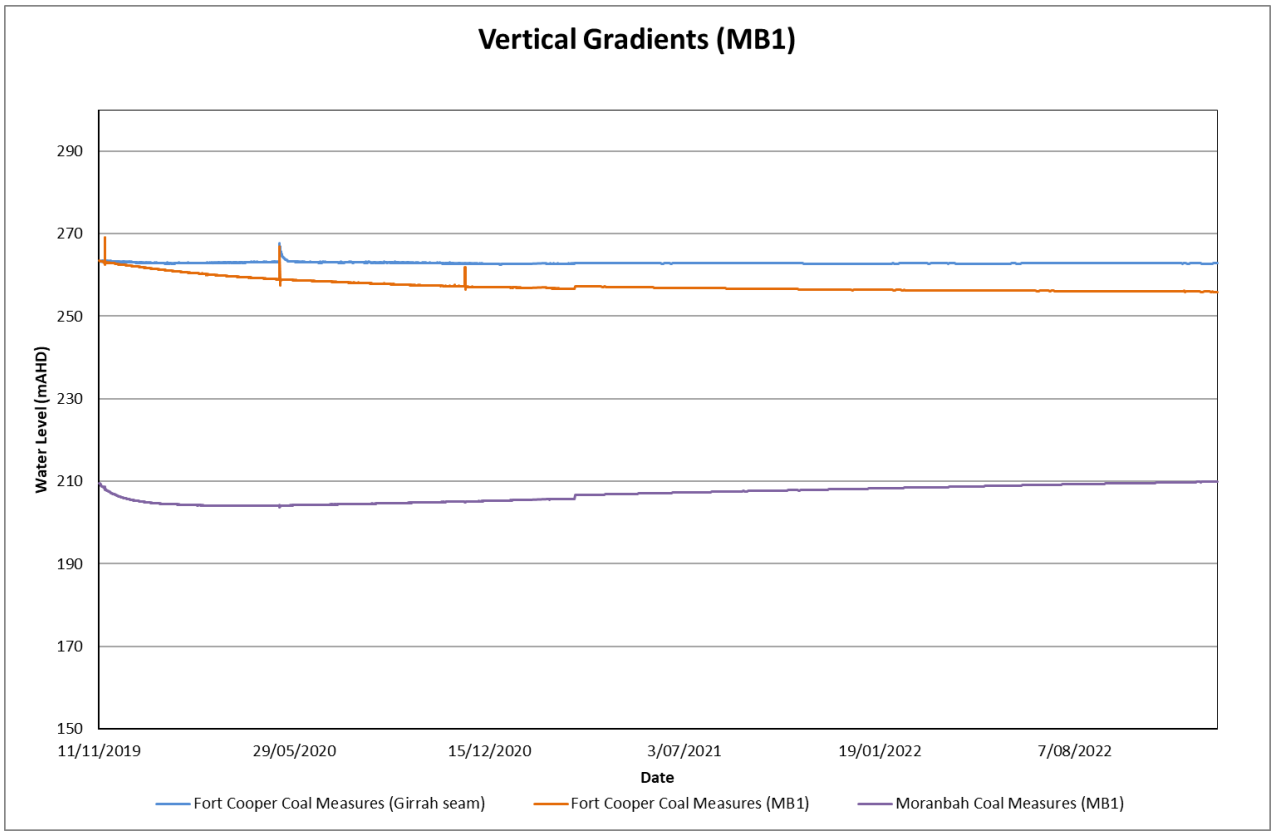


Figure 16: Site 3 - Review of Vertical Gradients (MB1)

5 GROUNDWATER QUALITY MONITORING

Groundwater quality is monitored in eight shallow groundwater monitoring bores. Monitoring has been undertaken since June 2012 in seven of the shallow groundwater monitoring bores and since May 2016 from the other remaining monitoring bore. It should be noted that one additional shallow groundwater monitoring bore (AN021F) exists and was sampled in 2022 but has not been able to be sampled previously due to the low water volume in the bore casing. An adjacent bore, AN020F, drilled and completed into the Rewan Formation, has been sampled since 13 May 2016.

Groundwater quality monitoring was also undertaken in four deep groundwater monitoring bores that were completed in July 2014, two additional deep groundwater monitoring bores that were completed in November 2015 and one more recent deep groundwater monitoring bore that was completed in August 2016.

As part of the commencement of the BGP, MB1 was an additional monitoring site that was incorporated into the monitoring network. MB1 is located in PL486 and has been added to the MGP network for analysis.

As outlined in the 2022 Bowen UWIR, GM031V replaced M162V to allow water levels in M162V to recover, and M300W replaced M230W as nearby mining operations were impacting water levels.

The groundwater quality monitoring results are shown in Appendix B. The primary purpose of groundwater quality monitoring is to identify changes in background water quality. A summary of these results (2012 to 2022) are provided in the following sections.

5.1 Shallow aquifer water quality

Table 9 provides a summary of water quality results obtained from bores targeting the shallow aquifers (M339W, M225W, M340W, M230W, M250W, M224W, M222W, AN020F and AN021F). This provides an indication of water quality ranges for each parameter analysed based on aquifer type. Results for some parameters between different monitoring locations in the Tertiary Basalt show a high degree of variation which is likely to be attributable to the spatial heterogeneity of the hydrogeological system. Additionally, a high degree of variation is also shown in the Tertiary Sediment as no sampling was able to be conducted prior to 2022 from bore AN021F due to low water volume in the bore casing.

Review of this data indicates that there are no notable trends. As displayed by the groundwater level data in Section 4.2.1 , recharge by rainfall or streams occurs to shallow aquifers and is likely to result in variations in some parameters at the same monitoring location as shown in the table below.

In general, the salinity ranges[3] for the underlying units can be described as follows:

- Groundwater quality of the quaternary alluvium varies from brackish to saline;
- Groundwater quality of the tertiary basalt aquifer varies from brackish to saline;
- Groundwater quality of the tertiary sediment aquifer is fresh to brackish to brackish;
- Groundwater quality of the weathered coal measures is saline; and
- Groundwater quality of the Rewan Formation is saline.

[3] Environmental Protection Agency (EPA) of South Australia

Table 9: Background Water Quality - Shallow Monitoring Bores

Parameter	Units	Quaternary Alluvium		Tertiary Basalt		Tertiary Sediment		Weathered Coal Measures		Rewan Formation	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Field pH		5.73	7.48	6.28	8.49	5.42	12.6	5.92	8.16	6.02	7.58
Electrical Conductivity	µS/cm	4240	31600	5300	42769	2170	13800	9090	11400	9590	11200
Total Dissolved Solids	mg/L	2360	27000	3000	29000	1300	5470	5190	9990	6210	9070
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	<1	<5	<1	<5	<1	2420	<1	<5	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	<5	<1	94	<1	80	<1	<5	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	101	336	380	827	53	116	243	457	3	126
Total Alkalinity as CaCO3	mg/L	101	336	380	827	53	2500	243	457	5	126
Sulphate, SO4	mg/L	541	6200	60	1140	28	106	78	178	<1	1
Chloride, Cl	mg/L	1020	14000	1490	17000	660	1280	3140	4140	3750	4030
Calcium - Dissolved	mg/L	172	1000	55	362	12	312	290	448	51	460
Magnesium - Dissolved	mg/L	107	1400	85	808	<1	52	340	518	147	203
Sodium - Dissolved	mg/L	543	6200	891	13000	344	1330	932	1400	1450	2160
Potassium - Dissolved	mg/L	5	17	12	150	9	580	9	14	21	29
Arsenic-Dissolved	mg/L	<0.001	0.008	<0.001	0.003	<0.001	<0.01	<0.001	0.011	<0.001	<0.001
Beryllium-Dissolved	mg/L	<0.00001	0.193	<0.0005	<0.005	<0.0005	<0.001	<0.000001	<0.001	<0.001	<0.001
Barium-Dissolved	mg/L	0.045	0.2	0.05	0.283	0.047	1.06	0.184	3.9	3.42	5.34
Cadmium-Dissolved	mg/L	<0.0001	0.0002	<0.0001	0.0012	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium-Dissolved	mg/L	<0.001	0.015	<0.001	0.014	0.001	0.076	<0.001	0.002	<0.001	<0.001
Cobalt-Dissolved	mg/L	<0.001	0.027	<0.001	0.005	<0.0001	0.005	<0.001	0.002	<0.001	0.001
Copper-Dissolved	mg/L	<0.00005	0.063	<0.001	0.094	<0.001	0.145	<0.001	0.036	<0.001	0.005
Lead-Dissolved	mg/L	<0.001	<0.01	<0.001	<0.005	<0.001	0.112	<0.001	<0.001	<0.001	<0.001
Manganese-Dissolved	mg/L	0.313	8.1	<0.005	0.611	0.003	0.095	1.1	1.87	1.17	2.28
Molybdenum	mg/L	0.001	0.003	0.002	0.008	<0.001	0.152	0.002	0.004	<0.001	0.007
Nickel-Dissolved	mg/L	0.004	0.17	0.005	0.361	0.006	0.088	<0.001	0.125	<0.001	0.006
Selenium	mg/L	<0.01	<0.05	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	3.19	14	1.52	8.98	0.686	0.725	6.67	8.96	11	11.3
Vanadium-Dissolved	mg/L	<0.001	0.002	<0.001	0.042	<0.001	<0.01	<0.001	<0.01	<0.01	<0.01
Zinc-Dissolved	mg/L	0.008	0.302	<0.005	2.27	<0.005	0.131	<0.005	0.719	<0.005	0.014
Boron	mg/L	0.13	0.55	0.42	2.96	0.13	0.76	0.3	0.33	0.09	0.2
Iron	mg/L	0.2	14.2	<0.05	0.59	<0.05	0.43	0.05	22.2	1.68	14.3
Mercury-Dissolved	mg/L	<0.00005	<0.0001	<0.00005	0.001	<0.00005	<0.0001	<0.00005	<0.0001	<0.0001	<0.0001
Fluoride, F	mg/L	0.2	0.9	0.09	2	0.1	0.6	0.4	1	<0.1	0.1
Phosphate as P in water	mg/L	0.007	0.79	0.026	12.6	<0.005	1.3	0.11	2.09	<0.01	0.11

5.2 Deep aquifer water quality

Table 10 provides a summary of water quality results obtained from bores targeting the deep aquifers (M313W, M314W, M324W, M325W, AN019F, GR067V, M162V, M134GMV and MB1-D. This provides an indication of water quality ranges for each parameter analysed based on aquifer type. Results for some parameters between different monitoring locations show high degree of variation which is likely to be attributable to the spatial heterogeneity and low permeability of the hydrogeological system. In addition to this, as displayed by the groundwater pressure data, groundwater recovery for some sites is slow and this is likely to result in variations in some parameters at the same monitoring location. Overall, a review of this data indicates that there are no notable trends. In general, this data shows that:

- Groundwater quality of the Fort Cooper Coal Measures aquifer is fresh to saline[4]; and
- Groundwater quality of the Moranbah Coal Measures is fresh to saline.

Table 10: Background Water Quality – Deep Monitoring Bores

Parameters	Units	Fort Cooper Coal Measures		Moranbah Coal Measures	
		Min	Max	Min	Max
Field pH		6.79	11.8	7.27	9.42
Electrical Conductivity	µS/cm	1170	15700	1710	16000
Total Dissolved Solids	mg/L	707	9910	1160	9810
Hydroxide Alkalinity (OH-) as CaCO3	mg/L	<1	456	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	<1	157	<1	456
Bicarbonate Alkalinity as CaCO3	mg/L	<1	1380	159	2380
Total Alkalinity as CaCO3	mg/L	223	1380	159	2420
Sulphate, SO4	mg/L	<1	68	<1	134
Chloride, Cl	mg/L	188	4920	198	5850
Calcium - Dissolved	mg/L	<1	276	6	209
Magnesium - Dissolved	mg/L	<1	256	<1	62
Sodium - Dissolved	mg/L	199	2590	212	3490
Potassium - Dissolved	mg/L	12	73	6	1450
Arsenic-Dissolved	mg/L	<0.001	0.005	<0.001	0.013
Beryllium-Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001
Barium-Dissolved	mg/L	0.005	12.2	0.236	23
Cadmium-Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Chromium-Dissolved	mg/L	<0.001	0.004	<0.001	0.018
Cobalt-Dissolved	mg/L	<0.001	0.004	<0.001	0.01
Copper-Dissolved	mg/L	<0.001	0.582	<0.001	7.08
Lead-Dissolved	mg/L	<0.001	0.459	<0.001	2.19
Manganese-Dissolved	mg/L	<0.001	0.304	0.007	0.446
Molybdenum	mg/L	0.006	0.114	0.001	0.091
Nickel-Dissolved	mg/L	<0.001	0.02	<0.001	0.05
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.639	8.18	1.18	10.8
Vanadium-Dissolved	mg/L	<0.01	<0.01	<0.01	0.02
Zinc-Dissolved	mg/L	<0.005	2.16	<0.005	0.568
Boron	mg/L	0.24	1.17	0.46	2.4
Iron	mg/L	<0.05	2.94	0.07	3
Mercury-Dissolved	mg/L	0.42	0.42	<0.0001	0.87
Fluoride, F	mg/L	0.2	4.5	0.4	2.6
Phosphate as P in water	mg/L	<0.01	0.59	<0.01	17.4

[4] Environmental Protection Agency (EPA) of South Australia

6 SPRINGS AND GROUNDWATER DEPENDANT ECOSYSTEMS

As outlined in the 2022 Bowen UWIR, no relevant springs or Groundwater Dependent Ecosystems (GDE's) have been identified in the MGP or BGP areas.

7 CONCLUSION

Key findings of the 2023 UWIR annual review for the water production are:

MGP:

- Based on the observed water produced since the 2022 Bowen UWIR, there has been 19.4 ML less water produced than was forecasted in the 2022 UWIR;
- The updated water production forecast is 52% less than the modelled water production to the end of 2022.Given the updated water production forecast is less than what was modelled in the 2022 UWIR, the predicted impacts are expected to be less than originally modelled, an update of the of the 2022 UWIR is not proposed. Accordingly, a material change to the Immediately Impacted Area (IAA) or the Long-Term Affected Area (LAA) is not expected; and
- The maps prepared under s.376(1)(b)(iv and v) do not require updating as there has not been a material change in the information or predictions used to prepare the maps.

BGP:

- Water production for PL486 commenced in 2022 with a combined water production of 18.4 ML for the 2022 annual review data capture period. The updated water production was 45.4% less than modelled water production up to the end of 2022. As a result, there is no material change in the information or predictions made in the 2022 Bowen UWIR. Based on this, no change is proposed to the modelling undertaken for the 2022 Bowen UWIR;
- Three production testing wells in ATP 1103 were active in 2020 (RH098A, RH099A and RH100A), with a combined water production of 5.3 ML since the 2022 Bowen UWIR. This amount of water produced is below the Peak Downs reference pilot site. Therefore, any IAA or LAA arising from production testing wells in the 2022 annual review data capture period will be smaller than that associated with the reference pilot sites;
- No landholder bores are located within the 1-kilometre IAA radius from any production testing wells. Given the updated water production forecast is less than what was modelled in the 2022 UWIR, the predicted impacts are expected to be less than originally modelled, an update of the of the 2022 UWIR is not proposed; and
- The maps prepared under s.376(1)(b)(iv and v) do not require updating as there has not been a material change in the information or predictions used to prepare the maps.

As identified above, there is no material increase in observed and predicted water production for the MGP or BGP, therefore the modelling conducted in the 2022 UWIR overestimates groundwater impacts and an update of the 2022 UWIR is not proposed.

Key findings of the 2023 annual review for water levels monitoring are:

- There is no apparent influence of CSG production to the Quaternary alluvium, weathered Tertiary basalt, Tertiary sediment and Rewan aquifers in which these bores are installed. Decline in water levels noted for the FCCM are observed to correlate to the water production 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. This relationship will continue to be monitored.

Key findings of the 2023 annual review for water quality monitoring are:

- A review of this data indicates that there are no notable trends for both the shallow and deep aquifers.

APPENDIX A: WATER LEVEL RESULTS

SHALLOW BORES

Bore Name	SWL (mAHD)																											
	9/06/2012	13/12/2012	8/04/2013	25/05/2013	6/08/2013	6/12/2013	5/05/2014	19/08/2014	5/12/2014	11/03/2015	17/05/2015	27/07/2015	13/11/2015	2/03/2016	13/05/2016	29/08/2016	15/11/2016	15/06/2017	12/11/2017	1/06/2018	17/11/2018	24/05/2019	12/11/2019	22/11/2020	24/05/2021	30/10/2021	9/06/2022	29/11/2022
M339W	200.426	200.456	200.43	200.451	200.462	200.546	200.49		200.56	200.533	200.416	200.398	200.556	200.466	200.456	200.426	200.500	200.507	200.498	200.520	200.600	200.620	200.660	200.750	200.680	200.820	200.780	200.870
M225W	206.298	206.641	206.737	206.8	207.455	207.152	207.11		207.27	207.349	207.257	207.23	207.402	207.215	207.245	207.248	207.316	207.54	207.685	207.75	207.9		207.78	207.43	207.2	207.14	207.01	207.03
M340W	207.621	208.973	208.118	208.216	208.261	208.507	208.6		208.7	208.771	208.753	208.805	208.918	208.869	208.9	208.761	205.946	203.032	dry									
M230W	208.495	208.705	208.715	208.837	208.865	209.062	209.07		209.2	209.204	209.106	209.058	209.145	208.884	208.922	208.863	208.992	208.629	208.591	208.214	207.7	206.94	205.95	203.17	202.6			
M300W																										200.1	204.496	204.437
GW004A																							235.162	234.692	234.542	234.442	234.542	234.437
GW007A																							dry					
M250W	233.288	233.248	233.238	233.232	233.248	233.308	233.26		233.33	233.289	233.25	233.221	233.25	233.243	233.258	233.328	233.237	233.283	233.273	233.29	233.32	233.34	233.34			233.55	233.39	
AN021F															237.06		242.34		238.47	239.06	239.52		240.52	241.52	237.62	237.37	242.44	242.7
M224W	211.675	211.365	211.45	211.705	211.42	211.11	210.89	210.65	210.49	210.561	210.419	210.277	209.982	210.02	209.969		209.852	210.354	210.355	210.08	209.69	209.57	209.36	208.96	207.84	208.76	208.8	209.22
M222W	202.414	202.974	203.209		203.819	204.014	204.3	204.65	204.95	205.21	205.44	205.54	205.994	205.929	205.969	206.014	206.014	206.149	206.301	206.3	206.28	206.22	206.22	206.22	205.98	206	205.94	206.02
MB1S																							263.51	262.72	262.75	262.7	262.745	262.7875
GW004B																							232.09	230.95	231.80	231.74	232.74	231.67
AEN1214																								215.12	217.32	215.32		216.18
AEN1234																								185.34	185.44	185.35	185.45	185.35
AEN1063																								143.12	142.845	142.53	142.64	142.965
MB12																				298.54	286.88	286.31	294.26	296.01	298.28	298.51	298.62	298.65
AN020F														238.37	238.366	238.48	238.44		237.18	238.61	238.39	238.36	238.36	237.99	237.62	237.37	236.86	236.61

APPENDIX B: WATER QUALITY RESULTS

SHALLOW MONITORING

Monitoring Bore ID	Sample Date	Field pH	Electrical Conductivity	Total Dissolved Solids	Hydroxide Alkalinity (OH-) as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate	Chloride	Calcium	Magnesium	Sodium	Potassium	Aluminium - Dissolved	Arsenic-Dissolved	Beryllium-Dissolved	Barium-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Cobalt-Dissolved	Copper-Dissolved	Lead-Dissolved	Manganese-Dissolved	Molybdenum	Nickel-Dissolved	Selenium - Dissolved	Strontium	Vanadium-Dissolved	Zinc-Dissolved	Boron - Dissolved	Iron - Dissolved	Mercury-Dissolved	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	mg/L	mg/L	mg/L	mg/L
M339W	11/12/2012	6.46	38000	26000	<5	<5	680	680	980	15000	150	670	10000	110		<0.001	<0.0005	0.056	0.0004	0.006	<0.001	0.007	<0.001	0.016		0.018			0.003	0.05			0.00008	0.45	0.1
M339W	4/04/2013	6.28	36000	22000	<5	<5	690	690	830	14000	160	700	9700	120		<0.001	<0.0005	0.057	0.0003	0.007	<0.001	0.005	<0.001	0.013		0.027			0.003	0.039			<0.00005	0.44	0.11
M339W	21/05/2013	8.09	37000	29000	<5	<5	680	680	1100	17000	150	710	10000	120		<0.001	<0.0005	0.067	0.0005	0.004	<0.001	0.059	<0.001	0.012		0.014			0.003	0.068			0.00009	0.33	0.026
M339W	7/08/2013	6.42	37000	25000	<5	<5	660	660	990	15000	190	670	13000	150		<0.002	<0.0005	0.061	0.0004	0.003	<0.001	0.004	<0.001	0.007		0.014			0.003	0.078			<0.00005	0.29	0.19
M339W	5/12/2013	6.6	39000	28000	<5	<5	660	660	1100	16000	160	740	11000	110		<0.001	<0.0005	0.055	0.0005	0.006	<0.001	0.007	<0.001	0.007		0.015			0.003	0.06			<0.00005	0.37	0.085
M339W	11/05/2014	6.6	37900	24600	<1	<1	698	698	1020	13800	150	722	7740	100	<0.5							<0.05		<0.01						<0.05			<0.0001		0.26
M339W	9/12/2014	6.46	39300	25400	<1	<1	706	706	893	13700	158	780	8220	138	<0.05							<0.005		<0.005						0.04			<0.0001	0.4	0.08
M339W	10/03/2015	6.53	39000	27100	<1	<1	644	644	932	13900	183	682	8360	98		<0.005	<0.005	0.058		<0.005	<0.005	<0.005	<0.005	0.009		0.026			<0.05	0.053				0.8	
M339W	16/05/2015	6.67	37500	24200	<1	<1	647	647	1140	12200	167	668	7770	82	<0.01	<0.001	<0.001	0.124	0.0007	0.002	<0.001	0.009	<0.001	0.009		0.012			<0.01	0.128			0.0008	0.4	
M339W	27/07/2015	6.53	38200	25400	<1	<1	658	658	1020	13500	180	676	7600	90	<0.01	<0.001	<0.001	0.051	0.0004	<0.001	<0.001	0.001	<0.001	0.003		0.012			<0.01	0.016			0.001	0.5	
M339W	16/11/2015	6.43	32300	21200	<1	<1	714	714	987	12700	147	669	7170	81	<0.05	<0.005	<0.005	0.053	<0.0005	<0.005	<0.005	0.01	<0.005	<0.005		0.014			<0.05	0.149			0.0006	0.4	0.1
M339W	2/03/2016	7.56	39800	21200	<1	<1	712	712	1000	13400	160	747	8710	104		<0.001	<0.001	0.050		0.007	<0.001	0.002	<0.001	0.002		0.014			<0.01	0.046				0.4	0.24
M339W	13/05/2016		39000	24400	<1	<1	681	681	1020	13000	178	712	7850	89	<0.01	0.001	<0.001	0.055		0.01	<0.001	0.008	<0.001	0.005	0.003	0.014	0.01	8.48	<0.01	0.051	2.58	<0.05	<0.0001	0.4	0.62
M339W	29/08/2016	8.37	41300	28200	<1	43	714	757	993	12600	170	688	7790	93		<0.005	<0.005	0.058		0.01	<0.005	0.005	<0.005	<0.005	<0.005	0.014	<0.05	8.98	<0.05	0.027	2.66	<0.05		0.5	0.07
M339W	15/11/2016	7.13	37100	22900	<1	<1	652	652	1050	12600	171	743	8440	92	<0.01	<0.001	<0.001	0.055	0.0001	0.002	<0.001	<0.001	<0.001	0.006	0.003	0.014	<0.01	8.36	<0.01	0.021	2.42	<0.05	<0.0001	0.5	0.15
M339W	13/06/2017		38600	25100	<1	<1	726	726	964	13500	186	780	9040	105	<0.05							0.006		<0.005						<0.025	2.74	<0.05	<0.0001	0.5	
M339W	12/11/2017	6.99	39800	27100	<1	<1	708	708	923	13700	204	792	9570	102		<0.005	<0.005	0.062		0.008	<0.005		<0.005	<0.005	<0.005	0.015	<0.05		<0.05	<0.025	2.96	0.06		0.4	0.07
M339W	1/06/2018	6.58	39300		<1	<1	644	644	974	12900	181	772	8990	97	<0.05							<0.005		<0.005						<0.025	2.66	<0.05	0.001	0.4	0.09
M339W	17/11/2018	6.51	42769	26800	<1	<1	661	661	916	11600	174	750	7800	96	<0.05	<0.005	<0.005	0.057		0.01	<0.005	<0.005	<0.005	<0.005	<0.005	0.013	<0.05		<0.05	<0.025	2.36	<0.05		0.09	
M339W	27/05/2019	6.47	37398	26200	<1	<1	632	632	958	13600	174	769	8370	95	<0.05							<0.005		<0.005						0.029	2.91	<0.05	0.0009	<0.05	
M339W	12/11/2019	6.69	38760	23400	<1	<1	669	669	936	13800	142	680	7860	88	<0.05	<0.005	<0.005	0.052		0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05		<0.05	0.047	2.81	<0.05		0.11	
M339W	22/11/2020	6.73	38200	26800	<1	<1	677	677	941	14000	154	708	8150	91		<0.005	<0.005	0.058		0.01	<0.005	0.008	<0.005	<0.005	<0.005	0.013	<0.05		<0.05	0.026	2.64	<0.05		0.4	0.13
M339W	30/10/2021	6.43	40600	28600	<1	<1	617	617	925	12900	168	729	8570	99	<0.05							<0.005		<0.005						0.028	2.39	<0.05	0.0002	0.4	0.14
M339W	28/11/2022	7.5	33700	26600	<1	<1	621	621	976	13600	166	700	8610	94		<0.005	<0.005	0.066		0.014	<0.005	<0.005	<0.005	0.03	<0.005	0.042	<0.05		<0.05	0.047	2.81	<0.05		0.4	0.22
M225W	3/04/2013	7.54	28000	17000	<5	<5	810	810	710	11000	150	510	7200	84		<0.001	<0.0005	0.063	0.0006	0.003	<0.001	0.01	<0.001	0.011		0.025			0.015	0.042			<0.00005	0.48	0.2
M225W	21/05/2013	6.53	28000	21000	<5	<5	790	790	660	10000	150	520	7500	82		0.001	<0.0005	0.140	0.0006	0.002	0.001	0.01	<0.001	0.21		0.034			0.009	0.053			<0.00005	0.37	0.11
M225W	8/08/2013	6.59	29000	20000	<5	<5	780	780	700	11000	160	480	7500	75		<0.001	<0.0005	0.120	0.001	0.002	0.001	0.03	<0.001	0.18		0.068			0.013	0.036			<0.00005	0.32	0.19
M225W	5/12/2013	6.84	30000	21000	<5	<5	780	780	780	11000	180	490	9500	95	<0.5	<0.001	<0.0005	0.120	0.0007	0.002	0.002	0.009	<0.001	0.35		0.056			0.009	0.031			<0.00005	0.37	0.11
M225W	6/05/2014	6.98	29900	19400	<1	<1	745	745	369	9940	142	495	5440	72	<0.01							<0.05		<0.01						0.059			<0.0001		0.1
M225W	5/12/2014	6.73	30500	20100	<1	<1	808	808	617	9880	151	523	6450	76								0.028		0.004						0.058			0.0001	0.5	0.27
M225W	11/03/2015	6.82	30100	20000	<1	<1	716	716	827	10200	163	508	6600	75	<0.01	<0.005	<0.005	0.075		<0.005	<0.005	<0.005	<0.005	0.009		0.026			<0.05	0.096				0.8	
M225W	17/05/2015	6.89	30200	19800	<1	<1	780	780	884	9850	161	518	6430	64	<0.01	0.001	<0.001	0.112	0.0012	0.001	<0.001	0.022	<0.001	0.161		0.048			0.01	0.029			<0.0001	0.4	
M225W	28/07/2015	6.96	28700	19300	<1	<1	790	790	735	9660	157	478	5670	65	<0.05	0.001	<0.001	0.089	0.0006	<0.001	<0.001	0.011	<0.001	0.033		0.016			0.01	0.018			<0.0001	0.6	
M225W	16/11/2015	6.38	23700	17400	<1	<1	826	826	738	9870	134	485	5460	59		<0.005	<0.005	0.055	0.0006	<0.005	<0.005	0.012	<0.005	<0.005		0.022			<0.05	0.099			0.0001	0.6	0.18
M225W	2/03/2016	7.71	30500	19400	<1	<1	817	817	721	10300	153	541	6530	76	<0.01	<0.001	<0.001	0.053		0.002	<0.001	0.02	<0.001	0.001		0.012			0.01	0.035				0.5	0.25
M225W	13/05/2016	7.57	29600	18400	<1	<1	779	779	752	9390	158	532	6570	66		<0.001	<0.001	0.062	0.0005	0.002	<0.001	0.006	<0.001	0.01	0.004	0.028	<0.01	4.25	0.01	0.036	2.48	<0.05	<0.0001	0.5	0.13
M225W	29/08/2016	7.45	29600	17900	<1	<1	799	799	727	9750	158	532	6220	68	<0.01	<0.001	<0.001	0.065		0.002	<0.001	0.012	<0.001	0.006	0.004	0.022	<0.01	4.58	0.01	0.038	2.1	<0.05		0.6	0.22
M225W	15/11/2016	7.31	30200	19800	<1	<1	778	778	711	9620	169	567	6560	72	<0.01	<0.001	<0.001	0.068	0.0006	0.002	<0.001	0.006	<0.001	0.008	0.006	0.058	<0.01	4.93	0.01	0.062	2.32	<0.05	0.0002	0.7	0.12
M225W	13/06/2017		29900	18300	<1	<1	827	827	786	10800	150	492	6780	66								0.013		0.005						0.018	1.92	<0.05	<0.0001	0.4	0.43
M225W	12/11/2017	7.15	30700	20100	<1	<1	814	814	691	10400	144	507	5930	64		<0.001	<0.001	0.060		0.003	<0.001		<0.001	0.008	0.004	0.253	<0.01		0.01	0.015	1.95	<0.05		0.5	0.17
M225W	31/05/2018	7.16	30100	19200	<1	<1	701	701	701	9900	169	578	6960	70	<0.05							0.012		0.027						<0.025	2.07	<0.05	<0.0001	0.6	0.1
M225W	21/11/2018	6.74	29700	19000	<1	<1	748	748	723	10200	159	566	6470	68	<0.05	<0.005	<0.005	0.103		<0.005	<0.005	0.07	<0.005	<0.005	<0.005	0.016	<0.05		<0.05	0.046	2.02	<0.05	0.0001	0.5	0.14
M225W	25/05/2019	6.59	29500	19500	<1	<1	738	738	745	10700	159	541	6250	70								0.041		0.022						0.031	1.98	0.08	0.0001	0.5	0.09
M225W	7/11/2019	6.91	30400	21800	<1	<1	733	733	715	10200	149	566	6670	71	<0.05	<0.005	<0.005	0.067		<0.005	<0.005	<0.005	<0.005	0.008	<0.005	0.011	<0.05		<0.05	0.11	2.24	<0.05		0.5	0.09
M225W	19/11/2020	6.81	29700	20000	<1	<1	758	758	746	10600	179	518	6130	68	<0.05	<0.005	<0.005	0.000		<0.005	<0.005	0.022	<0.005	0.062	<0.005	0.361	<0.05		<0.05	0.045	1.81	<0.05	<0.0001	0.5	0.18
M225W	25/10/2021	7.99	25600	21100	<1	<1	749	749	725	9950	168	567	6640	73	<0.05	<0.005	<0.005	0.062		<0.005	<0.005	0.014	<0.005	<0.005	<0.005	0.026	<0.05		<0.05	0.032	2.07	<0.05		0.5	0.18
M225W	23/11/2022	6.61	26600	19700	<1	<1	681	681	712	10400	169	523	6780	68	<0.05	<0.005	<0.005	0.08		0.008	<0.005	0.094	<0.005	<0.005	<0.005	0.127	<0.05		<0.05	0.115	2.23	<0.05	<0.0001	0.5	0.17
M340W	11/12/2012	6.6	8600	5200	<5	<5	620	620	240	2900	57	110	2100	25		<0.001	<0.0005	0.056	0.0002	<0.001	0.0002	0.005	<0.001	0.1		0.012			0.003	0.035			<0.00005	0.45	0.1
M340W	4/04/2013	6.3	8300	5200	<5	<5	620	620	230	2600	62	120	1900	32		<0.001	<0.0005	0.056	<0.0001	<0.001	0.002	0.004	<0.001	0.085		0.014			0.002	0.028			<0.00005	1.6	0.077
M340W	22/05/2013	6.81	8400	5000	<5	<5	610	610	240	2700	59	120	1900	25		<0.001	<0.0005	0.057	<0.0001	<0.001	0.002	0.005	<0.001	0.086		0.007			0.002	0.036			<0.00005	1.4	0.055
M340W	7/08/2013	6.63	8600	5000	<5	<5	620	620	230	2700	55	110	2000	26		<0.001	<0.0005	0.061	<0.0001	<0.001	0.002	0.002	<0.001	0.095		0.006			0.001	0.037			<0.00005	1.3	0.1
M340W	5/12/2013	6.63	9100	5700	<5	<5	610	610	260	2800	56	110	2200	27		<0.001	<0.0005	0.058	<0.0001	<0.001	0.002	<0.001	<0.001	0.1		0.013			0.001	0.021			<0.00005	1.5	0.063
M340W	10/05/2014	6.74	10000	6500	<1	<1	661	661	246	3150	71	141	1920	25	<0.01							0.007		0.075						0.041			<0.0001		0.12
M340W	8/12/2014	6.69	11100	6390	<1	<1	708	708	257	3400	85	172	2050	33	<0.01							0.008		0.081						0.076			<0.0001	1.8	0.08
M340W	12/03/2015	6.81	11400	6500	<1	<1	689	689	269	3760	102	174	2240	32		<0.001	<0.001	0.068		<0.001	0.002	0.003	<0.001	0.058		0.022			<0.01	0.013				1.7	
M340W	17/05/2015	6.82	11700	6900	<1	<1	679	679	383	3740	96	179	2060	27	<0.01	<0.001	<0.001	0.194	<0.0001	<0.001	0.001	0.024	<0.001	0.051		0.009			<0.01	0.185			<0.0001	1.6	
M340W	28/07/2015	6.68	11400	6280	<1	<1	668	668	319	3670	100	177	2120	29	<0.01	<0.001	<0.001	0.113	<0.0001	<0.001	<0.001	0.011	<0.001	0.049		0.038			<0.01	0.06			<0.0001	1.9	
M340W	16/11/2015	6.38	10700	7320	<1	<1	727	727	322	3850	89	193	2180	28	<0.01	<0.001	<0.001	0.057	<0.0001	0.001	0.001	0.018	<0.001	0.047		0.01			<0.01	0.098			<0.0001	1.6	0.04
M340W	2/03/2016	8.43	12600	6400	<1	43	681	725	320	4060	101	203	2480	33		<0.001	<0.001	0.060		<0.001	0.002	0.002	<0.001	0.044		0.01				0.018				2.0	0.08
M340W	13/05/2016	7.67	12400	7140	<1	<1	693	693	342	3790	100	200	2310	30	<0.01	<0.001	<0.001	0.070	<0.0001	<0.001	0.001	0.012	<0.001	0.034	0.004	0.005	<0.01	2.95	<0.01	0.132	2.26	<0.05	<0.0001	1.8	0.05
M340W	29/08/2016	8.49	13000	7250	<1	94	636	730	345	3780	107	198	2340	30		<0.001	<0.001	0.073		0.001	0.003	0.002	<0.001	0.06	0.004	0.008	<0.01	3.32	<0.01	0.005	1.83	<0.05		2.0	0.05
M340W	15/11/2016	7.44	13100	7430	<1	<1	668	668	371	4310	109	216	2420	31		<0.001	<0.001	0.075	<0.0001	0.002	0.002	<0.001	<0.001	0.056		0.006	<0.01		<0.01	0.014	2.14		<0.0001	1.6	0.08
M340W	13/06/2017		11300	6590	<1	<1	651	651	353	3690	90	180	2180	27	<0.01							<0.001		0.611						<0.005	1.75	<0.05	<0.0001	1.9	12.6
M230W	11/12/2012	7.15	5600	3300	<5	<5	420	420	64	1600	55	93	1200	18		0.002	<0.0005	0.150	<0.0001	<0.001	<0.001	0.001	<0.001	0.097		0.005			<0.001	0.014			<0.00005	0.79	0.67
M230W	3/04/2013	6.66	5400	3200	<5	<5	420	420	66	1600	60	96	1000	19		0.002	<0.0005	0.170	<0.0001	<0.001	0.002	0.002	<0.001	0.26		0.01			<0.001	0.027			<0.00005	0.76	0.16
M230W	21/05/2013	7.01	5300	3300	<5	<5	410	410	60	1700	60	96	1100	18		0.002	<0.0005	0.180	<0.0001	<0.001	0.002	0.004	<0.001	0.18		0.014			<0.001	0.021			<0.00005	0.54	0.094
M230W	7/08/2013	7.05	5600	3000	<5	<5	400	400	77	1700	58	93	1100	16		0.002	<0.0005	0.180	<0.0001	<0.001	<0.001	0.003	<0.001	0.091		0.01			<0.001	0.033			<0.00005	0.46	0.27
M230W	7/12/2013	6.96	5900	3700	<5	<5	390	390	83	1700	56	85	1200	15		0.002	<0.0005	0.180	<0.0001	<0.001	0.002	0.003	<0.001	0.16		0.008			<0.001	0.017			<0.00005	0.63	0.11
M230W	11/05/2014	6.99	6010	3910	<1	<1	426	426	82	1660	67	100	1040	14	<0.01							0.003		0.212						0.037			<0.0001		0.17
M230W	5/12/2014	7.05	6100	3120	<1	<1	418	418	73	1490	70	103	970	17	<0.01							0.001		0.317						0.06			<0.0001	0.7	0.3
M230W	12/03/2015	7	6080	3360	<1	<1	410	410	69	1730	74	100	1030	16		0.002	<0.001	0.195		<0.001	0.003	0.001	<0.001	0.251		0.131			<0.01	0.013				0.8	
M230W	17/05/2015	7	6180	3580	<1	<1	407	407	97	1550	75	106	985	14	<0.01	0.002	<0.001	0.283	<0.0001	<0.001	0.003	0.002	<0.001	0.243		0.01			<0.01	0.024			<0.0001	0.6	
M230W	28/07/2015	7.05	6000	3210	<1	<1	404	404	87	1500	74	107	1050	16	<0.01	0.002	<0.001	0.237	<0.0001	<0.001	0.001	0.004	<0.001	0.146		0.012			<0.01	0.049			<0.0001	0.7	
M230W	15/11/2015	6.62	6260	3440	<1	<1	419	419	82	1840	69	101	891	12	<0.01	0.002	<0.001	0.175	<0.0001	0.002	<0.001	0.002	<0.001	0.046		0.06			<0.01	0.068			<0.0001	0.8	0.17
M230W	2/03/2016	7.82	6350	3350	<1	<1	431	431	84	1760	68	104	995	17		0.001	<0.001	0.164		<0.001	0.001	0.002	<0.001	0.035		0.006			0.042	<0.01				0.7	0.19
M230W	13/05/2016	7.78	6120	3500	<1	<1	419	419	80	1760	72	110	1050	16	<0.01	0.001	<0.001	0.184	<0.0001	<0.001	<0.001	0.001	<0.001	0.04	0.006	0.021	<0.01	1.52	<0.01	0.024	0.6	<0.05	<0.0001	0.7	0.1
M230W	29/08/2016	7.48	6130	3450	<1	<1	417	417	79	1680	76	111	1050	18		0.001	<0.001	0.186		<0.001	<0.001	0.007	<0.001	0.027	0.008	0.039	<0.01	1.68	<0.01	0.026	0.42	<0.05		0.7	0.1
M230W	15/11/2016	7.51	6220	3500	<1	<1	414	414	83	1750	68	117	1100	15		0.002	<0.001	0.186	<0.0001	<0.001	<0.001	0.002	<0.001	0.097	0.008	0.026	<0.01	1.71	<0.01	0.036	0.47	<0.05	<0.0001	0.6	0.08
M230W	13/06/2017		6270	3470	<1	<1	442	442	78	1870	65	110	1100	15	<0.01							0.001		0.451						0.014	0.45	0.36	<0.0001	0.8	0.18
M230W	12/11/2017	7.5	6400	3710	<1	<1	420	420	79	1820	70	114	1070	15		0.002	<0.001	0.206		<0.001	0.005		<0.001	0.203	0.005	0.014	<0.01		<0.01	0.065	0.47	<0.05		0.7	0.23
M230W	1/06/2018	6.95	6860	3960	<1	<1	380	380	99	1920	78	121	1170	17								0.001		0.188						0.012	0.44	0.43	<0.0001	0.7	0.17
M230W	21/11/2018	6.83	7260	4140	<1	<1	401	401	104	2140	98	158	1300	17		0.002	<0.001	0.207		<0.001	0.003	<0.001	<0.001	0.186	0.003	0.009	<0.01		<0.01	0.047	0.48	<0.05	<0.0001	0.7	0.12
M230W	25/05/2019	6.74	7450	4410	<1	<1	397	397	117	2480	101	163	1350	18								0.001		0.213						0.012	0.56	0.39	<0.0001	0.7	0.14
M230W	10/11/2019	6.88	7420	4770	<1	<1	403	403	110	2330	93	150	1260	18		0.002	<0.001	0.206		<0.001	0.004	<0.001	<0.001	0.186	0.002	0.015	<0.01		<0.01	0.016	0.52	0.29		0.7	0.13
M230W	1/11/2020	6.9	7670	4630	<1	<1	416	416	110	2520	109	159	1280	18								<0.001		0.204						0.017	0.44	<0.05	<0.0001	0.6	0.14
M230W	19/11/2021	7.21	7620	4390	<1	<1	415	415	113	2540	128	208	1580	22		0.003	<0.001	0.283		<0.001	0.005	0.001	<0.001	0.286	0.004	0.262	<0.01		<0.01	0.025	0.71	0.59		0.7	0.13
M300W	26/10/2021	7.61	32600	22400	<1	<1	531	531	550	10700	297	687	6430	79	<0.05							0.015		0.016						2.27	1.45	<0.05	<0.0001	0.7	0.13
M300W	7/06/2022	6.3	31800	23300	<1	<1	558	558	603	11400	312	805	7140	87	<0.05							0.044		0.005						0.06	1.61	<0.05	0.0006	0.7	0.16
M300W	22/11/2022	6.56	33300	24000	<1	<1	598	598	633	11900	362	808	7110	88	<0.05							0.058		0.011						0.146	1.65	0.09	0.0006	0.7	0.11
M250W	13/12/2012	5.42	2400	1400	<5	<5	61	61	54	700	14	39	380	11		<0.001	<0.0005	0.1	<0.0001	0.002	<0.001	0.002	<0.001	0.027		0.008			<0.001	0.023			<0.00005	0.18	0.012
M250W	6/04/2013	5.77	2400	1600	<5	<5	69	69	69	660	17	45	490	13		<0.001	<0.0005	0.11	<0.0001	0.001	<0.001	0.002	<0.001	0.054		0.014			<0.001	0.02			<0.00005	0.14	0.01
M250W	25/05/2013	5.86	2500	1600	<5	<5	67	67	83	730	18	46	510	13		<0.001	<0.0005	0.1	<0.0001	0.003	<0.001	0.004	<0.001	0.015		0.007			<0.001	0.018			<0.00005	0.14	0.012
M250W	6/08/2013	5.82	2300	1300	<5	<5	72	72	81	730	19	43	450	11		<0.001	<0.0005	0.1	<0.0001	0.002	<0.001	0.002	<0.001	0.007		0.006			<0.001	0.016			<0.00005	0.13	0.079
M250W	5/12/2013	5.92	2500	1600	<5	<5	60	60	84	710	14	39	480	12		<0.001	<0.0005	0.083	<0.0001	0.002	<0.001	0.001	<0.001	0.019		0.01			<0.001	0.014			<0.00005	0.14	<0.005
M250W	9/05/2014	5.64	2440	1590	<1	<1	76	76	76	682	13	43	393	12	<0.01							0.004		0.018						0.019			<0.0001		1.3
M250W	7/12/2014	5.65	2530	1380	<1	<1	58	58	76	717	13	45	432	11	<0.01							<0.001		0.017						<0.005			<0.0001	0.2	0.08
M250W	10/03/2015	5.5	2540	1580	<1	<1	58	58	92	768	19	42	420	10		<0.001	<0.001	0.07		0.003	<0.001	<0.001	<0.001	0.013		0.01			<0.01	0.018				0.6	
M250W	18/05/2015	5.75	2560	1420	<1	<1	55	55	92	763	17	44	398	10	<001	<0.001	<0.001	0.07	<0.0001	0.002	0.001	<0.001	<0.001	0.015		0.011			<0.01	0.019				0.2	
M250W	29/07/2015	5.48	2430	1430	<1	<1	59	59	89	729	15	44	387	11	<0.01	<0.001	<0.001	0.078	<0.0001	0.003	0.001	<0.001	<0.001	0.028		0.01			<0.01	0.106			<0.0001	0.2	
M250W	16/11/2015	5.72	2170	1300	<1	<1	72	72	76	664	12	38	344	9	<0.01	<0.001	<0.001	0.061	<0.0001	0.001	0.004	0.005	<0.001	0.076		0.048			<0.01	0.131			<0.0001	0.2	0.4
M250W	2/03/2016	6.54	2650	1490	<1	<1	53	53	92	787	15	45	408	12		<0.001	<0.001	0.047		0.002	<0.001	0.001	<0.001	0.014		0.01			<0.01	0.048				0.2	0.16
M250W	13/05/2016	6.74	2620	1530	<1	<1	116	116	95	774	18	52	461	11	<0.01	<0.01	<0.001	<0.001		0.076	<0.0001	0.002	<0.001	0.011	<0.001	0.009	<0.01	0.725	<0.01	0.016	0.76	0.05	<0.0001	0.2	0.91
M250W	29/08/2016	7.76	2600	1440	<1	<1	64	64	81	678	14	44	396	10		<0.001	<0.001	0.055		0.002	0.001	0.001	<0.001	0.012	<0.001	0.01	<0.01	0.686	<0.01	0.008	0.61	<0.05		0.2	0.51
M250W	15/11/2016	6.36	2460	1400	<1	<1	60	60	86	715	12	46	411	10	<0.01	<0.001	<0.001	0.05	<0.0001	0.002	0.001	<0.001	<0.001	0.012	<0.001	0.008	<0.01	0.698	<0.01	0.032	0.73	<0.05	<0.0001	0.2	0.47
M250W	18/06/2017		2450	1360			63	63	80	708	12	42	402	10	<0.01							0.001		0.014						0.021	0.67	<0.05	<0.0001	0.2	0.44
M250W	13/11/2017	7.23	2650	1620			55	55	106	794	20	50	465	11		<0.001	<0.001	0.072		0.002	0.005	0.002	<0.001	0.095	0.002	0.043	<0.01		<0.01	0.111	0.7	<0.05		0.3	0.62
M250W	2/06/2018	5.8	2530					55	77	708	15	48	440	10	<0.01							<0.001		0.014						0.006	0.73	0.43	<0.0001	0.2	0.63
M250W	22/11/2018	5.66	2510	1520	<1	<1	62	62	89	746	15	48	420	11	<0.01	<0.001	<0.001	0.057		0.002	0.001	0.001	<0.001	0.016	<0.001	0.01	<0.01		<0.01	0.072	0.68	<0.05	<0.0001	0.2	0.77
M250W	26/05/2019	5.45	2480	1400	<1	<1	58	58	88	790	16	48	407	11	<0.01							0.001		0.021						0.031	0.74	<0.05	<0.0001	0.2	0.23
M250W	7/11/2019	5.93	2510	1560	<1	<1	59	59	87	744	20	46	414	11	<0.01	<0.001	<0.001	0.059		0.002	0.004	<0.001	<0.001	0.043	0.001	0.088	<0.01		<0.01	0.035	0.74	<0.05		0.2	0.03
M250W	21/12/2021	5.65	2420	1550	<1	<1	60	60	80	767	20	46	438	12		<0.001		0.063		0.002	0.003	<0.001	<0.001	0.05	0.003	0.056			<0.01	0.054	0.59	<0.05		0.1	
AN021F	10/102/2022	12.6	13800	5470	2420	80	<1	2500	28	1280	312	<1	1330	580		<0.001	<0.001	1.06		0.002	<0.001	0.145	0.112	0.003	0.152	0.042	<0.01		<0.01	0.064	0.13	0.14		0.2	0.03
M222W	16/06/2012	6.43	9520	6690	<1	<1	457	457	85	3140	326	355	1120	14		0.003	<0.000001	3.9	<0.0001	0.002	0.002	0.002	<0.001	1.17		0.125			<0.01	0.041			<0.0001	0.6	
M222W	14/12/2012	6.52	9300	6500	<5	<5	420	420	78	3500	290	340	1000	14		<0.001	<0.0005	1.2	<0.0001	<0.001	0.002	0.003	<0.001	1.3		0.005			<0.001	0.043			<0.00005	0.48	<0.005
M222W	5/04/2013	6.22	9100	6500	<5	<5	300	300	140	4100	320	440	1100	14		<0.001	<0.0005	0.26	<0.0001	<0.001	<0.001	0.002	<0.001	1.1		0.019			<0.001	0.037			<0.00005	0.68	<0.005
M222W	26/05/2013	6.67	9400	7500	<5	<5	290	290	100	3200	350	450	1100	14		0.001	<0.0005	0.24	<0.0001	<0.001	<0.001	0.002	<0.001	1.3		0.004			<0.001	0.007			<0.00005	0.47	<0.005
M222W	9/08/2013	6.17	9200	6200	<5	<5	310	310	110	3400	340	400	1100	11		0.003	<0.0005	0.23	<0.0001	<0.001	<0.001	0.001	<0.001	1.2		<0.001			<0.001	0.011			<0.00005	0.44	<0.005
M222W	6/12/2013	6.26	9700	9600	<5	<5	300	300	130	3300	440	380	1400	12		0.006	<0.0005	0.24	<0.0001	<0.001	<0.001	0.002	<0.001	1.7		0.001			<0.001	0.018			<0.00005	0.59	<0.005
M222W	10/05/2014	6.16	9480	6160	<1	<1	316	316	129	3420	363	428	1010	10	<0.01							0.004		1.35						0.019			<0.0001		2.09
M222W	19/08/2014	6.81	9090	8950	<1	<1	275	275	128	3450	365	448	1020	12	<0.01							0.001		1.54						0.036			<0.0001	0.4	0.18
M222W	4/12/2014	6.25	10200	7520	<1	<1	303	303	116	3330	361	451	1080	12	<0.01							<0.001		1.45						0.115			<0.0001	0.8	0.74
M222W	11/03/2015	6.55	10000	6810	<1	<1	295	295	122	3450	395	395	999	10		0.003	<0.001	0.248		<0.001	<0.001	<0.001	<0.001	1.27		<0.001			<0.01	0.02				1	
M222W	17/05/2015	6.32	9890	7160	<1	<1	304	304	165	3480	374	426	943	9	<0.01	0.011	<0.001	0.202	<0.0001	<0.001	<0.001	<0.001	<0.001	1.57		0.002			<0.01	0.021			<0.0001	0.7	
M222W	27/07/2015	6.23	9670	6150	<1	<1	290	290	129	3420	385	434	956	10	<0.01	0.004	<0.001	0.226	<0.0001	<0.001	<0.001	<0.001	<0.001	1.28		0.007			<0.01	<0.005			<0.0001	0.8	
M222W	17/11/2015	6.1	10200	6820	<1	<1	296	296	124	3560	352	376	932	10	0.36	0.004	<0.001	0.22	<0.0001	<0.001	<0.001	0.001	<0.001	1.37		<0.001			<0.01	0.074			<0.0001	0.9	0.53
M222W	2/03/2016	7.19	10700	5190	<1	<1	318	318	118	3560	342	434	1040	12		0.003	<0.001	0.219		0.002	<0.001	<0.001	<0.001	1.27		0.017			<0.01	0.043				0.8	0.11
M222W	13/05/2016	7.22	9890	5740	<1	<1	282	282	177	3340	376	456	1040	10	<0.01	0.009	<0.001	0.201	<0.0001	<0.001	<0.001	<0.001	<0.001	1.59	0.004	<0.001	<0.01	6.67	<0.01	<0.005	0.33	17.6	<0.0001	0.7	0.43
M222W	29/08/2016	8.16	10400	7370	<1	<1	280	280	155	3170	414	474	1080	10		0.01	<0.001	0.184		<0.001	<0.001	<0.001	<0.001	1.86	0.004	0.003	<0.01	8.96	<0.01	<0.005	0.32	21.1		0.8	0.55
M222W	15/11/2016	6.62	10300	6300	<1	<1	292	292	140	3660	407	492	1170	11	<0.01	0.005	<0.001	0.252	<0.0001	<0.001	<0.001	<0.001	<0.001	1.59	0.003	0.002	<0.01	8.73	<0.01	0.015	0.34	13.6	<0.0001	0.8	0.19
M222W	13/06/2017		10600	6320			310	310	145	3920	379	448	1140	11	<0.01							<0.001		1.55						<0.005	0.33	11.4	<0.0001	0.7	0.32
M222W	7/11/2017	6.82	10600	6800			271	271	126	3670	399	466	1080	10		0.005	<0.001	0.288		<0.001	<0.001	<0.001	<0.001	1.63	0.002	0.001	<0.01		<0.01	<0.005	0.3	14.5		0.8	0.43
M222W	29/05/2018	6.29	11000					286	131	4020	417	478	1170	12	<0.01							0.002		1.63						<0.005	0.32	15.5	<0.0001	0.7	0.46
M222W	18/11/2018	6.19	11000	6970	<1	<1	282	282	130	3630	406	494	1080	11	<0.01	0.004	<0.001	0.268		<0.001	<0.001	<0.001	<0.001	1.48	0.002	<0.001	<0.01		<0.01	<0.005	0.34	11		0.6	0.12
M222W	24/05/2019	6.09	10700	7230	<1	<1	261	261	159	4000	432	506	1180	10								0.036		1.65						0.069	0.32	18.6	<0.0001	0.7	0.39
M222W	10/11/2019	6.09	10700	8400	<1	<1	275	275	161	3780	404	470	1110	11	<0.01	0.007	<0.001	0.248		<0.001	<0.001	0.014	<0.001	1.56	0.003	0.028	<0.01		<0.01	0.059	0.32	17.1		0.7	0.41
M222W	20/11/2020	6.3	11100	8600	<1	<1	292	292	155	4090	448	513	1200	11	<0.01							<0.001		1.72						0.013	0.33	0.05	<0.0001	0.7	0.67
M222W	28/10/2021	5.92	11400	9990	<1	<1	243	243	163	3800	438	481	1110	10	<0.01							0.007		1.78						0.719	0.33	19.5	<0.0001	0.7	0.39
M222W	25/11/2022	6.06	10800	8830	<1	<1	249	249	178	4140	422	518	1180	11	<0.01	0.005	<0.001	0.287		<0.001	<0.001	0.006	<0.001	1.87	0.003	0.016	<0.01		<0.01	0.066	0.33	22.2	<0.0001	0.6	0.54
M224W	16/06/2012	6.22	29500	22300	<1	<1	355	355	1600	9560	831	1260	4170	11		<0.050	<0.00001	0.078	<0.0050	<0.010	0.011	<0.00005	<0.010	7.75		<0.00005			<0.10	0.06			<0.0001	0.9	
M224W	15/12/2012	6.24	28000	22000	<5	<5	340	340	1500	14000	780	1100	4500	13		0.003	<0.0005	0.11	<0.0001	<0.001	0.012	<0.001	<0.001	7.8		0.023			0.001	0.009			<0.00005	0.74	0.03
M224W	7/04/2013	5.73	25000	20000	<5	<5	360	360	1300	11000	740	1000	4300	16		0.002	<0.0005	0.2	0.0002	<0.001	0.015	<0.001	<0.001	8.1		0.04			<0.001	0.024			<0.00005	0.45	<0.005
M224W	25/05/2013	6.11	18000	14000	<5	<5	220	220	880	6200	610	680	2600	17		0.004	<0.0005	0.14	<0.0001	<0.001	0.007	<0.001	<0.001	4.8		0.083			0.002	0.008			<0.00005	0.23	<0.005
M224W	6/08/2013	6.07	23000	17000	<5	<5	240	240	1200	9100	840	980	4500	12		0.005	<0.0005	0.13	<0.0001	<0.001	0.01	<0.001	<0.001	6.8		0.018			<0.001	0.027			<0.00005	0.37	0.052
M224W	6/12/2013	6.15	28000	27000	<5	<5	280	280	6200	11000	1000	1400	6200	13	<.5	0.007	<0.0005	0.13	<0.0001	<0.001	0.012	<0.001	<0.001	8		0.015			<0.001	0.021			<0.00005	0.51	0.007
M224W	10/05/2014	6.24	27200	17700	<1	<1	253	253	1250	10200	779	1080	3690	11	<0.01							<0.05		7.57						0.056			<0.0001		0.3
M224W	19/08/2014	6.34	27600	21000	<1	<1	192	192	1060	10800	822	1300	4590	13	<0.01							<0.001		7.98						0.302			<0.0001	0.4	0.79
M224W	4/12/2014	6.14	31600	22900	<1	<1	186	186	842	9710	764	1320	4080	13								<0.001		6.83						0.067			<0.0001	0.4	0.17
M224W	12/03/2015	6.46	22900	16500	<1	<1	174	174	710	8850	661	842	3240	10	<0.01	0.004	<0.001	0.157		<0.001	0.016	0.006	<0.001	4.4		0.119			<0.01	0.044				0.6	
M224W	17/05/2015	6.36	21000	16800	<1	<1	184	184	978	7200	640	768	2760	8	<0.01	0.006	<0.001	0.164	<0.0001	<0.001	0.021	0.001	<0.001	4.59		0.025			<0.01	0.05			<0.0001	0.3	
M224W	27/07/2015	6.13	24700	17100	<1	<1	188	188	948	8670	712	984	3390	9	<0.01	0.008	<0.001	0.157	0.0001	<0.001	0.019	0.003	<0.001	4.51		0.17			<0.01	0.059			<0.0001	0.5	
M224W	17/11/2015	6.13	27700	17500	<1	<1	158	158	890	9930	613	870	3320	7		0.008	<0.001	0.163	<0.0001	<0.001	0.027	<0.001	<0.001	3.78		0.014			<0.01	0.101			<0.0001	0.4	0.11
M224W	2/03/2016	7.38	10800	5950	<1	<1	128	128	656	3350	316	360	1600	6	<0.01	0.005	<0.001	0.065		<0.001	0.009	0.002	<0.001	1.36		0.021			<0.01	0.037				0.4	0.06
M224W	13/05/2016	7.48	17900	11100	<1	<1	202	202	799	5860	512	664	2680	9		0.008	<0.001	0.159	<0.0001	<0.001	0.011	0.005	<0.001	3.42	0.001	0.007	<0.01	11.4	<0.01	0.176	0.34	4.8	<0.0001	0.4	<0.05
M224W	29/08/2016	7.21	4240	2360	<1	<1	101	101	541	1020	172	107	543	5		0.003	<0.001	0.06		<0.001	0.005	<0.001	<0.001	0.834	0.001	0.004	<0.01	3.19	<0.01	0.037	0.13	0.2		0.2	0.09
M224W	15/11/2016	6.77	17700	11700	<1	<1	192	192	802	6210	570	696	2650	8	<0.01	0.008	<0.001	0.182	<0.0001	<0.001	0.017	<0.001	<0.001	3.75	0.002	0.02	<0.01	14	<0.01	0.21	0.24	5.39	<0.0001	0.4	0.07
M224W	13/06/2017		17600	11000	<1	<1	238	238	1070	6490	676	630	2400	9								<0.001		4.04						0.052	0.22	7.91	<0.0001	0.3	0.08
M224W	07/11/2017	6.97	20400	14100	<1	<1	232	232	1000	7120	774	778	2650	10		<0.001	0.193	<0.001		0.015	<0.001		<0.001	4.94	0.003	0.042	<0.01	<0.01	<0.01	0.044	0.22	10.1		0.4	0.3
M224W	29/05/2018	6.28	27200					304	1240	10100	870	1090	4100	10								0.002		6.72						0.062	0.34	7.2	<0.0001	0.5	0.22
M224W	18/11/2018	6.33	5490	3630	<1	<1	141	141	574	1270	264	137	669	5	<0.01	<0.001	<0.001	0.045		<0.001	0.003	0.017	<0.001	0.313	<0.001	0.014	<0.01		<0.01	0.103	0.16	0.52		0.2	0.03
M224W	24/05/2019	6.53	12800	8730	<1	<1	152	152	907	4490	448	440	1960	6	<0.01							0.001		1.68						0.032	0.29	1.12	<0.0001	0.4	0.13
M224W	10/11/2019	6.12	18400	15200	<1	<1	141	141	644	6430	426	628	2760	6	<0.01	0.006	<0.001	0.126		<0.001	0.026	0.002	<0.001	1.58	0.001	0.045	<0.01		<0.01	0.059	0.39	4.43		0.3	<0.05
M224W	20/11/2020	6.13	20100	15600	<1	<1	137	137	575	7590	413	670	2980	5	<0.01							<0.001		1.64						0.042	0.39	0.2	<0.0001	0.3	0.09
M224W	28/10/2021	6.22	22600	18800	<1	<1	209	209	718	7490	582	767	3150	7	<0.01							<0.001		5.23						0.038	0.38	14.2	<0.0001	0.5	0.08
M224W	25/11/2022	6.03	25600	22600	<1	<1	336	336	1210	10700	758	1170	5030	8	<0.05	<0.005	<0.005	0.169		<0.005	0.017	0.063	<0.005	6.03	<0.005	0.12	<0.05		<0.05	0.18	0.55	3.82	<0.0001	0.7	0.4
AN020F	13/05/2016	6.2	10800	6210	<1	<1	22	22	<1	3750	429	178	1550	29	<0.01	<0.001	<0.001	3.72	<0.0001	<0.001	0.001	<0.001	<0.001	1.92	<0.001	<0.001	<0.01	11.3	<0.01	<0.005	0.14	14.3	<0.0001	<0.1	<0.01
AN020F	15/11/2016	6.32	10600	7210	<1	<1	21	21	1	4030	439	174	1450	26		<0.001	<0.001	3.62		<0.001	<0.001	<0.001	<0.001	1.85	0.001	0.001	<0.01	11	<0.01	<0.005	0.19	8.25		<0.1	<0.05
AN020F	15/11/2017	7.39	10900	7010	<1	<1	47	47	<1	3790	456	182	1650	29		<0.001	<0.001	3.42		<0.001	<0.001	<0.001	<0.001	1.17	0.005	0.006	<0.01		<0.01	<0.005	0.14	5.01		<0.1	0.11
AN020F	15/11/2018	7.05	11200	7280	<1	<1	126	126	<1	3800	460	203	1460	24		<0.001	<0.001	3.88		<0.001	<0.001	0.001	<0.001	1.19	0.007	0.001	<0.01		<0.01	<0.005	0.2	5.36		<0.1	<0.01
AN020F	11/11/2019	7.58	10400	7310	<1	<1	20	20	<1	3830	457	174	1580	29		<0.001	<0.001	3.66		<0.001	<0.001	0.005	<0.001	1.42	0.002	0.002	<0.01		<0.01	<0.005	0.13	1.68		<0.1	<0.01
AN020F	21/11/2020	7.03	10300	8090	<1	<1	5	5	<1	3990	51	<1	2160	21		0	0	5.34				<0.001		2.28	0.002					0.006	0.16	2.99	<0.0001	<0.1	0.01
AN020F	30/10/2021	7.1	9590	9070	<1	<1	27	27	<1	3760	420	169	1540	28		<0.001	<0.001	3.7		<0.001	<0.001	0.001	<0.001	1.51	0.003	0.003	<0.01		<0.01	0.014	0.09	1.87		0.1	<0.01
AN020F	10/12/2022	6.02	10800	7610	<1	<1	3	3	<1	3800	380	147	1500	27		<0.001	<0.001	3.84		<0.001	<0.001	<0.001	<0.001	1.48	0.001	0.001	<0.01		<0.01	0.012	0.11	3.65		<0.1	<0.01

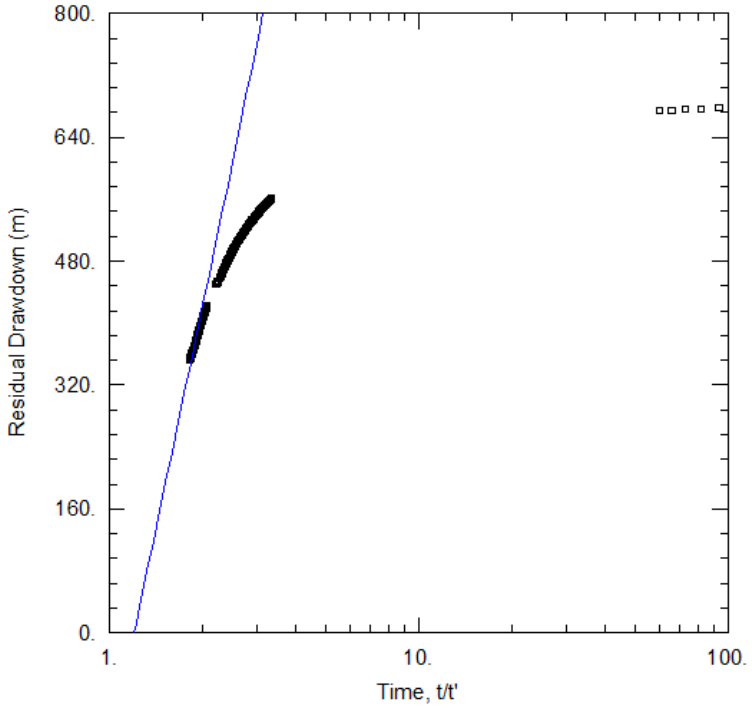
DEEP MONITORING

Monitoring Bore ID	Sample Date	Field pH	Electrical Conductivity	Total Dissolved Solids	Hydroxide Alkalinity (OH-) as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Calcium - Dissolved	Magnesium - Dissolved	Sodium - Dissolved	Potassium - Dissolved	Aluminium - Dissolved	Arsenic-Dissolved	Beryllium-Dissolved	Barium-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Cobalt-Dissolved	Copper-Dissolved	Lead-Dissolved	Manganese-Dissolved	Molybdenum	Nickel-Dissolved	Selenium	Strontium	Vanadium-Dissolved	Zinc-Dissolved	Boron	Iron	Mercury-Dissolved	Fluoride, F	Phosphate as P in water
			µS/cm	(grav) mg/L	as CaCO3 mg/L	CaCO3 mg/L	CaCO3 mg/L	CaCO3 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
M313W	25/07/2014	9.42	1710	1160	<1	51	283	334	12	252	7	<1	319	98		0.004	<0.001	0.843		0.018	0.01	2.12	2.19	0.429		0.032			0.02	0.568				0.6	
M313W	13/02/2015	8.12	6940	4110	<1	<1	781	781	4	1810	26	5	1420	126		<0.001	<0.001	4.88		<0.001	<0.001	0.055	<0.001	0.139		0.004			<0.01	<0.005				2.4	
M313W	11/11/2015	8.3	6890	3870	<1	<1	666	667	2	1910	22	4	1250	56	<0.01	<0.001	<0.001	2.8		<0.001	<0.001	0.002	<0.001	0.099		0.002			<0.01	<0.005				2.4	0.87
M313W	30/05/2016	8.48	4570	2420	<1	41	443	484	2	1130	10	1	1000	60		<0.001	<0.001	1.23	<0.001	<0.001	<0.001	<0.001	<0.001	0.04	0.017	<0.001	<0.01	1.39	<0.01	0.008	0.5	0.28			0.6
M313W	15/11/2016	7.8	5620	2950	<1	<1	634	634	<1	1420	20	3	1170	62		0.002	<0.001	2.63	<0.001	<0.001	<0.001	0.002	<0.001	0.077	0.035	0.003	<0.01	3.02	<0.01	0.018	0.95	1.08		2.3	0.89
M313W	19/11/2017	8.59	6020	3320	<1	48	587	636	<1	1720	24	4	1370	60		0.003	<0.001	2.54		<0.001	<0.001	<0.001	<0.001	0.071	0.035	0.002	<0.01		<0.01	<0.005	0.92	0.57		2	
M313W	16/11/2018	8.05	5840	3210	<1	4	621	625	<1	1350	24	4	1200	61		0.003	<0.001	2.25		<0.001	<0.001	0.002	<0.001	0.106	0.039	0.002	<0.01		<0.01	<0.005	0.81	1.07		1.9	0.77
M313W	14/11/2019	7.99	6030	3360	<1	<1	621	621	2	1600	20	4	1260	55		0.003	<0.001	2.42		<0.001	<0.001	<0.001	<0.001	0.088	0.041	0.002	<0.01		<0.01	<0.005	0.88	0.45		2.1	0.68
M313W	23/11/2020	8.23	6020	3390	<1	<1	648	648	1	1700	26	5	1520	67		0.003	<0.001	2.85		<0.001	<0.001	<0.001	<0.001	0.082	0.055	0.003	<0.01		<0.01	<0.005	1.31	1.4		2.2	0.65
M313W	29/10/2021	8.18	5740	3510	<1	19	624	643	<1	1530	21	5	1320	62		0.003	<0.001	2.18		<0.001	<0.001	<0.001	<0.001	0.074	0.044	0.002	<0.01		<0.01	<0.005	0.95	0.76		2	0.69
M313W	14/12/2022	8.49	5780	3380	<1	32	572	604	<1	1560	20	4	1280	54		0.002	<0.001	2.27		<0.001	<0.001	0.001	<0.001	0.071	0.042	0.002	<0.01		<0.01	0.019	1.03	0.91		2	0.67
M314W	24/07/2014	8.57	5090	4790	<1	9	1210	1220	134	198	46	1	212	1450		0.013	<0.001	0.575		0.015	0.005	7.08	0.562	0.446		0.018			<0.01	0.472				0.4	
M314W	13/02/2015	8.04	7150	5470	<1	<1	1180	1180	69	1370	29	6	1040	795		0.004	<0.001	1.37		<0.001	0.002	0.995	<0.001	0.141		0.01			<0.01	<0.005				0.9	
M314W	13/11/2015	8.01	8210	5280	<1	<1	836	836	2	2190	17	5	1420	335		0.003	<0.001	1.31		<0.001	<0.001	0.031	<0.001	0.14		0.013			<0.01	0.011				1.1	17.4
M314W	30/05/2016	8.6	8500	4880	<1	49	767	817	<1	2370	22	6	1640	326		0.003	<0.001	5.21	<0.001		<0.001	0.022	<0.001	0.028	0.053	0.001	<0.01	5.5	<0.01	0.01	0.87	0.1	0.87		9.67
M314W	15/11/2016	8.88	8180	4810	<1	108	827	934	<1	2290	19	6	1500	404		0.004	<0.001	3.88	<0.001	<0.001	<0.001	0.03	<0.001	0.036	0.062	0.002	<0.01	3.67	<0.01	0.009	0.9	0.21		1.3	12.1
M314W	18/11/2017	8.9	8300	4860	<1	169	908	1080	<1	2190	17	5	1880	543		0.004	<0.001	2.91		<0.001	<0.001	0.024	<0.001	0.053	0.068	0.002	<0.01		<0.01	<0.005	0.76	0.18		1.2	
M314W	20/11/2018	8.72	8010	4910	<1	142	892	1030	<1	2010	15	5	1530	459		0.005	<0.001	2.86		<0.001	<0.001	0.024	<0.001	0.057	0.078	0.002	<0.01		<0.01	<0.005	0.81	0.29		1.2	13.1
M314W	16/11/2019	8.59	7910	4900	<1	86	991	1080	2	1860	8	4	1460	465		0.005	<0.001	2.43		<0.001	<0.001	0.024	<0.001	0.068	0.082	0.003	<0.01		<0.01	<0.005	0.77	0.33		1.3	13.8
M314W	24/11/2020	8.64	7880	4510	<1	37	1010	1050	5	2130	10	4	1610	506		0.006	<0.001	2.82		<0.001	<0.001	0.021	<0.001	0.073	0.089	0.003	<0.01		<0.01	<0.005	0.91	0.59		1.3	14.5
M314W	31/10/2021	8.36	7620	5020	<1	73	992	1060	<1	1910	6	4	1500	468		0.006	<0.001	2.44		<0.001	<0.001	0.017	<0.001	0.025	0.078	0.002	<0.01		<0.01	<0.005	0.79	0.7		1.2	15.3
M314W	27/11/2022	8.29	7870	4980	<1	86	885	971	<1	1960	7	4	1580	499		0.006	<0.001	2.52		<0.001	<0.001	0.016	<0.001	0.017	0.091	0.004	<0.01		<0.01	0.02	0.94	0.64		1.2	15.4
GR067V	30/08/2016	9.05	7020	4000	<1	407	1550	1960	19	1180	7	1	1580	14		0.003	<0.001	1.48	0.001	0.001	<0.001	0.002	<0.001	0.11	0.032	0.006	<0.01	1.18	<0.01	0.011	0.81	1.56			
GR067V	15/11/2016	8.12	7850	4640	<1	<1	2310	2310	3	1260	15	3	1850	13		0.003	<0.001	4.94	0.001	0.001	<0.001	<0.001	<0.001	0.024	0.024	0.001	<0.01	3.72	<0.01	0.018	1.17	0.68		1.8	
GR067V	19/11/2017	8.72	8210	4910	<1	238	2120	2360	4	1440	19	3	2190	12		0.003	<0.001	3.83		<0.001	<0.001	<0.001	<0.001	0.008	0.019	<0.001	<0.01		<0.01	0.008	1.03	0.16		1.7	
GR067V	23/11/2018	8.46	8340	6020	<1	456	1950	2410	7	1460	18	3	2050	12		0.002	<0.001	4.44		<0.001	<0.001	<0.001	<0.001	0.008	0.023	<0.001	<0.01		<0.01	0.008	1.18	0.22		2	
GR067V	16/11/2019	8.19	7950	4950	<1	47	2380	2420	7	1350	7	3	2040	9		0.002	<0.001	3.23		<0.001	<0.001	<0.001	<0.001	0.009	0.019	<0.001	<0.01		<0.01	0.005	1.28	0.29		2	
GR067V	24/11/2020	8.73	7980	5040	<1	111	2240	2350	12	1520	7	3	1860	10		0.003	<0.001	5.28		<0.001	<0.001	<0.001	<0.001	0.014	0.03	<0.001	<0.01		<0.01	<0.005	1.56	0.54		2.2	
GR067V	31/10/2021	8.44	7700	5240	<1	223	2070	2300	22	1410	6	3	1980	10		0.002	<0.001	4.06		<0.001	<0.001	0.001	<0.001	0.012	0.017	<0.001	<0.01		<0.01	<0.005	1.39	0.32		1.9	0.44
GR067V	27/11/2022	8.37	8120	4920	<1	221	2000	2220	29	1490	10	4	2120	11		0.002	<0.001	4.62		<0.001	<0.001	<0.001	<0.001	0.016	0.024	<0.001	<0.01		<0.01	0.01	1.3	0.42		2	0.51
M162V	14/11/2015	8.44	11500	6970	<1	38	1060	1090	3	3640	10	6	2370	12		<0.001	<0.001	0.236		<0.001	<0.001	<0.001	<0.001	0.092		<0.001			<0.01	<0.005				1.9	
M162V	30/05/2016	7.91	12700	7250	<1	<1	1050	1050	2	4040	56	19	2590	12		<0.001	<0.001	11	<0.001	<0.001	<0.001	0.01	<0.001	0.063	0.002	0.001	<0.01	10.8	<0.01	0.16	2.4	3			
M162V	15/11/2016	7.7	12300	6660	<1	<1	1060	1060	<1	3870	69	18	2670	12		<0.001	<0.001	9.93	<0.001	<0.001	<0.001	<0.001	<0.001	0.034	0.001	<0.001	<0.01	9.77	<0.01	0.032	2.02	2.19		2.6	
M134W	14/11/2017	8.1	15600	9810	<1	<1	168	168	<1	5770	209	62	3490	12		<0.001	<0.001	23		<0.001	<0.001	<0.001	<0.001	0.064	0.001	<0.001	<0.01		<0.01	0.009	0.46	0.4		0.5	
M134W	215/11/2018	7.3	16000	9710	<1	<1	159	159	<1	5310	182	61	2990	12		<0.001	<0.001	20.3		<0.001	<0.001	0.002	<0.001	0.063	0.001	<0.001	<0.01		<0.01	0.011	0.48	0.3		0.5	
M134W	14/11/2019	7.27	15500	9670	<1	<1	162	162	1	5460	134	58	3200	12		0.002	<0.001	20.2		<0.001	0.005	<0.001	<0.001	0.098	0.007	0.02	<0.01		<0.01	0.02	0.47	1.18		0.5	
M134W	24/11/2020	7.73	15500	9430	<1	<1	166	166	<1	5850	114	55	3100	11	<0.01							<0.001		0.068						0.011	0.49	0.45	<0.0001	0.6	
GM031V	21/12/2021	8.06	10170	5750	<1	<1	694	694	<1	3300	20	11	2240	6		<0.001	<0.001			<0.001	<0.001	0.006	<0.001	0.011	0.002	<0.001	<0.01		<0.01	0.007	1.11	0.07		1.5	
GM031V	14/12/2022	8.44	9940	5890	<1	31	610	641	<1	3180	19	10	2220	6		<0.001	<0.001	7.35		<0.001	<0.001	<0.001	<0.001	0.012	0.002	<0.001	<0.01		<0.01	0.006	1.47	0.07		1.6	<0.01
MB1-D	17/11/2019	7.95	8790	5110	<1	<1	817	817	<1	2250	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	
MB1-D	20/11/2020	8.26	9380	5460	<1	<1	1600	1600	<1	2560	14	10	2410	24		0.003	<0.001	4.12		<0.001	<0.001	0.002	0.006	0.015	0.017	0.032	<0.01		<0.01	0.024	1.68	1.14	<0.0001	2	
MB1-D	27/10/2021	8.15	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	0.01	<0.01		<0.01	<0.005	1.19	0.56		2	
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	0.05	<0.01		<0.01	0.008	1.39	0.68		2.1	1.31
GW007B	15/11/2019	6.79	15700	9910	<1	<1	1380	1380	<1	4920	276	256	2330	64		0.005	<0.001	12.2		<0.001	0.001	<0.001	<0.001	0.12	0.006	0.02	<0.01		<0.01	2.16	0.24	2.94		0.2	
M324W	26/07/2014	9.17	1170	707	<1	48	177	225	24	188	26	5	199	31		0.005	<0.001	0.31		0.004	0.004	0.582	0.459	0.304		0.008			<0.01	0.427				1	
M324W	13/02/2015	8.83	2660	1540	<1	105	615	720	1	505	7	2	627	29		<0.001	<0.001	0.482		<0.001	<0.001	<0.001	<0.001	0.018		0.002			<0.01	0.093				3.7	
M324W	30/05/2016	8.57	2750	1390	<1	64	624	688	6	522	6	1	599	12		<0.001	<0.001	0.921	<0.001	<0.001	<0.001	<0.001	<0.001	0.025	0.02	<0.001	<0.01	0.889	<0.01	0.006	0.76	0.22			0.46
M324W	15/11/2016	8.58	2650	1540	<1	59	635	694	<1	503	5	1	612	12		0.001	<0.001	0.738	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	0.024	<0.001	<0.01	0.807	<0.01	0.01	0.78	0.13		4.5	0.44
M324W	19/11/2017	8.86	2740	1300	<1	104	568	672	<1	536	4	1	666	13		0.001	<0.001	0.572		<0.001	<0.001	<0.001	<0.001	0.006	0.027	<0.001	<0.01		<0.01	<0.005	0.72	<0.05		3.9	
M324W	16/11/2018	8.66	2740	1520	<1	86	565	651	<1	507	3	1	579	13		0.001	<0.001	0.555		<0.001	<0.001	0.001	<0.001	0.006	0.031	<0.001	<0.01		<0.01	<0.005	0.74	0.12		3.8	0.49
M324W	14/11/2019	8.7	2690	1530	<1	74	571	645	1	524	2	<1	595	12		0.001	<0.001	0.56		<0.001	<0.001	<0.001	0.001	0.005	0.03	<0.001	<0.01		<0.01	<0.005	0.72	0.2		4.3	0.49
M324W	23/11/2020	8.99	2590	1480	<1	92	556	648	<1	566	1	1	748	15		0.001	<0.001	0.584		<0.001	<0.001	0.002	0.002	0.005	0.044	<0.001	<0.01		<0.01	0.005	0.99	0.22		4.3	0.57
M324W	29/10/2021	8.89	2650	1570	<1	87	552	639	<1	529	<1	<1	612	13		0.001	<0.001	0.433		<0.001	<0.001	<0.001	0.002	0.004	0.036	<0.001	<0.01		<0.01	<0.005	0.77	0.18		3.8	0.59
M325W	13/02/2015	8.55	3410	2260	<1	14	252	297	68	906	2	<1	709	73		0.002	<0.001	0.005		<0.001	0.003	0.016	<0.001	0.009		0.009			<0.01	0.024				0.7	
M325W	13/11/2015	8.13	5000	2730	<1	<1	450	450	4	1400	8	1	919	40		0.001	<0.001	0.252		<0.001	0.002	<0.001	<0.001	0.086		<0.001			<0.01	<0.005				1.1	
M325W	30/05/2016	8.74	6150	3310	<1	75	370	446	1	1600	6	<1	1250	39		0.002	<0.001	0.384	<0.001	<0.001	<0.001	0.008	<0.001	0.057	0.114	0.002	<0.01	0.639	<0.01	0.009	1.17	0.24			
AN019F	10/11/2015	11.8	10200	5430	456	82	<1	539	33	2920	154	<1	1620	19		0.002	<0.001	2.79		<0.001	<0.001	0.006	<0.001	<0.001		0.007			<0.01	0.01				0.8	0.04
AN019F	30/05/2016	11.6	10800	5970	410	100	<1	510	38	3180	168	<1	1840	29		0.004	<0.001	3.25	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.056	0.008	<0.01	8.18	<0.01	<0.005	0.42	<0.05	0.42		0.05
AN019F	15/11/2016	11.8	11100	6140	428	125	<1	553	37	3400	162	<1	1970	28		0.004	<0.001	2.65	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.036	0.006	<0.01	5.92	<0.01	0.014	0.46	<0.05		0.7	<0.05
AN019F	15/11/2017	11.1	10700	5890	123	135	<1	258	35	3340	104	<1	2330	27		0.004	<0.001	2.4		<0.001	<0.001	<0.001	<0.001	<0.001	0.027	0.003	<0.01		<0.01	0.006	0.45	<0.05		0.7	
AN019F	11/11/2019	11.41	10700	6550	195	125	<1	319	32	3540	82	<1	2280	23		0.004	<0.001	2.34		<0.001	<0.001	<0.001	<0.001	<0.001	0.024	0.002	<0.01		<0.01	<0.005	0.57	<0.05		0.8	<0.01
AN019F	21/11/2020	11.37	10800	5750	230	61	<1	291	29	3670	63	<1	2590	24		0.004	<0.001	2.86		<0.001	<0.001	<0.001	<0.001	<0.001	0.03	0.002	<0.01		<0.01	<0.005	0.75	<0.05		0.8	<0.01
AN019F	30/11/2021	11.43	10000	6040	66	157	<1	223	26	3410	41	<1	2120	20		0.004	<0.001	2.41		<0.001	<0.001	<0.001	<0.001	<0.001	0.019	0.002	<0.01		<0.01	<0.005	0.47	<0.05		0.7	0.08
AN019F	14/12/2022	11.2	9930	6030	129	100	<1	228	27	3440	40	<1	2220	20		0.003	<0.001	2.44		<0.001	<0.001	0.011	<0.001	0.004	0.021	0.003	<0.01		<0.01	0.082	0.62	<0.05		0.7	0.01

APPENDIX C: 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

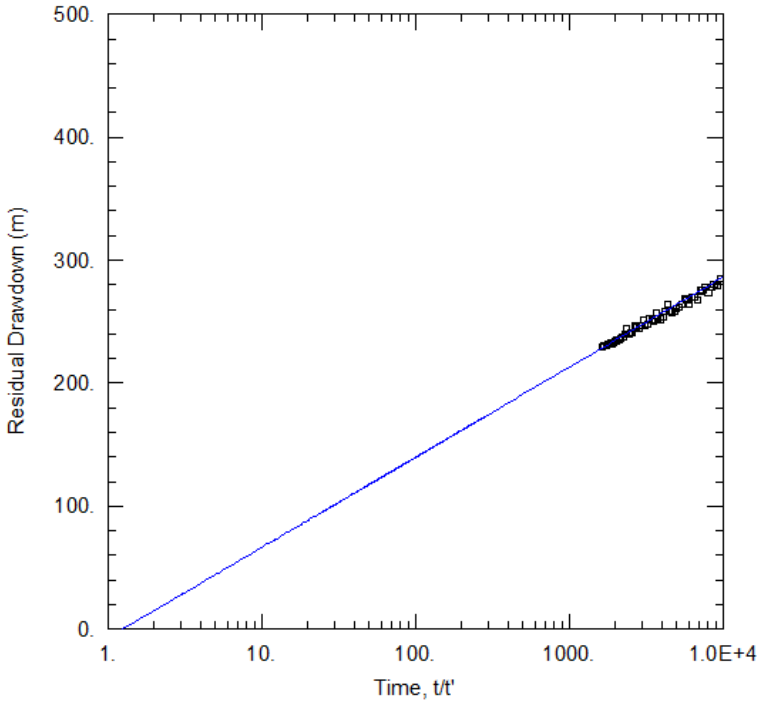
SOLUTION

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 B: Water Level Results

Shallow Monitoring Bores

Bore Name	SWL (mAHD)																											
	9/06/2012	13/12/2012	8/04/2013	25/05/2013	6/08/2013	6/12/2013	5/05/2014	19/08/2014	5/12/2014	11/03/2015	17/05/2015	27/07/2015	13/11/2015	2/03/2016	13/05/2016	29/08/2016	15/11/2016	15/06/2017	12/11/2017	1/06/2018	17/11/2018	24/05/2019	12/11/2019	22/11/2020	24/05/2021	30/10/2021	9/06/2022	29/11/2022
M339W	200.426	200.456	200.43	200.451	200.462	200.546	200.49		200.56	200.533	200.416	200.398	200.556	200.466	200.456	200.426	200.500	200.507	200.498	200.520	200.600	200.620	200.660	200.750	200.680	200.820	200.780	200.870
M225W	206.298	206.641	206.737	206.8	207.455	207.152	207.11		207.27	207.349	207.257	207.23	207.402	207.215	207.245	207.248	207.316	207.54	207.685	207.75	207.9		207.78	207.43	207.2	207.14	207.01	207.03
M340W	207.621	208.973	208.118	208.216	208.261	208.507	208.6		208.7	208.771	208.753	208.805	208.918	208.869	208.9	208.761	205.946	203.032	dry									
M230W	208.495	208.705	208.715	208.837	208.865	209.062	209.07		209.2	209.204	209.106	209.058	209.145	208.884	208.922	208.863	208.992	208.629	208.591	208.214	207.7	206.94	205.95	203.17	202.6			
M300W																										200.1	204.496	204.437
GW004A																							235.162	234.692	234.542	234.442	234.542	234.437
GW007A																							dry					
M250W	233.288	233.248	233.238	233.232	233.248	233.308	233.26		233.33	233.289	233.25	233.221	233.25	233.243	233.258	233.328	233.237	233.283	233.273	233.29	233.32	233.34	233.34			233.55	233.39	
AN021F															237.06		242.34		238.47	239.06	239.52		240.52	241.52	237.62	237.37	242.44	242.7
M224W	211.675	211.365	211.45	211.705	211.42	211.11	210.89	210.65	210.49	210.561	210.419	210.277	209.982	210.02	209.969		209.852	210.354	210.355	210.08	209.69	209.57	209.36	208.96	207.84	208.76	208.8	209.22
M222W	202.414	202.974	203.209		203.819	204.014	204.3	204.65	204.95	205.21	205.44	205.54	205.994	205.929	205.969	206.014	206.014	206.149	206.301	206.3	206.28	206.22	206.22	206.22	205.98	206	205.94	206.02
MB1S																							263.51	262.72	262.75	262.7	262.745	262.7875
GW004B																							232.09	230.95	231.80	231.74	232.74	231.67
AEN1214																								215.12	217.32	215.32		216.18
AEN1234																								185.34	185.44	185.35	185.45	185.35
AEN1063																								143.12	142.845	142.53	142.64	142.965
MB12																				298.54	286.88	286.31	294.26	296.01	298.28	298.51	298.62	298.65
AN020F														238.37	238.366	238.48	238.44		237.18	238.61	238.39	238.36	238.36	237.99	237.62	237.37	236.86	236.61

APPENDIX C: Water Quality Results

Shallow Monitoring Bores

Monitoring Bore ID	Sample Date	Field pH	Electrical Conductivity	Total Dissolved Solids	Hydroxide Alkalinity (OH-) as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate	Chloride	Calcium	Magnesium	Sodium	Potassium	Aluminium - Dissolved	Arsenic-Dissolved	Beryllium-Dissolved	Barium-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Cobalt-Dissolved	Copper-Dissolved	Lead-Dissolved	Manganese-Dissolved	Molybdenum	Nickel-Dissolved	Selenium - Dissolved	Strontium	Vanadium-Dissolved	Zinc-Dissolved	Boron - Dissolved	Iron - Dissolved	Mercury-Dissolved	Fluoride, F	Phosphate as P in water	Ammonia as N	Nitrite as N	Nitrate as N	Dissolved Organic Carbon	Total Organic Carbon	Methane
			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	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L
M339W	11/12/2012	6.46	38000	26000	<5	<5	680	680	980	15000	150	670	10000	110		<0.001	<0.0005	0.056	0.0004	0.006	<0.001	0.007	<0.001	0.016		0.018			0.003	0.05			0.00008	0.45	0.1						
M339W	4/04/2013	6.28	36000	22000	<5	<5	690	690	830	14000	160	700	9700	120		<0.001	<0.0005	0.057	0.0003	0.007	<0.001	0.005	<0.001	0.013		0.027			0.003	0.039			<0.00005	0.44	0.11						
M339W	21/05/2013	8.09	37000	29000	<5	<5	680	680	1100	17000	150	710	10000	120		<0.001	<0.0005	0.067	0.0005	0.004	<0.001	0.059	<0.001	0.012		0.014			0.003	0.068			0.00009	0.33	0.026						
M339W	7/08/2013	6.42	37000	25000	<5	<5	660	660	990	15000	190	670	13000	150		<0.002	<0.0005	0.061	0.0004	0.003	<0.001	0.004	<0.001	0.007		0.014			0.003	0.078			<0.00005	0.29	0.19						
M339W	5/12/2013	6.6	39000	28000	<5	<5	660	660	1100	16000	160	740	11000	110		<0.001	<0.0005	0.055	0.0005	0.006	<0.001	0.007	<0.001	0.007		0.015			0.003	0.06			<0.00005	0.37	0.085						
M339W	11/05/2014	6.6	37900	24600	<1	<1	698	698	1020	13800	150	722	7740	100	<0.5							<0.05		<0.01						<0.05			<0.0001		0.26						
M339W	9/12/2014	6.46	39300	25400	<1	<1	706	706	893	13700	158	780	8220	138	<0.05							<0.005		<0.005						0.04			<0.0001	0.4	0.08						
M339W	10/03/2015	6.53	39000	27100	<1	<1	644	644	932	13900	183	682	8360	98		<0.005	<0.005	0.058		<0.005	<0.005	<0.005	<0.005	0.009		0.026			<0.05	0.053				0.8		0.08	<0.01	0.1	3	3	
M339W	16/05/2015	6.67	37500	24200	<1	<1	647	647	1140	12200	167	668	7770	82	<0.01	<0.001	<0.001	0.124	0.0007	0.002	<0.001	0.009	<0.001	0.009		0.012			<0.01	0.128			0.0008	0.4		0.04	0.01	0.06	10	9	
M339W	27/07/2015	6.53	38200	25400	<1	<1	658	658	1020	13500	180	676	7600	90	<0.01	<0.001	<0.001	0.051	0.0004	<0.001	<0.001	0.001	<0.001	0.003		0.012			<0.01	0.016			0.001	0.5		0.02	<0.01	0.03	2	6	
M339W	16/11/2015	6.43	32300	21200	<1	<1	714	714	987	12700	147	669	7170	81	<0.05	<0.005	<0.005	0.053	<0.0005	<0.005	<0.005	0.01	<0.005	<0.005		0.014			<0.05	0.149			0.0006	0.4	0.1	0.04	<0.01	0.08	11	8	
M339W	2/03/2016	7.56	39800	21200	<1	<1	712	712	1000	13400	160	747	8710	104		<0.001	<0.001	0.050		0.007	<0.001	0.002	<0.001	0.002		0.014			<0.01	0.046				0.4	0.24	0.03	<0.01	0.15	3	5	
M339W	13/05/2016		39000	24400	<1	<1	681	681	1020	13000	178	712	7850	89	<0.01	0.001	<0.001	0.055		0.01	<0.001	0.008	<0.001	0.005	0.003	0.014	0.01	8.48	<0.01	0.051	2.58	<0.05	<0.0001	0.4	0.62	0.02	<0.01	0.16	6	12	<10
M339W	29/08/2016	8.37	41300	28200	<1	43	714	757	993	12600	170	688	7790	93		<0.005	<0.005	0.058		0.01	<0.005	0.005	<0.005	<0.005	<0.005	0.014	<0.05	8.98	<0.05	0.027	2.66	<0.05		0.5	0.07	<0.01	<0.01	0.2	6	5	<10
M339W	15/11/2016	7.13	37100	22900	<1	<1	652	652	1050	12600	171	743	8440	92	<0.01	<0.001	<0.001	0.055	0.0001	0.002	<0.001	<0.001	<0.001	0.006	0.003	0.014	<0.01	8.36	<0.01	0.021	2.42	<0.05	<0.0001	0.5	0.15	<0.01	<0.01	<0.01	<1	8	<10
M339W	13/06/2017		38600	25100	<1	<1	726	726	964	13500	186	780	9040	105	<0.05							0.006		<0.005						<0.025	2.74	<0.05	<0.0001	0.5							
M339W	12/11/2017	6.99	39800	27100	<1	<1	708	708	923	13700	204	792	9570	102		<0.005	<0.005	0.062		0.008	<0.005		<0.005	<0.005	<0.005	0.015	<0.05		<0.05	<0.025	2.96	0.06		0.4	0.07						
M339W	1/06/2018	6.58	39300		<1	<1	644	644	974	12900	181	772	8990	97	<0.05							<0.005		<0.005						<0.025	2.66	<0.05	0.001	0.4	0.09						
M339W	17/11/2018	6.51	42769	26800	<1	<1	661	661	916	11600	174	750	7800	96	<0.05	<0.005	<0.005	0.057		0.01	<0.005	<0.005	<0.005	<0.005	<0.005	0.013	<0.05		<0.05	<0.025	2.36	<0.05		0.09		0.03	<0.01	0.17	12	10	<10
M339W	27/05/2019	6.47	37398	26200	<1	<1	632	632	958	13600	174	769	8370	95	<0.05							<0.005		<0.005						0.029	2.91	<0.05	0.0009	<0.05							
M339W	12/11/2019	6.69	38760	23400	<1	<1	669	669	936	13800	142	680	7860	88	<0.05	<0.005	<0.005	0.052		0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05		<0.05	0.047	2.81	<0.05		0.11		0.03	<0.01	0.21	2	14	<10
M339W	22/11/2020	6.73	38200	26800	<1	<1	677	677	941	14000	154	708	8150	91		<0.005	<0.005	0.058		0.01	<0.005	0.008	<0.005	<0.005	<0.005	0.013	<0.05		<0.05	0.026	2.64	<0.05		0.4	0.13	0.06	<0.01	0.18	2	4	<10
M339W	30/10/2021	6.43	40600	28600	<1	<1	617	617	925	12900	168	729	8570	99	<0.05							<0.005		<0.005						0.028	2.39	<0.05	0.0002	0.4	0.14						
M339W	28/11/2022	7.5	33700	26600	<1	<1	621	621	976	13600	166	700	8610	94		<0.005	<0.005	0.066		0.014	<0.005	<0.005	<0.005	0.03	<0.005	0.042	<0.05		<0.05	0.047	2.81	<0.05		0.4	0.22	0.03	<0.01	0.32	<1	7	<10
M225W	3/04/2013	7.54	28000	17000	<5	<5	810	810	710	11000	150	510	7200	84		<0.001	<0.0005	0.063	0.0006	0.003	<0.001	0.01	<0.001	0.011		0.025			0.015	0.042			<0.00005	0.48	0.2						
M225W	21/05/2013	6.53	28000	21000	<5	<5	790	790	660	10000	150	520	7500	82		0.001	<0.0005	0.140	0.0006	0.002	0.001	0.01	<0.001	0.21		0.034			0.009	0.053			<0.00005	0.37	0.11						
M225W	8/08/2013	6.59	29000	20000	<5	<5	780	780	700	11000	160	480	7500	75		<0.001	<0.0005	0.120	0.001	0.002	0.001	0.03	<0.001	0.18		0.068			0.013	0.036			<0.00005	0.32	0.19						
M225W	5/12/2013	6.84	30000	21000	<5	<5	780	780	780	11000	180	490	9500	95	<0.5	<0.001	<0.0005	0.120	0.0007	0.002	0.002	0.009	<0.001	0.35		0.056			0.009	0.031			<0.00005	0.37	0.11						
M225W	6/05/2014	6.98	29900	19400	<1	<1	745	745	369	9940	142	495	5440	72	<0.01							<0.05		<0.01						0.059			<0.0001		0.1						
M225W	5/12/2014	6.73	30500	20100	<1	<1	808	808	617	9880	151	523	6450	76								0.028		0.004						0.058			0.0001	0.5	0.27						
M225W	11/03/2015	6.82	30100	20000	<1	<1	716	716	827	10200	163	508	6600	75	<0.01	<0.005	<0.005	0.075		<0.005	<0.005	<0.005	<0.005	0.009		0.026			<0.05	0.096				0.8		0.07	<0.01	0.25	4	2	
M225W	17/05/2015	6.89	30200	19800	<1	<1	780	780	884	9850	161	518	6430	64	<0.01	0.001	<0.001	0.112	0.0012	0.001	<0.001	0.022	<0.001	0.161		0.048			0.01	0.029			<0.0001	0.4		0.03	<0.01	0.21	6	5	
M225W	28/07/2015	6.96	28700	19300	<1	<1	790	790	735	9660	157	478	5670	65	<0.05	0.001	<0.001	0.089	0.0006	<0.001	<0.001	0.011	<0.001	0.033		0.016			0.01	0.018			<0.0001	0.6		<0.01	<0.01	0.25	<5	<5	
M225W	16/11/2015	6.38	23700	17400	<1	<1	826	826	738	9870	134	485	5460	59		<0.005	<0.005	0.055	0.0006	<0.005	<0.005	0.012	<0.005	<0.005		0.022			<0.05	0.099			0.0001	0.6	0.18	0.01	<0.01	0.25	9	10	
M225W	2/03/2016	7.71	30500	19400	<1	<1	817	817	721	10300	153	541	6530	76	<0.01	<0.001	<0.001	0.053		0.002	<0.001	0.02	<0.001	0.001		0.012			0.01	0.035				0.5	0.25	0.03	<0.01	0.27	6	5	
M225W	13/05/2016	7.57	29600	18400	<1	<1	779	779	752	9390	158	532	6570	66		<0.001	<0.001	0.062	0.0005	0.002	<0.001	0.006	<0.001	0.01	0.004	0.028	<0.01	4.25	0.01	0.036	2.48	<0.05	<0.0001	0.5	0.13	<0.01	<0.01	0.24	4	2	<10
M225W	29/08/2016	7.45	29600	17900	<1	<1	799	799	727	9750	158	532	6220	68	<0.01	<0.001	<0.001	0.065		0.002	<0.001	0.012	<0.001	0.006	0.004	0.022	<0.01	4.58	0.01	0.038	2.1	<0.05		0.6	0.22	<0.01	<0.01	0.26	<5	<5	<10
M225W	15/11/2016	7.31	30200	19800	<1	<1	778	778	711	9620	169	567	6560	72	<0.01	<0.001	<0.001	0.068	0.0006	0.002	<0.001	0.006	<0.001	0.008	0.006	0.058	<0.01	4.93	0.01	0.062	2.32	<0.05	0.0002	0.7	0.12	0.02	<0.01	0.27	4	4	<10
M225W	13/06/2017		29900	18300	<1	<1	827	827	786	10800	150	492	6780	66								0.013		0.005						0.018	1.92	<0.05	<0.0001	0.4	0.43						
M225W	12/11/2017	7.15	30700	20100	<1	<1	814	814	691	10400	144	507	5930	64		<0.001	<0.001	0.060		0.003	<0.001		<0.001	0.008	0.004	0.253	<0.01		0.01	0.015	1.95	<0.05		0.5	0.17						
M225W	31/05/2018	7.16	30100	19200	<1	<1	701	701	701	9900	169	578	6960	70	<0.05							0.012		0.027						<0.025	2.07	<0.05	<0.0001	0.6	0.1						
M225W	21/11/2018	6.74	29700	19000	<1	<1	748	748	723	10200	159	566	6470	68	<0.05	<0.005	<0.005	0.103		<0.005	<0.005	0.07	<0.005	<0.005	<0.005	0.016	<0.05		<0.05	0.046	2.02	<0.05	0.0001	0.5	0.14	0.05	<0.01	0.28	4	10	<10
M225W	25/05/2019	6.59	29500	19500	<1	<1	738	738	745	10700	159	541	6250	70								0.041		0.022						0.031	1.98	0.08	0.0001	0.5	0.09						
M225W	7/11/2019	6.91	30400	21800	<1	<1	733	733	715	10200	149	566	6670	71	<0.05	<0.005	<0.005	0.067		<0.005	<0.005	<0.005	<0.005	0.008	<0.005	0.011	<0.05		<0.05	0.11	2.24	<0.05		0.5	0.09	0.02	<0.01	0.29	<1	9	<10
M225W	19/11/2020	6.81	29700	20000	<1	<1	758	758	746	10600	179	518	6130	68	<0.05	<0.005	<0.005	0.000		<0.005	<0.005	0.022	<0.005	0.062	<0.005	0.361	<0.05		<0.05	0.045	1.81	<0.05	<0.0001	0.5	0.18						
M225W	25/10/2021	7.99	25600	21100	<1	<1	749	749	725	9950	168	567	6640	73	<0.05	<0.005	<0.005	0.062		<0.005	<0.005	0.014	<0.005	<0.005	<0.005	0.026	<0.05		<0.05	0.032	2.07	<0.05		0.5	0.18	0.02	<0.01	0.3	7	9	<10
M225W	23/11/2022	6.61	26600	19700	<1	<1	681	681	712	10400	169	523	6780	68	<0.05	<0.005	<0.005	0.08		0.008	<0.005	0.094	<0.005	<0.005	<0.005	0.127	<0.05		<0.05	0.115	2.23	<0.05	<0.0001	0.5	0.17	0.01	<0.01	0.3	7	4	<10
M340W	11/12/2012	6.6	8600	5200	<5	<5	620	620	240	2900	57	110	2100	25		<0.001	<0.0005	0.056	0.0002	<0.001	0.0002	0.005	<0.001	0.1		0.012			0.003	0.035			<0.00005	0.45	0.1						
M340W	4/04/2013	6.3	8300	5200	<5	<5	620	620	230	2600	62	120	1900	32		<0.001	<0.0005	0.056	<0.0001	<0.001	0.002	0.004	<0.001	0.085		0.014			0.002	0.028			<0.00005	1.6	0.077						
M340W	22/05/2013	6.81	8400	5000	<5	<5	610	610	240	2700	59	120	1900	25		<0.001	<0.0005	0.057	<0.0001	<0.001	0.002	0.005	<0.001	0.086		0.007			0.002	0.036			<0.00005	1.4	0.055						
M340W	7/08/2013	6.63	8600	5000	<5	<5	620	620	230	2700	55	110	2000	26		<0.001	<0.0005	0.061	<0.0001	<0.001	0.002	0.002	<0.001	0.095		0.006			0.001	0.037			<0.00005	1.3	0.1						
M340W	5/12/2013	6.63	9100	5700	<5	<5	610	610	260	2800	56	110	2200	27		<0.001	<0.0005	0.058	<0.0001	<0.001	0.002	<0.001	<0.001	0.1		0.013			0.001	0.021			<0.00005	1.5	0.063						
M340W	10/05/2014	6.74	10000	6500	<1	<1	661	661	246	3150	71	141	1920	25	<0.01							0.007		0.075						0.041			<0.0001		0.12						
M340W	8/12/2014	6.69	11100	6390	<1	<1	708	708	257	3400	85	172	2050	33	<0.01							0.008		0.081						0.076			<0.0001	1.8	0.08						
M340W	12/03/2015	6.81	11400	6500	<1	<1	689	689	269	3760	102	174	2240	32		<0.001	<0.001	0.068		<0.001	0.002	0.003	<0.001	0.058		0.022			<0.01	0.013				1.7		0.02	<0.01	0.01	2	3	
M340W	17/05/2015	6.82	11700	6900	<1	<1	679	679	383	3740	96	179	2060	27	<0.01	<0.001	<0.001	0.194	<0.0001	<0.001	0.001	0.024	<0.001	0.051		0.009			<0.01	0.185			<0.0001	1.6		0.02	<0.01	<0.01	<1	4	
M340W	28/07/2015	6.68	11400	6280	<1	<1	668	668	319	3670	100	177	2120	29	<0.01	<0.001	<0.001	0.113	<0.0001	<0.001	<0.001	0.011	<0.001	0.049		0.038			<0.01	0.06			<0.0001	1.9		<0.01	<0.01	0.04	<5	<5	
M340W	16/11/2015	6.38	10700	7320	<1	<1	727	727	322	3850	89	193	2180	28	<0.01	<0.001	<0.001	0.057	<0.0001	0.001	0.001	0.018	<0.001	0.047		0.01			<0.01	0.098			<0.0001	1.6	0.04	<0.01	<0.01	0.01	8	10	
M340W	2/03/2016	8.43	12600	6400	<1	43	681	725	320	4060	101	203	2480	33		<0.001	<0.001	0.060		<0.001	0.002	0.002	<0.001	0.044		0.01				0.018				2.0	0.08	0.02	<0.01	0.02	2	6	
M340W	13/05/2016	7.67	12400	7140	<1	<1	693	693	342	3790	100	200	2310	30	<0.01	<0.001	<0.001	0.070	<0.0001	<0.001	0.001	0.012	<0.001	0.034	0.004	0.005	<0.01	2.95	<0.01	0.132	2.26	<0.05	<0.0001	1.8	0.05	<0.01	<0.01	<0.01	5	2	<10
M340W	29/08/2016	8.49	13000	7250	<1	94	636	730	345	3780	107	198	2340	30		<0.001	<0.001	0.073		0.001	0.003	0.002	<0.001	0.06	0.004	0.008	<0.01	3.32	<0.01	0.005	1.83	<0.05		2.0	0.05	<0.01	<0.01	<0.01	5	2	<10
M340W	15/11/2016	7.44	13100	7430	<1	<1	668	668	371	4310	109	216	2420	31		<0.001	<0.001	0.075	<0.0001	0.002	0.002	<0.001	<0.001	0.056		0.006	<0.01		<0.01	0.014	2.14		<0.0001	1.6	0.08	0.04	<0.01	<0.01	4	31	<10
M340W	13/06/2017		11300	6590	<1	<1	651	651	353	3690	90	180	2180	27	<0.01							<0.001		0.611						<0.005	1.75	<0.05	<0.0001	1.9	12.6						
M230W	11/12/2012	7.15	5600	3300	<5	<5	420	420	64	1600	55	93	1200	18		0.002	<0.0005	0.150	<0.0001	<0.001	<0.001	0.001	<0.001	0.097		0.005			<0.001	0.014			<0.00005	0.79	0.67						
M230W	3/04/2013	6.66	5400	3200	<5	<5	420	420	66	1600	60	96	1000	19		0.002	<0.0005	0.170	<0.0001	<0.001	0.002	0.002	<0.001	0.26		0.01			<0.001	0.027			<0.00005	0.76	0.16						
M230W	21/05/2013	7.01	5300	3300	<5	<5	410	410	60	1700	60	96	1100	18		0.002	<0.0005	0.180	<0.0001	<0.001	0.002	0.004	<0.001	0.18		0.014			<0.001	0.021			<0.00005	0.54	0.094						
M230W	7/08/2013	7.05	5600	3000	<5	<5	400	400	77	1700	58	93	1100	16		0.002	<0.0005	0.180	<0.0001	<0.001	<0.001	0.003	<0.001	0.091		0.01			<0.001	0.033			<0.00005	0.46	0.27						
M230W	7/12/2013	6.96	5900	3700	<5	<5	390	390	83	1700	56	85	1200	15		0.002	<0.0005	0.180	<0.0001	<0.001	0.002	0.003	<0.001	0.16		0.008			<0.001	0.017			<0.00005	0.63	0.11						
M230W	11/05/2014	6.99	6010	3910	<1	<1	426	426	82	1660	67	100	1040	14	<0.01							0.003		0.212						0.037			<0.0001		0.17						
M230W	5/12/2014	7.05	6100	3120	<1	<1	418	418	73	1490	70	103	970	17	<0.01							0.001		0.317						0.06			<0.0001	0.7	0.3						
M230W	12/03/2015	7	6080	3360	<1	<1	410	410	69	1730	74	100	1030	16		0.002	<0.001	0.195		<0.001	0.003	0.001	<0.001	0.251		0.131			<0.01	0.013				0.8		0.02	<0.01	0.02	2	<1	
M230W	17/05/2015	7	6180	3580	<1	<1	407	407	97	1550	75	106	985	14	<0.01	0.002	<0.001	0.283	<0.0001	<0.001	0.003	0.002	<0.001	0.243		0.01			<0.01	0.024			<0.0001	0.6		0.02	<0.01	0.01	<1	<1	
M230W	28/07/2015	7.05	6000	3210	<1	<1	404	404	87	1500	74	107	1050	16	<0.01	0.002	<0.001	0.237	<0.0001	<0.001	0.001	0.004	<0.001	0.146		0.012			<0.01	0.049			<0.0001	0.7		<0.01	<0.01	0.02	<1	1	
M230W	15/11/2015	6.62	6260	3440	<1	<1	419	419	82	1840	69	101	891	12	<0.01	0.002	<0.001	0.175	<0.0001	0.002	<0.001	0.002	<0.001	0.046		0.06			<0.01	0.068			<0.0001	0.8	0.17	0.07	<0.01	<0.01	5	3	
M230W	2/03/2016	7.82	6350	3350	<1	<1	431	431	84	1760	68	104	995	17		0.001	<0.001	0.164		<0.001	0.001	0.002	<0.001	0.035		0.006			0.042	<0.01				0.7	0.19	0.02	<0.01	0.02	4	1	
M230W	13/05/2016	7.78	6120	3500	<1	<1	419	419	80	1760	72	110	1050	16	<0.01	0.001	<0.001	0.184	<0.0001	<0.001	<0.001	0.001	<0.001	0.04	0.006	0.021	<0.01	1.52	<0.01	0.024	0.6	<0.05	<0.0001	0.7	0.1	<0.01	<0.01	<0.01	5	2	<10
M230W	29/08/2016	7.48	6130	3450	<1	<1	417	417	79	1680	76	111	1050	18		0.001	<0.001	0.186		<0.001	<0.001	0.007	<0.001	0.027	0.008	0.039	<0.01	1.68	<0.01	0.026	0.42	<0.05		0.7	0.1	<0.01	<0.01	<0.01	6	<5	<10
M230W	15/11/2016	7.51	6220	3500	<1	<1	414	414	83	1750	68	117	1100	15		0.002	<0.001	0.186	<0.0001	<0.001	<0.001	0.002	<0.001	0.097	0.008	0.026	<0.01	1.71	<0.01	0.036	0.47	<0.05	<0.0001	0.6	0.08	0.02	<0.01	<0.01	7	<1	<10
M230W	13/06/2017		6270	3470	<1	<1	442	442	78	1870	65	110	1100	15	<0.01							0.001		0.451						0.014	0.45	0.36	<0.0001	0.8	0.18						
M230W	12/11/2017	7.5	6400	3710	<1	<1	420	420	79	1820	70	114	1070	15		0.002	<0.001	0.206		<0.001	0.005		<0.001	0.203	0.005	0.014	<0.01		<0.01	0.065	0.47	<0.05		0.7	0.23						
M230W	1/06/2018	6.95	6860	3960	<1	<1	380	380	99	1920	78	121	1170	17								0.001		0.188						0.012	0.44	0.43	<0.0001	0.7	0.17						
M230W	21/11/2018	6.83	7260	4140	<1	<1	401	401	104	2140	98	158	1300	17		0.002	<0.001	0.207		<0.001	0.003	<0.001	<0.001	0.186	0.003	0.009	<0.01		<0.01	0.047	0.48	<0.05	<0.0001	0.7	0.12	0.09	<0.01	<0.01	10	8	<10
M230W	25/05/2019	6.74	7450	4410	<1	<1	397	397	117	2480	101	163	1350	18								0.001		0.213						0.012	0.56	0.39	<0.0001	0.7	0.14						
M230W	10/11/2019	6.88	7420	4770	<1	<1	403	403	110	2330	93	150	1260	18		0.002	<0.001	0.206		<0.001	0.004	<0.001	<0.001	0.186	0.002	0.015	<0.01		<0.01	0.016	0.52	0.29		0.7	0.13	0.06	<0.01	<0.01	<1	<1	<10
M230W	1/11/2020	6.9	7670	4630	<1	<1	416	416	110	2520	109	159	1280	18								<0.001		0.204						0.017	0.44	<0.05	<0.0001	0.6	0.14						
M230W	19/11/2021	7.21	7620	4390	<1	<1	415	415	113	2540	128	208	1580	22		0.003	<0.001	0.283		<0.001	0.005	0.001	<0.001	0.286	0.004	0.262	<0.01		<0.01	0.025	0.71	0.59		0.7	0.13						
M300W	26/10/2021	7.61	32600	22400	<1	<1	531	531	550	10700	297	687	6430	79	<0.05							0.015		0.016						2.27	1.45	<0.05	<0.0001	0.7	0.13	0.14	<0.01	0.3	7	5	<10
M300W	7/06/2022	6.3	31800	23300	<1	<1	558	558	603	11400	312	805	7140	87	<0.05							0.044		0.005						0.06	1.61	<0.05	0.0006	0.7	0.16						
M300W	22/11/2022	6.56	33300	24000	<1	<1	598	598	633	11900	362	808	7110	88	<0.05							0.058		0.011						0.146	1.65	0.09	0.0006	0.7	0.11						
M250W	13/12/2012	5.42	2400	1400	<5	<5	61	61	54	700	14	39	380	11		<0.001	<0.0005	0.1	<0.0001	0.002	<0.001	0.002	<0.001	0.027		0.008			<0.001	0.023			<0.00005	0.18	0.012						
M250W	6/04/2013	5.77	2400	1600	<5	<5	69	69	69	660	17	45	490	13		<0.001	<0.0005	0.11	<0.0001	0.001	<0.001	0.002	<0.001	0.054		0.014			<0.001	0.02			<0.00005	0.14	0.01						
M250W	25/05/2013	5.86	2500	1600	<5	<5	67	67	83	730	18	46	510	13		<0.001	<0.0005	0.1	<0.0001	0.003	<0.001	0.004	<0.001	0.015		0.007			<0.001	0.018			<0.00005	0.14	0.012						
M250W	6/08/2013	5.82	2300	1300	<5	<5	72	72	81	730	19	43	450	11		<0.001	<0.0005	0.1	<0.0001	0.002	<0.001	0.002	<0.001	0.007		0.006			<0.001	0.016			<0.00005	0.13	0.079						
M250W	5/12/2013	5.92	2500	1600	<5	<5	60	60	84	710	14	39	480	12		<0.001	<0.0005	0.083	<0.0001	0.002	<0.001	0.001	<0.001	0.019		0.01			<0.001	0.014			<0.00005	0.14	<0.005						
M250W	9/05/2014	5.64	2440	1590	<1	<1	76	76	76	682	13	43	393	12	<0.01							0.004		0.018						0.019			<0.0001		1.3						
M250W	7/12/2014	5.65	2530	1380	<1	<1	58	58	76	717	13	45	432	11	<0.01							<0.001		0.017						<0.005			<0.0001	0.2	0.08						
M250W	10/03/2015	5.5	2540	1580	<1	<1	58	58	92	768	19	42	420	10		<0.001	<0.001	0.07		0.003	<0.001	<0.001	<0.001	0.013		0.01			<0.01	0.018				0.6		0.04	<0.01	1.39	<1	<1	
M250W	18/05/2015	5.75	2560	1420	<1	<1	55	55	92	763	17	44	398	10	<001	<0.001	<0.001	0.07	<0.0001	0.002	0.001	<0.001	<0.001	0.015		0.011			<0.01	0.019				0.2		0.03	<0.01	1.46	14	7	
M250W	29/07/2015	5.48	2430	1430	<1	<1	59	59	89	729	15	44	387	11	<0.01	<0.001	<0.001	0.078	<0.0001	0.003	0.001	<0.001	<0.001	0.028		0.01			<0.01	0.106			<0.0001	0.2		0.01	<0.01	1.42	3	2	
M250W	16/11/2015	5.72	2170	1300	<1	<1	72	72	76	664	12	38	344	9	<0.01	<0.001	<0.001	0.061	<0.0001	0.001	0.004	0.005	<0.001	0.076		0.048			<0.01	0.131			<0.0001	0.2	0.4	0.01	<0.01	1.38	<5	5	
M250W	2/03/2016	6.54	2650	1490	<1	<1	53	53	92	787	15	45	408	12		<0.001	<0.001	0.047		0.002	<0.001	0.001	<0.001	0.014		0.01			<0.01	0.048				0.2	0.16	0.02	<0.01	1.53	62	1	
M250W	13/05/2016	6.74	2620	1530	<1	<1	116	116	95	774	18	52	461	11	<0.01	<0.01	<0.001	<0.001		0.076	<0.0001	0.002	<0.001	0.011	<0.001	0.009	<0.01	0.725	<0.01	0.016	0.76	0.05	<0.0001	0.2	0.91	0.02	<0.01	1.45	4	2	<10
M250W	29/08/2016	7.76	2600	1440	<1	<1	64	64	81	678	14	44	396	10		<0.001	<0.001	0.055		0.002	0.001	0.001	<0.001	0.012	<0.001	0.01	<0.01	0.686	<0.01	0.008	0.61	<0.05		0.2	0.51	<0.01	<0.01	1.32	2	2	<10
M250W	15/11/2016	6.36	2460	1400	<1	<1	60	60	86	715	12	46	411	10	<0.01	<0.001	<0.001	0.05	<0.0001	0.002	0.001	<0.001	<0.001	0.012	<0.001	0.008	<0.01	0.698	<0.01	0.032	0.73	<0.05	<0.0001	0.2	0.47	0.03	<0.01	1.51	3	1	<10
M250W	18/06/2017		2450	1360			63	63	80	708	12	42	402	10	<0.01							0.001		0.014						0.021	0.67	<0.05	<0.0001	0.2	0.44						
M250W	13/11/2017	7.23	2650	1620			55	55	106	794	20	50	465	11		<0.001	<0.001	0.072		0.002	0.005	0.002	<0.001	0.095	0.002	0.043	<0.01		<0.01	0.111	0.7	<0.05		0.3	0.62						
M250W	2/06/2018	5.8	2530					55	77	708	15	48	440	10	<0.01							<0.001		0.014						0.006	0.73	0.43	<0.0001	0.2	0.63						
M250W	22/11/2018	5.66	2510	1520	<1	<1	62	62	89	746	15	48	420	11	<0.01	<0.001	<0.001	0.057		0.002	0.001	0.001	<0.001	0.016	<0.001	0.01	<0.01		<0.01	0.072	0.68	<0.05	<0.0001	0.2	0.77	0.07	<0.01	1.43	<1	<1	<10
M250W	26/05/2019	5.45	2480	1400	<1	<1	58	58	88	790	16	48	407	11	<0.01							0.001		0.021						0.031	0.74	<0.05	<0.0001	0.2	0.23						
M250W	7/11/2019	5.93	2510	1560	<1	<1	59	59	87	744	20	46	414	11	<0.01	<0.001	<0.001	0.059		0.002	0.004	<0.001	<0.001	0.043	0.001	0.088	<0.01		<0.01	0.035	0.74	<0.05		0.2	0.03	<0.01	<0.01	1.42	1	1	<10
M250W	21/12/2021	5.65	2420	1550	<1	<1	60	60	80	767	20	46	438	12		<0.001		0.063		0.002	0.003	<0.001	<0.001	0.05	0.003	0.056			<0.01	0.054	0.59	<0.05		0.1		<0.01	<0.01	1.4	3	4	<10
AN021F	10/12/2022	12.6	13800	5470	2420	80	<1	2500	28	1280	312	<1	1330	580		<0.001	<0.001	1.06		0.002	<0.001	0.145	0.112	0.003	0.152	0.042	<0.01		<0.01	0.064	0.13	0.14		0.2	0.03	5.02	<0.01	0.01	36	30	278
M222W	16/06/2012	6.43	9520	6690	<1	<1	457	457	85	3140	326	355	1120	14		0.003	<0.000001	3.9	<0.0001	0.002	0.002	0.002	<0.001	1.17		0.125			<0.01	0.041			<0.0001	0.6							
M222W	14/12/2012	6.52	9300	6500	<5	<5	420	420	78	3500	290	340	1000	14		<0.001	<0.0005	1.2	<0.0001	<0.001	0.002	0.003	<0.001	1.3		0.005			<0.001	0.043			<0.00005	0.48	<0.005						
M222W	5/04/2013	6.22	9100	6500	<5	<5	300	300	140	4100	320	440	1100	14		<0.001	<0.0005	0.26	<0.0001	<0.001	<0.001	0.002	<0.001	1.1		0.019			<0.001	0.037			<0.00005	0.68	<0.005						
M222W	26/05/2013	6.67	9400	7500	<5	<5	290	290	100	3200	350	450	1100	14		0.001	<0.0005	0.24	<0.0001	<0.001	<0.001	0.002	<0.001	1.3		0.004			<0.001	0.007			<0.00005	0.47	<0.005						
M222W	9/08/2013	6.17	9200	6200	<5	<5	310	310	110	3400	340	400	1100	11		0.003	<0.0005	0.23	<0.0001	<0.001	<0.001	0.001	<0.001	1.2		<0.001			<0.001	0.011			<0.00005	0.44	<0.005						
M222W	6/12/2013	6.26	9700	9600	<5	<5	300	300	130	3300	440	380	1400	12		0.006	<0.0005	0.24	<0.0001	<0.001	<0.001	0.002	<0.001	1.7		0.001			<0.001	0.018			<0.00005	0.59	<0.005						
M222W	10/05/2014	6.16	9480	6160	<1	<1	316	316	129	3420	363	428	1010	10	<0.01							0.004		1.35						0.019			<0.0001		2.09						
M222W	19/08/2014	6.81	9090	8950	<1	<1	275	275	128	3450	365	448	1020	12	<0.01							0.001		1.54						0.036			<0.0001	0.4	0.18						
M222W	4/12/2014	6.25	10200	7520	<1	<1	303	303	116	3330	361	451	1080	12	<0.01							<0.001		1.45						0.115			<0.0001	0.8	0.74						
M222W	11/03/2015	6.55	10000	6810	<1	<1	295	295	122	3450	395	395	999	10		0.003	<0.001	0.248		<0.001	<0.001	<0.001	<0.001	1.27		<0.001			<0.01	0.02				1		1.05	<0.01	0.02	4	4	
M222W	17/05/2015	6.32	9890	7160	<1	<1	304	304	165	3480	374	426	943	9	<0.01	0.011	<0.001	0.202	<0.0001	<0.001	<0.001	<0.001	<0.001	1.57		0.002			<0.01	0.021			<0.0001	0.7		0.87	<0.01	0.03	2	<1	
M222W	27/07/2015	6.23	9670	6150	<1	<1	290	290	129	3420	385	434	956	10	<0.01	0.004	<0.001	0.226	<0.0001	<0.001	<0.001	<0.001	<0.001	1.28		0.007			<0.01	<0.005			<0.0001	0.8		1.06	<0.01	0.02	3	1	
M222W	17/11/2015	6.1	10200	6820	<1	<1	296	296	124	3560	352	376	932	10	0.36	0.004	<0.001	0.22	<0.0001	<0.001	<0.001	0.001	<0.001	1.37		<0.001			<0.01	0.074			<0.0001	0.9	0.53	1.04	<0.01	<0.01	7	6	
M222W	2/03/2016	7.19	10700	5190	<1	<1	318	318	118	3560	342	434	1040	12		0.003	<0.001	0.219		0.002	<0.001	<0.001	<0.001	1.27		0.017			<0.01	0.043				0.8	0.11	1.09	<0.01	0.02	17	3	
M222W	13/05/2016	7.22	9890	5740	<1	<1	282	282	177	3340	376	456	1040	10	<0.01	0.009	<0.001	0.201	<0.0001	<0.001	<0.001	<0.001	<0.001	1.59	0.004	<0.001	<0.01	6.67	<0.01	<0.005	0.33	17.6	<0.0001	0.7	0.43	1.03	<0.01	<0.01	8	4	<10
M222W	29/08/2016	8.16	10400	7370	<1	<1	280	280	155	3170	414	474	1080	10		0.01	<0.001	0.184		<0.001	<0.001	<0.001	<0.001	1.86	0.004	0.003	<0.01	8.96	<0.01	<0.005	0.32	21.1		0.8	0.55	1.08	<0.1	<0.1	6	2	<10
M222W	15/11/2016	6.62	10300	6300	<1	<1	292	292	140	3660	407	492	1170	11	<0.01	0.005	<0.001	0.252	<0.0001	<0.001	<0.001	<0.001	<0.001	1.59	0.003	0.002	<0.01	8.73	<0.01	0.015	0.34	13.6	<0.0001	0.8	0.19	0.97	<0.01	<0.01	7	<5	<10
M222W	13/06/2017		10600	6320			310	310	145	3920	379	448	1140	11	<0.01							<0.001		1.55						<0.005	0.33	11.4	<0.0001	0.7	0.32						
M222W	7/11/2017	6.82	10600	6800			271	271	126	3670	399	466	1080	10		0.005	<0.001	0.288		<0.001	<0.001	<0.001	<0.001	1.63	0.002	0.001	<0.01		<0.01	<0.005	0.3	14.5		0.8	0.43						
M222W	29/05/2018	6.29	11000					286	131	4020	417	478	1170	12	<0.01							0.002		1.63						<0.005	0.32	15.5	<0.0001	0.7	0.46						
M222W	18/11/2018	6.19	11000	6970	<1	<1	282	282	130	3630	406	494	1080	11	<0.01	0.004	<0.001	0.268		<0.001	<0.001	<0.001	<0.001	1.48	0.002	<0.001	<0.01		<0.01	<0.005	0.34	11		0.6	0.12	1.05	<0.01	<0.01	7	7	<10
M222W	24/05/2019	6.09	10700	7230	<1	<1	261	261	159	4000	432	506	1180	10								0.036		1.65						0.069	0.32	18.6	<0.0001	0.7	0.39						
M222W	10/11/2019	6.09	10700	8400	<1	<1	275	275	161	3780	404	470	1110	11	<0.01	0.007	<0.001	0.248		<0.001	<0.001	0.014	<0.001	1.56	0.003	0.028	<0.01		<0.01	0.059	0.32	17.1		0.7	0.41	1.07	<0.01	<0.01	6	4	<10
M222W	20/11/2020	6.3	11100	8600	<1	<1	292	292	155	4090	448	513	1200	11	<0.01							<0.001		1.72						0.013	0.33	0.05	<0.0001	0.7	0.67	1.06	<0.01	0.02	4	6	<10
M222W	28/10/2021	5.92	11400	9990	<1	<1	243	243	163	3800	438	481	1110	10	<0.01							0.007		1.78						0.719	0.33	19.5	<0.0001	0.7	0.39	1.2	<0.05	<0.05	6	4	<10
M222W	25/11/2022	6.06	10800	8830	<1	<1	249	249	178	4140	422	518	1180	11	<0.01	0.005	<0.001	0.287		<0.001	<0.001	0.006	<0.001	1.87	0.003	0.016	<0.01		<0.01	0.066	0.33	22.2	<0.0001	0.6	0.54	0.83	<0.01	<0.01	3	3	<10
M224W	16/06/2012	6.22	29500	22300	<1	<1	355	355	1600	9560	831	1260	4170	11		<0.050	<0.00001	0.078	<0.0050	<0.010	0.011	<0.00005	<0.010	7.75		<0.00005			<0.10	0.06			<0.0001	0.9							
M224W	15/12/2012	6.24	28000	22000	<5	<5	340	340	1500	14000	780	1100	4500	13		0.003	<0.0005	0.11	<0.0001	<0.001	0.012	<0.001	<0.001	7.8		0.023			0.001	0.009			<0.00005	0.74	0.03						
M224W	7/04/2013	5.73	25000	20000	<5	<5	360	360	1300	11000	740	1000	4300	16		0.002	<0.0005	0.2	0.0002	<0.001	0.015	<0.001	<0.001	8.1		0.04			<0.001	0.024			<0.00005	0.45	<0.005						
M224W	25/05/2013	6.11	18000	14000	<5	<5	220	220	880	6200	610	680	2600	17		0.004	<0.0005	0.14	<0.0001	<0.001	0.007	<0.001	<0.001	4.8		0.083			0.002	0.008			<0.00005	0.23	<0.005						
M224W	6/08/2013	6.07	23000	17000	<5	<5	240	240	1200	9100	840	980	4500	12		0.005	<0.0005	0.13	<0.0001	<0.001	0.01	<0.001	<0.001	6.8		0.018			<0.001	0.027			<0.00005	0.37	0.052						
M224W	6/12/2013	6.15	28000	27000	<5	<5	280	280	6200	11000	1000	1400	6200	13	<.5	0.007	<0.0005	0.13	<0.0001	<0.001	0.012	<0.001	<0.001	8		0.015			<0.001	0.021			<0.00005	0.51	0.007						
M224W	10/05/2014	6.24	27200	17700	<1	<1	253	253	1250	10200	779	1080	3690	11	<0.01							<0.05		7.57						0.056			<0.0001		0.3						
M224W	19/08/2014	6.34	27600	21000	<1	<1	192	192	1060	10800	822	1300	4590	13	<0.01							<0.001		7.98						0.302			<0.0001	0.4	0.79						
M224W	4/12/2014	6.14	31600	22900	<1	<1	186	186	842	9710	764	1320	4080	13								<0.001		6.83						0.067			<0.0001	0.4	0.17						
M224W	12/03/2015	6.46	22900	16500	<1	<1	174	174	710	8850	661	842	3240	10	<0.01	0.004	<0.001	0.157		<0.001	0.016	0.006	<0.001	4.4		0.119			<0.01	0.044				0.6		0.66	<0.01	0.01	2	1	
M224W	17/05/2015	6.36	21000	16800	<1	<1	184	184	978	7200	640	768	2760	8	<0.01	0.006	<0.001	0.164	<0.0001	<0.001	0.021	0.001	<0.001	4.59		0.025			<0.01	0.05			<0.0001	0.3		0.46	<0.01	<0.01	5	3	
M224W	27/07/2015	6.13	24700	17100	<1	<1	188	188	948	8670	712	984	3390	9	<0.01	0.008	<0.001	0.157	0.0001	<0.001	0.019	0.003	<0.001	4.51		0.17			<0.01	0.059			<0.0001	0.5		0.66	<0.01	0.01	<1	<1	
M224W	17/11/2015	6.13	27700	17500	<1	<1	158	158	890	9930	613	870	3320	7		0.008	<0.001	0.163	<0.0001	<0.001	0.027	<0.001	<0.001	3.78		0.014			<0.01	0.101			<0.0001	0.4	0.11	0.51	<0.01	<0.01	4	5	
M224W	2/03/2016	7.38	10800	5950	<1	<1	128	128	656	3350	316	360	1600	6	<0.01	0.005	<0.001	0.065		<0.001	0.009	0.002	<0.001	1.36		0.021			<0.01	0.037				0.4	0.06	0.26	<0.01	0.02	2	3	
M224W	13/05/2016	7.48	17900	11100	<1	<1	202	202	799	5860	512	664	2680	9		0.008	<0.001	0.159	<0.0001	<0.001	0.011	0.005	<0.001	3.42	0.001	0.007	<0.01	11.4	<0.01	0.176	0.34	4.8	<0.0001	0.4	<0.05	0.34	<0.01	<0.01	7	3	78
M224W	29/08/2016	7.21	4240	2360	<1	<1	101	101	541	1020	172	107	543	5		0.003	<0.001	0.06		<0.001	0.005	<0.001	<0.001	0.834	0.001	0.004	<0.01	3.19	<0.01	0.037	0.13	0.2		0.2	0.09	0.09	<0.01	0.03	5	2	12
M224W	15/11/2016	6.77	17700	11700	<1	<1	192	192	802	6210	570	696	2650	8	<0.01	0.008	<0.001	0.182	<0.0001	<0.001	0.017	<0.001	<0.001	3.75	0.002	0.02	<0.01	14	<0.01	0.21	0.24	5.39	<0.0001	0.4	0.07	0.47	<0.01	<0.01	4	2	79
M224W	13/06/2017		17600	11000	<1	<1	238	238	1070	6490	676	630	2400	9								<0.001		4.04						0.052	0.22	7.91	<0.0001	0.3	0.08						
M224W	07/11/2017	6.97	20400	14100	<1	<1	232	232	1000	7120	774	778	2650	10		<0.001	0.193	<0.001		0.015	<0.001		<0.001	4.94	0.003	0.042	<0.01	<0.01	<0.01	0.044	0.22	10.1		0.4	0.3						
M224W	29/05/2018	6.28	27200					304	1240	10100	870	1090	4100	10								0.002		6.72						0.062	0.34	7.2	<0.0001	0.5	0.22						
M224W	18/11/2018	6.33	5490	3630	<1	<1	141	141	574	1270	264	137	669	5	<0.01	<0.001	<0.001	0.045		<0.001	0.003	0.017	<0.001	0.313	<0.001	0.014	<0.01		<0.01	0.103	0.16	0.52		0.2	0.03	0.05	<0.01	<0.01	8	4	<10
M224W	24/05/2019	6.53	12800	8730	<1	<1	152	152	907	4490	448	440	1960	6	<0.01							0.001		1.68						0.032	0.29	1.12	<0.0001	0.4	0.13						
M224W	10/11/2019	6.12	18400	15200	<1	<1	141	141	644	6430	426	628	2760	6	<0.01	0.006	<0.001	0.126		<0.001	0.026	0.002	<0.001	1.58	0.001	0.045	<0.01		<0.01	0.059	0.39	4.43		0.3	<0.05	0.2	<0.01	<0.01	2	4	41
M224W	20/11/2020	6.13	20100	15600	<1	<1	137	137	575	7590	413	670	2980	5	<0.01							<0.001		1.64						0.042	0.39	0.2	<0.0001	0.3	0.09	0.17	<0.01	<0.01	2	2	38
M224W	28/10/2021	6.22	22600	18800	<1	<1	209	209	718	7490	582	767	3150	7	<0.01							<0.001		5.23						0.038	0.38	14.2	<0.0001	0.5	0.08	0.2	<0.01	0.03	4	3	26
M224W	25/11/2022	6.03	25600	22600	<1	<1	336	336	1210	10700	758	1170	5030	8	<0.05	<0.005	<0.005	0.169		<0.005	0.017	0.063	<0.005	6.03	<0.005	0.12	<0.05		<0.05	0.18	0.55	3.82	<0.0001	0.7	0.4	0.53	<0.01	<0.01	4	5	<10
AN020F	13/05/2016	6.2	10800	6210	<1	<1	22	22	<1	3750	429	178	1550	29	<0.01	<0.001	<0.001	3.72	<0.0001	<0.001	0.001	<0.001	<0.001	1.92	<0.001	<0.001	<0.01	11.3	<0.01	<0.005	0.14	14.3	<0.0001	<0.1	<0.01	4.14	<0.01	<0.01	11	8	18600
AN020F	15/11/2016	6.32	10600	7210	<1	<1	21	21	1	4030	439	174	1450	26		<0.001	<0.001	3.62		<0.001	<0.001	<0.001	<0.001	1.85	0.001	0.001	<0.01	11	<0.01	<0.005	0.19	8.25		<0.1	<0.05	8.32	<0.01	<0.01	6	13	19800
AN020F	15/11/2017	7.39	10900	7010	<1	<1	47	47	<1	3790	456	182	1650	29		<0.001	<0.001	3.42		<0.001	<0.001	<0.001	<0.001	1.17	0.005	0.006	<0.01		<0.01	<0.005	0.14	5.01		<0.1	0.11						
AN020F	15/11/2018	7.05	11200	7280	<1	<1	126	126	<1	3800	460	203	1460	24		<0.001	<0.001	3.88		<0.001	<0.001	0.001	<0.001	1.19	0.007	0.001	<0.01		<0.01	<0.005	0.2	5.36		<0.1	<0.01	2.73	<0.01	<0.01	6	12	18600
AN020F	11/11/2019	7.58	10400	7310	<1	<1	20	20	<1	3830	457	174	1580	29		<0.001	<0.001	3.66		<0.001	<0.001	0.005	<0.001	1.42	0.002	0.002	<0.01		<0.01	<0.005	0.13	1.68		<0.1	<0.01	6.71	<0.01	0.03	4	7	12100
AN020F	21/11/2020	7.03	10300	8090	<1	<1	5	5	<1	3990	51	<1	2160	21		0	0	5.34				<0.001		2.28	0.002					0.006	0.16	2.99	<0.0001	<0.1	0.01	5.76	<0.01	<0.01	4	4	10300
AN020F	30/10/2021	7.1	9590	9070	<1	<1	27	27	<1	3760	420	169	1540	28		<0.001	<0.001	3.7		<0.001	<0.001	0.001	<0.001	1.51	0.003	0.003	<0.01		<0.01	0.014	0.09	1.87		0.1	<0.01	5.48	<0.01	<0.01	3	3	2770
AN020F	10/12/2022	6.02	10800	7610	<1	<1	3	3	<1	3800	380	147	1500	27		<0.001	<0.001	3.84		<0.001	<0.001	<0.001	<0.001	1.48	0.001	0.001	<0.01		<0.01	0.012	0.11	3.65		<0.1	<0.01	5.73	<0.01	<0.01	4	4	3830

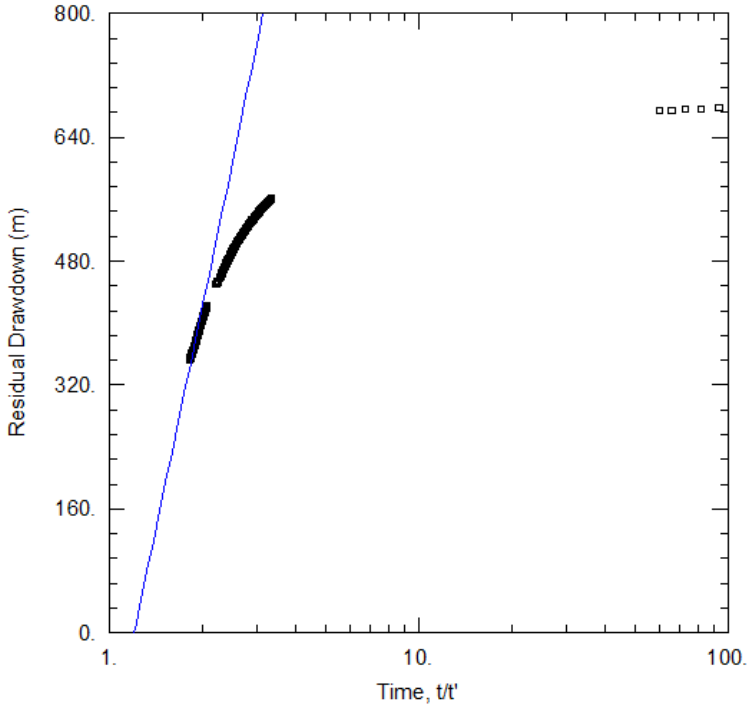
Deep Monitoring Bores

Monitoring Bore ID	Sample Date	Field pH	Electrical Conductivity	Total Dissolved Solids	Hydroxide Alkalinity (OH-) as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Calcium - Dissolved	Magnesium - Dissolved	Sodium - Dissolved	Potassium - Dissolved	Aluminium - Dissolved	Arsenic-Dissolved	Beryllium-Dissolved	Barium-Dissolved	Cadmium-Dissolved	Chromium-Dissolved	Cobalt-Dissolved	Copper-Dissolved	Lead-Dissolved	Manganese-Dissolved	Molybdenum	Nickel-Dissolved	Selenium	Strontium	Vanadium-Dissolved	Zinc-Dissolved	Boron	Iron	Mercury-Dissolved	Fluoride, F	Phosphate as P in water	Ammonia as N	Nitrite as N	Nitrate as N	Dissolved Organic Carbon	Total Organic Carbon	Methane
			µS/cm	(grav) mg/L	as CaCO3 mg/L	CaCO3 mg/L	CaCO3 mg/L	as CaCO3 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	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L
M313W	25/07/2014	9.42	1710	1160	<1	51	283	334	12	252	7	<1	319	98		0.004	<0.001	0.843		0.018	0.01	2.12	2.19	0.429		0.032			0.02	0.568				0.6								
M313W	13/02/2015	8.12	6940	4110	<1	<1	781	781	4	1810	26	5	1420	126		<0.001	<0.001	4.88		<0.001	<0.001	0.055	<0.001	0.139		0.004			<0.01	<0.005				2.4								
M313W	11/11/2015	8.3	6890	3870	<1	<1	666	667	2	1910	22	4	1250	56	<0.01	<0.001	<0.001	2.8		<0.001	<0.001	0.002	<0.001	0.099		0.002			<0.01	<0.005				2.4	0.87	2.68	<0.01	0.04	58	56	
M313W	30/05/2016	8.48	4570	2420	<1	41	443	484	2	1130	10	1	1000	60	<0.001	<0.001	<0.001	1.23	<0.001	<0.001	<0.001	<0.001	<0.001	0.04	0.017	<0.001	<0.01	1.39	<0.01	0.008	0.5	0.28			0.6	1.12	<0.01	0.03	32	32	32900
M313W	15/11/2016	7.8	5620	2950	<1	<1	634	634	<1	1420	20	3	1170	62		0.002	<0.001	2.63	<0.001	<0.001	<0.001	0.002	<0.001	0.077	0.035	0.003	<0.01	3.02	<0.01	0.018	0.95	1.08		2.3	0.89	1.39	<0.01	<0.01	28	25	13500
M313W	19/11/2017	8.59	6020	3320	<1	48	587	636	<1	1720	24	4	1370	60		0.003	<0.001	2.54		<0.001	<0.001	<0.001	<0.001	0.071	0.035	0.002	<0.01		<0.01	<0.005	0.92	0.57		2								
M313W	16/11/2018	8.05	5840	3210	<1	4	621	625	<1	1350	24	4	1200	61		0.003	<0.001	2.25		<0.001	<0.001	0.002	<0.001	0.106	0.039	0.002	<0.01		<0.01	<0.005	0.81	1.07		1.9	0.77	2.28	<0.01	<0.01	21	22	12700
M313W	14/11/2019	7.99	6030	3360	<1	<1	621	621	2	1600	20	4	1260	55		0.003	<0.001	2.42		<0.001	<0.001	<0.001	<0.001	0.088	0.041	0.002	<0.01		<0.01	<0.005	0.88	0.45		2.1	0.68	2.33	<0.01	0.04	19	20	14800
M313W	23/11/2020	8.23	6020	3390	<1	<1	648	648	1	1700	26	5	1520	67		0.003	<0.001	2.85		<0.001	<0.001	<0.001	<0.001	0.082	0.055	0.003	<0.01		<0.01	<0.005	1.31	1.4		2.2	0.65	2.36	<0.01	<0.01	22	20	12600
M313W	29/10/2021	8.18	5740	3510	<1	19	624	643	<1	1530	21	5	1320	62		0.003	<0.001	2.18		<0.001	<0.001	<0.001	<0.001	0.074	0.044	0.002	<0.01		<0.01	<0.005	0.95	0.76		2	0.69	2.34	<0.01	0.01	30	28	11200
M313W	14/12/2022	8.49	5780	3380	<1	32	572	604	<1	1560	20	4	1280	54		0.002	<0.001	2.27		<0.001	<0.001	0.001	<0.001	0.071	0.042	0.002	<0.01		<0.01	0.019	1.03	0.91		2	0.67	2.46	<0.01	<0.01	23	23	10000
M314W	24/07/2014	8.57	5090	4790	<1	9	1210	1220	134	198	46	1	212	1450		0.013	<0.001	0.575		0.015	0.005	7.08	0.562	0.446		0.018			<0.01	0.472				0.4								
M314W	13/02/2015	8.04	7150	5470	<1	<1	1180	1180	69	1370	29	6	1040	795		0.004	<0.001	1.37		<0.001	0.002	0.995	<0.001	0.141		0.01			<0.01	<0.005				0.9								
M314W	13/11/2015	8.01	8210	5280	<1	<1	836	836	2	2190	17	5	1420	335		0.003	<0.001	1.31		<0.001	<0.001	0.031	<0.001	0.14		0.013			<0.01	0.011				1.1	17.4	6.92	<0.01	0.17	352	372	
M314W	30/05/2016	8.6	8500	4880	<1	49	767	817	<1	2370	22	6	1640	326		0.003	<0.001	5.21	<0.001	<0.001	<0.001	0.022	<0.001	0.028	0.053	0.001	<0.01	5.5	<0.01	0.01	0.87	0.1	0.87		9.67	2.97	<0.01	0.01	224	238	26900
M314W	15/11/2016	8.88	8180	4810	<1	108	827	934	<1	2290	19	6	1500	404		0.004	<0.001	3.88	<0.001	<0.001	<0.001	0.03	<0.001	0.036	0.062	0.002	<0.01	3.67	<0.01	0.009	0.9	0.21		1.3	12.1	1.83	<0.01	<0.01	213	241	19100
M314W	18/11/2017	8.9	8300	4860	<1	169	908	1080	<1	2190	17	5	1880	543		0.004	<0.001	2.91		<0.001	<0.001	0.024	<0.001	0.053	0.068	0.002	<0.01		<0.01	<0.005	0.76	0.18		1.2								
M314W	20/11/2018	8.72	8010	4910	<1	142	892	1030	<1	2010	15	5	1530	459		0.005	<0.001	2.86		<0.001	<0.001	0.024	<0.001	0.057	0.078	0.002	<0.01		<0.01	<0.005	0.81	0.29		1.2	13.1	1.63	<0.01	<0.01	80	78	15500
M314W	16/11/2019	8.59	7910	4900	<1	86	991	1080	2	1860	8	4	1460	465		0.005	<0.001	2.43		<0.001	<0.001	0.024	<0.001	0.068	0.082	0.003	<0.01		<0.01	<0.005	0.77	0.33		1.3	13.8	1.94	<0.01	<0.01	70	76	15300
M314W	24/11/2020	8.64	7880	4510	<1	37	1010	1050	5	2130	10	4	1610	506		0.006	<0.001	2.82		<0.001	<0.001	0.021	<0.001	0.073	0.089	0.003	<0.01		<0.01	<0.005	0.91	0.59		1.3	14.5	1.8	<0.01	0.01	68	66	9260
M314W	31/10/2021	8.36	7620	5020	<1	73	992	1060	<1	1910	6	4	1500	468		0.006	<0.001	2.44		<0.001	<0.001	0.017	<0.001	0.025	0.078	0.002	<0.01		<0.01	<0.005	0.79	0.7		1.2	15.3	1.99	<0.01	<0.01	60	63	9650
M314W	27/11/2022	8.29	7870	4980	<1	86	885	971	<1	1960	7	4	1580	499		0.006	<0.001	2.52		<0.001	<0.001	0.016	<0.001	0.017	0.091	0.004	<0.01		<0.01	0.02	0.94	0.64		1.2	15.4	0.9	<0.01	<0.01	48	49	9000
GR067V	30/08/2016	9.05	7020	4000	<1	407	1550	1960	19	1180	7	1	1580	14		0.003	<0.001	1.48	0.001	0.001	<0.001	0.002	<0.001	0.11	0.032	0.006	<0.01	1.18	<0.01	0.011	0.81	1.56			11.8	<0.01	<0.01	<0.01	13	42	31400
GR067V	15/11/2016	8.12	7850	4640	<1	<1	2110	2310	3	1260	15	3	1850	13		0.003	<0.001	4.94	0.001	<0.001	<0.001	<0.001	<0.001	0.024	0.024	0.001	<0.01	3.72	<0.01	0.018	1.17	0.68		1.8		11.7	<0.01	<0.01	31	20	5470
GR067V	19/11/2017	8.72	8210	4910	<1	238	2120	2360	4	1440	19	3	2190	12		0.003	<0.001	3.83		<0.001	<0.001	<0.001	<0.001	0.008	0.019	<0.001	<0.01		<0.01	0.008	1.03	0.16		1.7								
GR067V	23/11/2018	8.46	8340	6020	<1	456	1950	2410	7	1460	18	3	2050	12		0.002	<0.001	4.44		<0.001	<0.001	<0.001	<0.001	0.008	0.023	<0.001	<0.01		<0.01	0.008	1.18	0.22		2		12.1	<0.01	<0.01	16	23	19900
GR067V	16/11/2019	8.19	7950	4950	<1	47	2380	2420	7	1350	7	3	2040	9		0.002	<0.001	3.23		<0.001	<0.001	<0.001	<0.001	0.009	0.019	<0.001	<0.01		<0.01	0.005	1.28	0.29		2		11.6	<0.01	<0.01	31	31	22800
GR067V	24/11/2020	8.73	7980	5040	<1	111	2240	2350	12	1520	7	3	1860	10		0.003	<0.001	5.28		<0.001	<0.001	<0.001	<0.001	0.014	0.03	<0.001	<0.01		<0.01	<0.005	1.56	0.54		2.2		11	<0.01	<0.01	38	36	8860
GR067V	31/10/2021	8.44	7700	5240	<1	223	2070	2300	22	1410	6	3	1980	10		0.002	<0.001	4.06		<0.001	<0.001	0.001	<0.001	0.012	0.017	<0.001	<0.01		<0.01	<0.005	1.39	0.32		1.9	0.44	10.6	<0.01	<0.01	36	34	16500
GR067V	27/11/2022	8.37	8120	4920	<1	221	2000	2220	29	1490	10	4	2120	11		0.002	<0.001	4.62		<0.001	<0.001	<0.001	<0.001	0.016	0.024	<0.001	<0.01		<0.01	0.01	1.3	0.42		2	0.51	10.6	<0.01	<0.01	23	26	10800
M162V	14/11/2015	8.44	11500	6970	<1	38	1060	1090	3	3640	10	6	2370	12		<0.001	<0.001	0.236		<0.001	<0.001	<0.001	<0.001	0.092		<0.001			<0.01	<0.005				1.9		3.5	<0.01	0.02	78	71	
M162V	30/05/2016	7.91	12700	7250	<1	<1	1050	1050	2	4040	56	19	2590	12		<0.001	<0.001	11	<0.001	<0.001	<0.001	<0.001	<0.001	0.063	0.002	0.001	<0.01	10.8	<0.01	0.16	2.4	3			1.86	<0.01	0.03	9	8	1840
M162V	15/11/2016	7.7	12300	6660	<1	<1	1060	1060	<1	3870	69	18	2670	12		<0.001	<0.001	9.93	<0.001	<0.001	<0.001	<0.001	<0.001	0.034	0.001	<0.001	<0.01	9.77	<0.01	0.032	2.02	2.19		2.6		4.04	<0.01	<0.01	7	6	17300
M134W	14/11/2017	8.1	15600	9810	<1	<1	168	168	<1	5770	209	62	3490	12		<0.001	<0.001	23		<0.001	<0.001	<0.001	<0.001	0.064	0.001	<0.001	<0.01		<0.01	0.009	0.46	0.4		0.5								
M134W	215/11/2018	7.3	16000	9710	<1	<1	159	159	<1	5310	182	61	2990	12		<0.001	<0.001	20.3		<0.001	<0.001	0.002	<0.001	0.063	0.001	<0.001	<0.01		<0.01	0.011	0.48	0.3		0.5		5.3	<0.01	<0.01	3	4	9050
M134W	14/11/2019	7.27	15500	9670	<1	<1	162	162	1	5460	134	58	3200	12		0.002	<0.001	20.2		<0.001	0.005	<0.001	<0.001	0.098	0.007	0.02	<0.01		<0.01	0.02	0.47	1.18		0.5		4.92	<0.01	<0.01	9	11	10500
M134W	24/11/2020	7.73	15500	9430	<1	<1	166	166	<1	5850	114	55	3100	11	<0.01							<0.001		0.068						0.011	0.49	0.45	<0.0001	0.6		5.97	<0.01	<0.01	3	3	6420
GM031V	21/12/2021	8.06	10170	5750	<1	<1	694	694	<1	3300	20	11	2240	6		<0.001	<0.001			<0.001	<0.001	0.006	<0.001	0.011	0.002	<0.001	<0.01		<0.01	0.007	1.11	0.07		1.5		4.22	<0.01	<0.01	8	9	13400
GM031V	14/12/2022	8.44	9940	5890	<1	31	610	641	<1	3180	19	10	2220	6		<0.001	<0.001	7.35		<0.001	<0.001	<0.001	<0.001	0.012	0.002	<0.001	<0.01		<0.01	0.006	1.47	0.07		1.6	<0.01	5.03	<0.01	0.01	4	7	12100
MB1-D	17/12/2019	7.95	8790	5110	<1	<1	817	817	<1	2250	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		1.92	<0.01	<0.01	37	38	13700
MB1-D	20/11/2020	8.26	9380	5460	<1	<1	1600	1600	<1	2560	14	10	2410	24		0.003	<0.001	4.12		<0.001	<0.001	0.002	0.006	0.015	0.017	0.032	<0.01		<0.01	0.024	1.68	1.14	<0.0001	2		2.45	<0.01	<0.01	24	23	8050
MB1-D	27/10/2021	8.15	8600	5320	<1	<1	1870	1870	<1	1970	12	6	2010	21		0.002	<0.001	2.72		<0.001	<0.001	0.004	0.007	0.014	0.01	<0.01	<0.01		<0.01	<0.005	1.19	0.56		2								
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	0.05	<0.01		<0.01	0.008	1.39	0.68		2.1	1.31	2.82	<0.01	<0.01	16	15	5030
GW907B	15/11/2019	6.79	15700	9910	<1	<1	1380	1380	<1	4920	276	256	2330	64		0.005	<0.001	12.2		<0.001	0.001	<0.001	<0.001	0.12	0.006	0.02	<0.01		<0.01	2.16	0.24	2.94		0.2		8.88	<0.01	<0.01	6	11	2580
M324W	26/07/2014	9.17	1170	707	<1	48	177	225	24	188	26	5	199	31		0.005	<0.001	0.31		0.004	0.004	0.582	0.459	0.304		0.008			<0.01	0.427				1								
M324W	13/02/2015	8.83	2660	1540	<1	105	615	720	1	505	7	2	627	29		<0.001	<0.001	0.482		<0.001	<0.001	<0.001	<0.001	0.018		0.002			<0.01	0.093				3.7								
M324W	30/05/2016	8.57	2750	1390	<1	64	624	688	6	522	6	1	599	12		<0.001	<0.001	0.921	<0.001	<0.001	<0.001	<0.001	<0.001	0.025	0.02	<0.001	<0.01	0.889	<0.01	0.006	0.76	0.22			0.46	1.05	<0.01	<0.01	22	22	21000
M324W	15/11/2016	8.58	2650	1540	<1	59	635	694	<1	503	5	1	612	12		0.001	<0.001	0.738	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	0.024	<0.001	<0.01	0.807	<0.01	0.01	0.78	0.13		4.5	0.44	0.93	<0.01	<0.01	16	14	13200
M324W	19/11/2017	8.86	2740	1300	<1	104	568	672	<1	536	4	1	666	13		0.001	<0.001	0.572		<0.001	<0.001	<0.001	<0.001	0.006	0.027	<0.001	<0.01		<0.01	<0.005	0.72	<0.05		3.9								
M324W	16/11/2018	8.66	2740	1520	<1	86	565	651	<1	507	3	1	579	13		0.001	<0.001	0.555		<0.001	<0.001	0.001	<0.001	0.006	0.031	<0.001	<0.01		<0.01	<0.005	0.74	0.12		3.8	0.49	0.97	<0.01	<0.01	22	21	13300
M324W	14/11/2019	8.7	2690	1530	<1	74	571	645	1	524	2	<1	595	12		0.001	<0.001	0.56		<0.001	<0.001	<0.001	0.001	0.005	0.03	<0.001	<0.01		<0.01	<0.005	0.72	0.2		4.3	0.49	1.02	<0.01	<0.01	15	15	13100
M324W	23/11/2020	8.99	2590	1480	<1	92	556	648	<1	566	1	1	748	15		0.001	<0.001	0.584		<0.001	<0.001	0.002	0.002	0.005	0.044	<0.001	<0.01		<0.01	0.005	0.99	0.22		4.3	0.57	0.99	<0.01	<0.01	16	17	11900
M324W	29/10/2021	8.89	2650	1570	<1	<1	87	552	639	<1	529	<1	<1	612	13		0.001	<0.001	0.433		<0.001	<0.001	<0.001	0.002	0.004	0.036	<0.001	<0.01		<0.01	<0.005	0.77	0.18		3.8	0.59	0.96	<0.01	<0.01	12	14	12100
M325W	13/02/2015	8.55	3410	2260	<1	<1	14	252	297	68	906	2	<1	709	73		0.002	<0.001	0.005		<0.001	0.003	0.016	<0.001	0.009		0.009			<0.01	0.024				0.7								
M325W	13/11/2015	8.13	5000	2730	<1	<1	450	450	4	1400	8	1	919	40		0.001	<0.001	0.252		<0.001	0.002	<0.001	<0.001	0.086		<0.001			<0.01	<0.005				1.1		0.18	0.02	0.02	108	85	
M325W	30/05/2016	8.74	6150	3310	<1	75	370	446	1	1600	6	<1	1250	39		0.002	<0.001	0.384	<0.001	<0.001	<0.001	0.008	<0.001	0.057	0.114	0.002	<0.01	0.639	<0.01	0.009	1.17	0.24			0.54	0.01	0.01	75	84	9640
AN019F	10/11/2015	11.8	10200	5430	456	82	<1	539	33	2920	154	<1	1620	19		0.002	<0.001	2.79		<0.001	<0.001	0.006	<0.001	<0.001	0.007		<0.01		<0.01	0.01				0.8	0.04	1.51	<0.01	<0.01	40	22	
AN019F	30/05/2016	11.6	10800	5970	410	100	<1	510	38	3180	168	<1	1840	29		0.004	<0.001	3.25	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.056	0.008	<0.01	8.18	<0.01	<0.005	0.42	<0.05	0.42		0.05	6.29	<0.01	0.02	14	17	12900
AN019F	15/11/2016	11.8	11100	6140	428	125	<1	553	37	3400	162	<1	1970	28		0.004	<0.001	2.65	<0.001	<0.001	<0.001	<0.001	0.036	0.006	0.06	<0.01	<0.01	5.92	<0.01	0.014	0.46	<0.05		0.7	<0.05	7.26	<0.01	<0.01	17	14	12600
AN019F	15/11/2017	11.1	10700	5890	123	135	<1	258	35	3340	104	<1	2330	27		0.004	<0.001	2.4		<0.001	<0.001	<0.001	<0.001	<0.001	0.027	0.003	<0.01		<0.01	0.006	0.45	<0.05		0.7								
AN019F	11/11/2019	11.41	10700	6550	195	125	<1	319	32	3540	82	<1	2280	23		0.004	<0.001	2.34		<0.001	<0.001	<0.001	<0.001	<0.001	0.024	0.002	<0.01		<0.01	<0.005	0.57	<0.05		0.8	<0.01	4.56	<0.01	<0.01	16	17	13800
AN019F	21/11/2020	11.37	10800	5750	230	61	<1	291	29	3670	63	<1	2590	24		0.004	<0.001	2.86		<0.001	<0.001	<0.001	<0.001	<0.001	0.03	0.002	<0.01		<0.01	<0.005	0.75	<0.05		0.8	<0.01	3.64	<0.01	<0.01	15	15	12500
AN019F	30/11/2021	11.43	10000	6040	66	157	<1	223	26	3410	41	<1	2120	20		0.004	<0.001	2.41		<0.001	<0.001	<0.001	<0.001	<0.001	0.019	0.002	<0.01		<0.01	<0.005	0.47	<0.05		0.7	0.08	3.76	<0.01	<0.01	14	11	10900
AN019F	14/12/2022	11.2	9930	6030	129	100	<1	228	27	3440	40	<1	2220	20		0.003	<0.001	2.44		<0.001	<0.001	0.011	<0.001	0.004	0.021	0.003	<0.01		<0.01	0.082	0.62	<0.05		0.7	0.01	3.67	<0.01	<0.01	4	4	1130

APPENDIX D: 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			Observation Wells		
Well Name	X (m)	Y (m)	Well Name	X (m)	Y (m)
RH60	0	0	▫ RH60	0	0

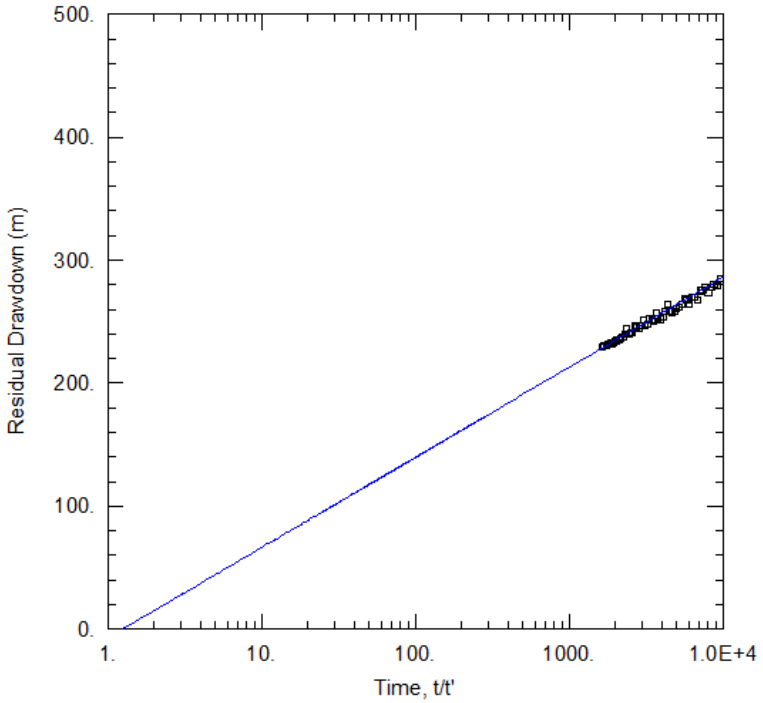
SOLUTION

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