

Appendix C

AGE – 2025 groundwater modelling report



Australasian
Groundwater
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Consultants

Report on

Bowen UWIR 2025 Groundwater Modelling Report

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Bowen UWIR 2025 – Groundwater Modelling Report

1 Introduction

1.1 Background

Arrow Energy Pty Ltd (Arrow) and QPM Energy (QPME) appointed Australasian Groundwater and Environmental Consultants Pty Ltd (AGE) to update an existing numerical groundwater modelling tool developed by AGE (2021) and AGE (2018), which was originally developed by Ausenco and Norwest (2012), in order to assess the impacts of coal seam gas activities in the Bowen Basin related to:

- Petroleum Leases (PLs) 191, 196, 223 and 224 which form part of the Moranbah Gas Project (MGP) for which QPME is the responsible tenure holder; and
- PL 486 and other Authority to Prospect (ATP) areas 1103, 742 and 1031 which form part of the Bowen Basin Gas Project (BGP) for which Arrow Energy is the responsible tenure holder.

The MGP has been producing gas for the domestic market since 2003 and was initially operated by Arrow and acquired by QPME in August 2023. The BGP is operated by Arrow and includes production testing since 2008. Previous UWIR reports for the MGP and BGP include:

- UWIR for PLs 191, 196, 223, 224 (Arrow Energy, 2012a);
- UWIR for ATP 1103 (Arrow Energy, 2012b);
- UWIR for ATP 1031 (Arrow Energy, 2014);
- UWIR for PL 191, 196, 223, 224 and ATP 644, 831, 742, 1031 and 1103 (Arrow Energy, 2016);
- UWIR for PL 191, 196, 223, 224 and ATP 644, 831, 742, 1031 and 1103 (Arrow Energy, 2019); and
- UWIR for PL 191, 196, 223, 224 and ATP 644, 831, 742, 1031 and 1103 (Arrow Energy, 2022).

The most recent 2022 UWIR for the MGP and BGP was approved with conditions and took effect on 2 August 2022. Subsequent the acquisition of the MGP by QPME in August 2023, QPME, rather than Arrow Energy, have become the responsible tenure holder for the MGP and separate UWIRs will have to be submitted in 2025 to DETSI for the BGP and MGP.

1.2 In this report

This report presents a summary of work completed to update the Bowen Basin numerical groundwater flow model previously developed by AGE (AGE, 2021; AGE, 2018). This report provides a description of the model construction, revised 2025 calibration results and setup of the predictive scenarios to assess the regional scale groundwater impacts of the MGP and BGP. This report is intended to be included as an appendix in separate UWIR reports relating to these two projects. Similarly predictive outputs generated using the groundwater flow model described herein will also be included in the 2025 MGP and BGP UWIR reports. It should be noted that the updated groundwater model described in this report does not simulate the impacts on groundwater due to coal mining occurring in the Bowen Basin.

2 Model construction details

2.1 Introduction

The Northern Bowen Basin numerical groundwater model was originally developed for Arrow by Ausenco and Norwest (Ausenco and Norwest, 2012) to predict and delineate groundwater impacts where drawdowns exceed the Queensland Department of Environmental and Heritage Protection (DEHP) threshold criteria. The model was developed using MODFLOW-SURFACT™.

For the 2019 Bowen UWIR (Arrow Energy, 2019), AGE converted the Ausenco and Norwest Bowen model to MODFLOW-USG in order to increase the resolution of the model mesh around the MGP area and better delineate groundwater structures (AGE, 2018).

For the 2022 Bowen UWIR (Arrow Energy, 2022), the groundwater model was further updated by AGE, including further mesh refinement, a revised stress-period setup, specific storage values and updated MGP and BGP field development plans (AGE, 2021).

Relative to the previous version of the model (AGE, 2021) which was used to assess groundwater impacts in the previous UWIR (Arrow Energy, 2022) the following changes have been made:

- extend the model calibration period from January 2018 to January 2024 (see Section 2.4, Section 2.7 and Section 3.1);
- update the MODFLOW well (WEL) package based on actual historic CSG related water extraction data provided for the BGP and MGP by Arrow Energy (Section 2.7);
- update the MODFLOW recharge (RCH) package based on updated historic actual climate records from Bureau of Meteorology (BoM) SILO website; and
- generate revised predictions based on revised calibrated model parameters (Section 2.6) and revised MGP and BGP field development plans provided by Arrow Energy and QPME (Chapter 4).

Although model features such as layering and mesh remain unchanged compared to the 2022 Bowen model, a summary of the 2025 Bowen model construction details is provided below in Sections 2.2 to 2.7.

2.2 Model domain, mesh and layering

No changes have been made to the model domain, mesh or layering relative to the previous Bowen Basin model (AGE, 2021). The text below therefore provides a brief description of these features of the model for completeness.

The model domain is approximately 157 km wide (west to east direction) and 395 km long (north to south direction) as shown in Figure 2.2. This area has been discretised and arranged into 22 layers comprising up to 18,082 cell nodes in each layer with the dimensions of the cells varying according to the features that required representation as follows:

- MGP area, approximately 200 x 200 m hexagonal cells aligned to in seam wells;
- BGP area, approximately 1,500 x 1,500 m voronoi/rectangle cells centred on downhole CSG production wells;
- Faults, approximately 1,000 x 1,000 m centred on either side of modelled faults;
- Surficial aquifer systems (e.g. basalt), approximately 1,000 x 1,000m centred either side of the mapped limit of each unit;
- Major drainage systems, approximately 500 x 500 m centred along river lines proximal to the MGP;
- 150 m cells within the Red Hill Production area in PL486 which forms part of the BGP; and
- 150 m cells centred at the location of each monitoring well.

Overall, the 2025 Bowen model comprises 212,667 cells across the 22 layers. Table 2.1 presents a summary of the model layers. Groundwater layer types were prescribed as convertible layers, with unsaturated flow represented using the 'upstream weighting' function.

Table 2.1 Bowen model layering

Model layer	Primary Formation/Group	Unit
1	Quaternary Alluvium, weathered materials	Surficial Coverage
2	Tertiary sediments (Duringa), Basalts (Anakie) & Moolayember	Tertiary, Triassic
3	Clematis Sandstone	Triassic
4	Rewan/Rangal Coal Measures	Triassic
5	Rangal Coal Measures (RCM)	Leichardt seam
6		Interburden
7		Vermont seam
8	Fort Cooper Coal Measures (FCCM)	FCCM
9		FCCM
10		FCCM
11	Moranbah Coal Measures (MCM)	Q Seam
12		Interburden
13		P seam
14		Interburden
15		GM seam
16		Interburden
17		GML seam
18		Interburden
19		DYU seam
20		Interburden
21		DYR seam
22	Collinsville, Back Creek Group	Permian basement

2.3 Stress period setup

No changes have been made to the stress period setup relative to the previous Bowen Basin model (AGE, 2021). The text below therefore provides a brief description of this feature of the model for completeness.

Model simulations comprise the following 405 stress-periods:

- December 2003, a single steady state stress period to simulate pre-CSG initial conditions.
- December 2003 to May 2030, 318 monthly stress periods to simulate historical and anticipated near-future CSG developments in the model domain which include all historical and future MGP developments.
- June 2030 to December 2099, one seven-month and 68 annual stress periods to simulate long-term future CSG developments that form part of the BGP and initial post-CSG recovery.
- January 2100 to 2180, one six-year and 15 five-year stress periods for long-term post-CSG recovery simulations.

2.4 Boundary conditions

The boundary conditions of the 2025 Bowen model are based on the 2022 Bowen model developed by AGE (2021). No changes were made to the following input packages:

- The MODFLOW River package (RIV) was used to represent the perennial reaches of the Bowen and Isaac Connors River system with river elevations, stage heights, incisions depths and vertical conductivity rates based on the Isaac Connors Groundwater Project (SKM, 2009).
- A general head boundary (GHB) package was used at all model boundaries to replicate regional groundwater gradients.
- Potential and actual evapotranspiration dataset was applied to the model using the MODFLOW evapotranspiration (EVT) package using a constant maximum evapotranspiration rate of 0.00274 m/day and an extinction depth of 15 m (i.e. when groundwater levels fall below this extinction depth no evapotranspiration losses occur).

As part of extending the calibration period of the previous Bowen basin model to January 2024, changes were made to recharge (RCH) package to represent rainfall recharge (see Section 2.5) and the MODFLOW WEL-package to simulate CSG water extraction (see Section 2.7).

2.5 Rainfall recharge

Rainfall recharge rates were derived base on soil-moisture bucket (SMB) model calculations, which computes a daily balance of water entering the soil zone via rainfall and exiting via evapotranspiration. On any days where soil moisture storage capacity is exceeded i.e., the soil moisture deficit reaches zero, then any rainfall in excess of evapotranspiration forms recharge to the underlying groundwater. Inputs to the SMB calculations are daily rainfall and evapotranspiration using climate data downloaded from the Bureau of Meteorology (BOM) for grid point coordinates -21.05 and 147.95. Calculated SMB recharge seepage rates were aggregated for each stress-period of the Bowen groundwater model and applied to the MODFLOW recharge package.

2.6 Initial hydraulic properties

As the Bowen Basin model was not re-calibrated for the 2022 UWIR (Arrow Energy, 2022) then, other than specific storage, initial (pre-calibration) hydraulic properties were assigned based the previous 2018 calibration (AGE, 2018). With regard to specific storage, a number of papers, in particular Rau et al. (2018), have been released since completion of the previous calibration (AGE, 2018) suggesting that the calibrated specific storage values may be unrealistically high. Rau et al. (2018) suggest an upper bound for specific storage of $2.0 \times 10^{-5} \text{ m}^{-1}$ and hence the previously calibrated values were adjusted downwards where necessary to prevent initial values exceeding this bound.

As per the previous model iterations (AGE, 2018; AGE, 2021) initial hydraulic properties of different formations in the Moranbah and Rangal Coal Measures also feature a depth-dependency. These depth relationships, presented in AGE (2018), are based on aquifer parameters reported by Ausenco and Norwest (2012) for different subregions in these hydrogeological units. A summary of initial hydraulic properties per model layer is provided in Table 2.2, which also indicates whether the hydraulic conductivity is depth-dependent for each model layer. Upper and lower bound used for model calibration are discussed in Section 3.3 and listed in Table 3.3.

Similar to AGE (2018) and AGE (2021), two-phase flow relative permeability effects encountered in the vicinity of CSG production wells are not considered in the model. These effects comprise a reduction of effective permeability due to the presence of gas and as reported in AGE (2018) lead to a potential misrepresentation of drawdowns in the immediate vicinity of the CSG production wells. In addition to this, there is a considerable amount of upscaling for regional scale models representing the interburden units surrounding the in-seam wells. This further contributes to the uncertainty of the groundwater pressures proximal to CSG production wells. As reported in AGE (2018), these effects are considered local, with minimal implications to regional groundwater drawdown predictions.

2.7 CSG extraction

Both historical and future CSG field development plan (FDP) data was provided by Arrow Energy and QPME.

Historical FDP data included monthly historical water extraction rates for each individual existing CSG well which form part of the MGP and BGP. This data was used to extend the historical CSG extraction period in the model to the end of the calibration period (i.e. January 2025) using the MODFLOW WEL package. Many of these existing CSG wells are non-vertical and also penetrate multiple model layers. Hence, prior to using the supplied well extraction volumes it was first necessary to distribute these volumes across several model nodes. This was carried out using inhouse AGE software which distributes the reported volumes based on the nodes intersected by each well and the modelled hydraulic conductivity of these nodes.

Information on expected future CSG well locations and forecast water extraction relating to both existing and proposed wells based on current FDPs for the MGP and BGP were also provided. Relative to the previous UWIR (Arrow Energy, 2022) the following changes have been made to simulate the MGP and BGP FDPs:

- revised FDP data provided for the BGP for the period 2025 to 2045 includes an additional 15 CSG wells on ATP 1103 and seven additional wells on PL486;
- no changes have been made to the BGP FDP for the period 2045 to 2063; and
- no changes have been made to MGP FDP and hence the predicted water extraction related to this project are the same as reported in the previous UWIR (Arrow Energy, 2022).

Modelled CSG extraction start and end dates based on updated information provided by Arrow Energy and QPME are presented in Figure 2.3 and Figure 2.4. During the model calibration period (i.e. to January 2025) only CSG production wells related to the MGP are active, although several pilot CSG wells associated with the BGP are also operating over this period. Figure 2.1 graphically illustrates the total daily production for the BGP and MGP with time.

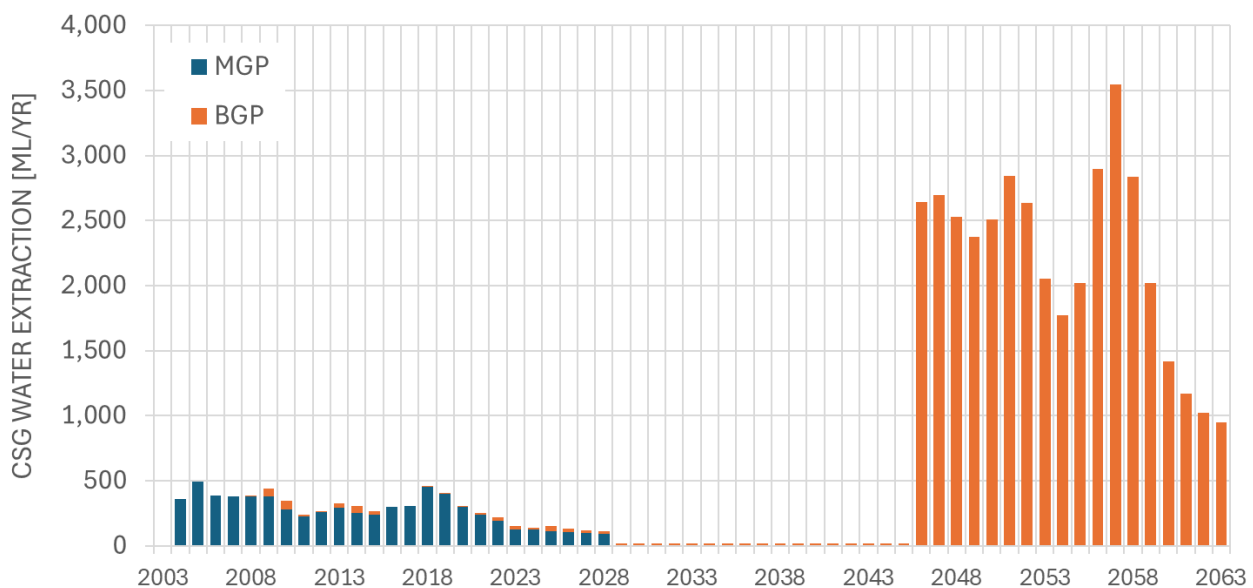
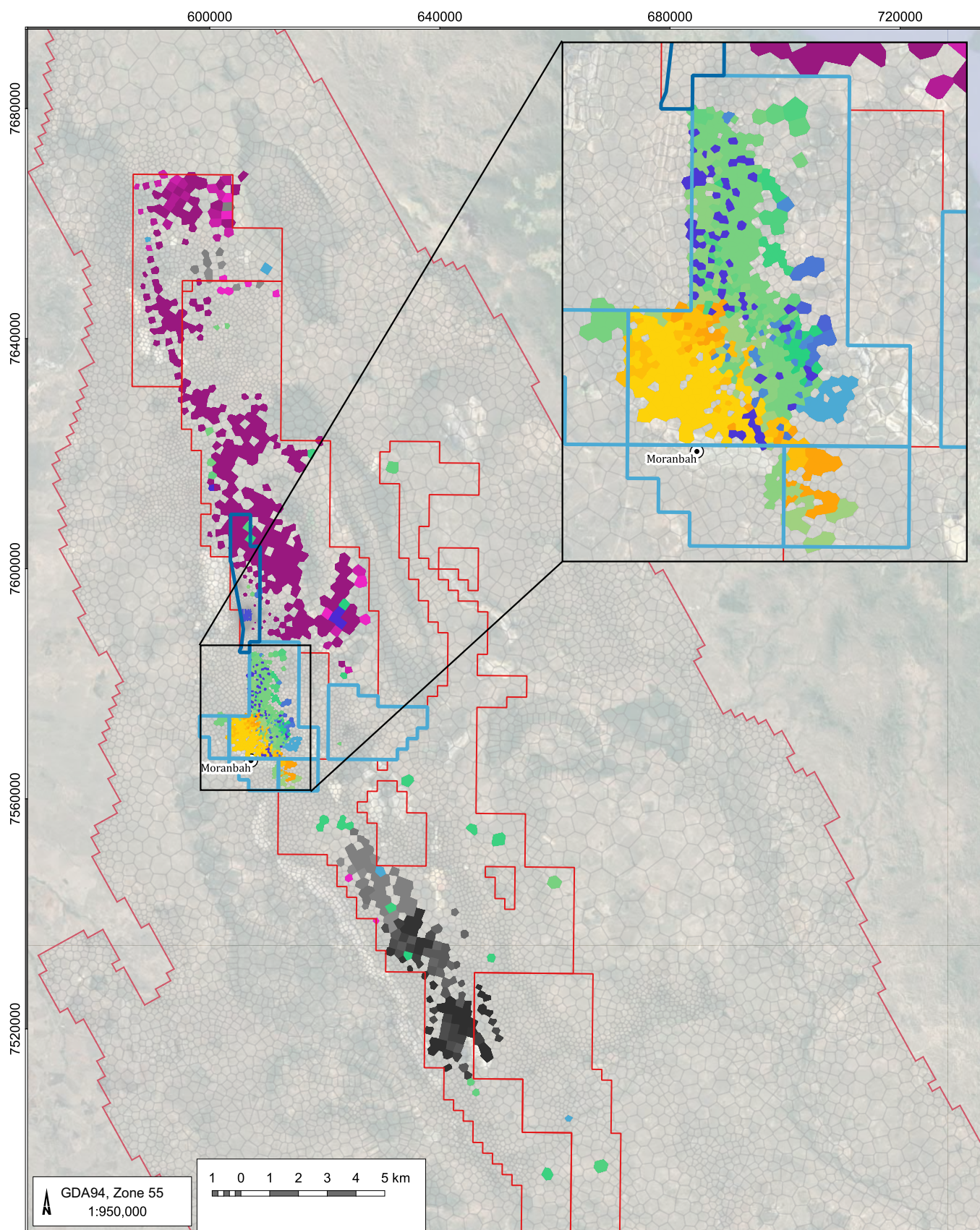


Figure 2.1 2025 FDP – timeseries of CSG extraction rates for the MGP and BGP

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 Source: 1 second SRTM Derived DEM-S - © Commonwealth of Australia (Geoscience Australia) 2011.; GEODATA TOPO 250K Series 3 - © Commonwealth of Australia (Geoscience Australia) 2006.;
 G:\Projects\BOW5000 2021 Bowen UWIR ARROW ENERGY and QPM ENERGY 50 50's Deliverables\001 Deliverable1\Figures\Fig 2-2 BOW5000 model grid update.gzg



LEGEND

- Populated place
- AGE model outline
- AGE mesh
- PL (QPM, MGP)
- PL (Arrow, BGP)
- ATP (Arrow, BGP)
- WEL start (year)**
- 2003
- 2004
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- 2007
- 2008
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- 2059

Bowen (BOW5000)

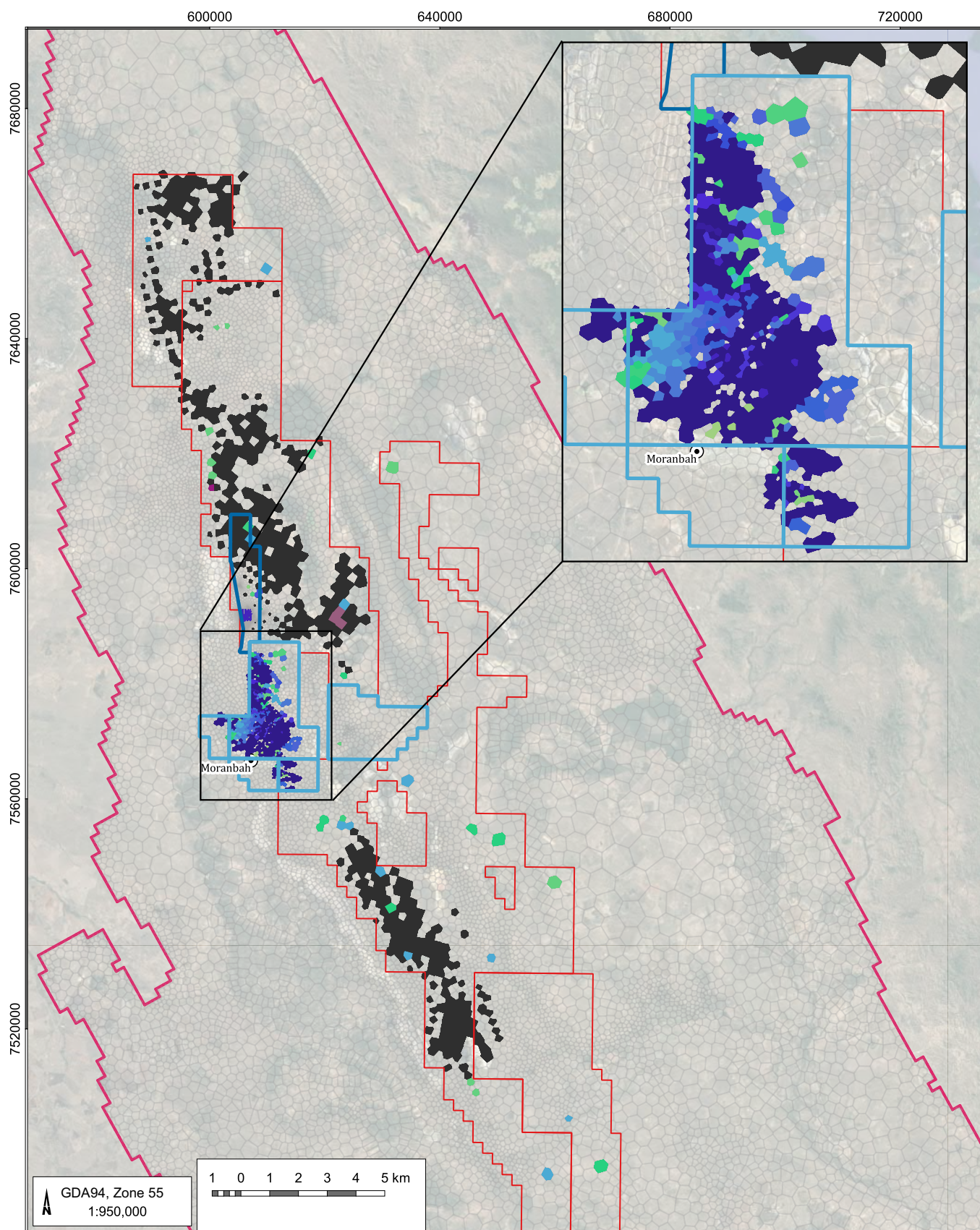
CSG well production start year - cumulative scenario



AGE

DATE
30/01/2025

FIGURE No:
2.3



LEGEND

- | | | | | |
|--|---|--|--|--|
| <ul style="list-style-type: none"> ⊙ Populated place AGE mesh AGE model outline PL (QPM, MGP) PL (Arrow, BGP) ATP (Arrow, BGP) | WEL stop (year) <ul style="list-style-type: none"> 2007 2008 2009 2010 2011 | <ul style="list-style-type: none"> 2012 2013 2014 2015 2016 2017 2018 | <ul style="list-style-type: none"> 2019 2020 2021 2022 2023 2024 2025 2026 | <ul style="list-style-type: none"> 2027 2028 2044 2045 2063 |
|--|---|--|--|--|

Bowen (BOW5000)

CSG well production end year - cumulative scenario



AGE

DATE
30/01/2025

FIGURE No:
2.4

Table 2.2 Summary of initial hydraulic parameters

Layer	Primary formation	Unit	Hydraulic conductivity average and max-min range			Specific storage average and max-min range (m-1)	Specific yield average and max-min range (%)
			Horizontal (Kh) (m/day)	Vertical (Kv) (m/day)	Depth Dependency		
1	Quaternary Alluvium, weathered materials	Surficial coverage	8.44E+00 (8.50E-03 - 1.40E+02)	1.61E+00 (8.50E-05 - 1.00E+01)	No	2.0E-05 (2.0E-05 - 2.0E-05)	19.1% (18.0% - 20.0%)
2	Tertiary sediments (Duringa), Basalts (Anakie) & Moolayember	Tertiary, Triassic	4.76E+00 (1.40E-05 - 6.20E+01)	2.53E+00 (2.60E-09 - 1.40E+02)	No	1.6E-05 (9.9E-07 - 2.0E-05)	14.7% (5.0% - 50.0%)
3	Clematis Sandstone	Triassic	2.06E-02 (6.30E-03 - 5.50E-02)	2.07E-03 (3.60E-04 - 7.50E-03)	No	2.0E-05 (2.0E-05 - 2.0E-05)	17.0% (17.0% - 17.0%)
4	Rewan	Triassic	1.08E-03 (7.50E-04 - 1.00E-02)	1.54E-07 (9.70E-08 - 5.50E-06)	No	1.0E-06 (9.9E-07 - 1.0E-06)	6.0% (6.0% - 6.0%)
5	Rangal Coal Measures	Leichardt seam	2.56E-02 (8.60E-06 - 1.00E-01)	6.90E-03 (8.60E-06 - 5.40E-02)	Yes	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
6		Interburden	1.00E-04 (1.00E-04 - 1.00E-04)	1.00E-08 (1.00E-08 - 1.00E-08)	No	1.0E-06 (9.9E-07 - 1.0E-06)	6.0% (6.0% - 6.0%)
7		Vermont seam	2.08E-02 (8.60E-06 - 1.00E-01)	5.25E-03 (8.60E-06 - 5.40E-02)	Yes	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
8	Fort cooper coal measures	Girrah	1.00E-04 (1.00E-04 - 1.00E-04)	8.60E-06 (8.60E-06 - 8.60E-06)	No	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
9		Fccm	4.40E-03 (4.40E-03 - 4.40E-03)	8.00E-05 (8.00E-05 - 8.00E-05)	No	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
10		FHF	1.00E-04 (1.00E-04 - 1.00E-04)	8.60E-06 (8.60E-06 - 8.60E-06)	No	2.0E-05 (1.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
11	Moranbah Coal Measures	Q seam	1.62E-02 (8.60E-06 - 1.00E-01)	5.31E-03 (8.60E-06 - 1.00E-01)	Yes	1.9E-05 (9.0E-07 - 2.1E-05)	5.0% (5.0% - 5.0%)
12		Interburden	9.98E-05 (8.80E-05 - 1.00E-04)	2.08E-08 (2.00E-08 - 9.20E-08)	No	9.6E-07 (7.0E-07 - 1.0E-06)	5.0% (5.0% - 5.0%)

Layer	Primary formation	Unit	Hydraulic conductivity average and max-min range			Specific storage average and max-min range (m-1)	Specific yield average and max-min range (%)
			Horizontal (Kh) (m/day)	Vertical (Kv) (m/day)	Depth Dependency		
13	Moranbah Coal Measures	P seam	1.16E-02 (8.60E-06 - 1.00E-01)	4.28E-03 (8.60E-06 - 1.00E-01)	Yes	1.9E-05 (9.0E-07 - 2.0E-05)	5.0% (5.0% - 5.0%)
14		Interburden	9.69E-05 (1.30E-05 - 1.00E-04)	6.69E-08 (1.00E-08 - 7.10E-08)	No	9.7E-07 (7.0E-07 - 1.0E-06)	5.0% (5.0% - 5.0%)
15		GM seam	7.72E-03 (8.60E-06 - 1.00E-01)	1.61E-03 (8.60E-06 - 3.20E-02)	Yes	1.8E-05 (9.0E-07 - 2.0E-05)	5.0% (5.0% - 5.0%)
16		Interburden	1.03E-04 (9.90E-05 - 3.40E-04)	8.29E-08 (6.90E-08 - 3.00E-06)	No	1.2E-06 (9.7E-07 - 6.5E-05)	5.0% (5.0% - 5.0%)
17		GML seam	6.90E-03 (8.60E-06 - 1.00E-01)	1.59E-03 (8.60E-06 - 3.20E-02)	Yes	2.0E-05 (1.9E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
18		Interburden	1.00E-04 (1.00E-04 - 1.00E-04)	7.00E-08 (7.00E-08 - 7.00E-08)	No	1.0E-06 (9.8E-07 - 1.0E-06)	5.0% (5.0% - 5.0%)
19		DYU seam	6.47E-03 (8.60E-06 - 1.00E-01)	1.50E-03 (8.60E-06 - 3.20E-02)	Yes	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
20		Interburden	1.00E-04 (1.00E-04 - 1.00E-04)	7.00E-08 (7.00E-08 - 7.00E-08)	No	1.0E-06 (9.9E-07 - 1.0E-06)	5.0% (5.0% - 5.0%)
21		DYR seam	6.40E-03 (8.60E-06 - 1.00E-01)	1.50E-03 (8.60E-06 - 3.20E-02)	Yes	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
22		Permian basement	4.40E-04 (4.40E-04 - 4.40E-04)	8.80E-06 (8.80E-06 - 8.80E-06)	No	1.0E-06 (9.9E-07 - 1.0E-06)	6.0% (6.0% - 6.0%)

3 Calibration

3.1 Calibration method

The calibration was performed using a combined pre-CSG steady state and transient simulation for the period January 2003 to January 2024. It was undertaken with reference to an updated groundwater level observation dataset for this period using automated parameter estimation software PEST_HP (Watermark Numerical Computing, 2021) to determine optimal hydraulic parameters and recharge rates. As per the previous calibration (AGE, 2018) a total of 6,705 model parameters were estimated. As mentioned previously (Section 2.6) initial parameter values were primarily based on previously calibrated parameters, other than specific storage where the initial values were adjusted to avoid exceeding the upper bound values reported in Rau et al. (2018). Due to the large number of parameters, singular-value-decomposition was adopted to assist with model calibration and preferred value regularisation was also used to restrict parameter changes that are not informed by the calibration dataset.

3.2 Calibration dataset

Transient calibration was undertaken with reference to updated data for 38 monitoring points for which time series groundwater level data are available. The steady state part of the calibration uses data for a substantially larger number of 481 monitoring points which includes single time of drilling readings for a large number of landholder monitoring points. The locations of steady-state and transient monitoring points are shown in Figure 3.1.

The steady-state calibration data set was the same as that used for the previous calibration (AGE, 2018). Details of the 41 transient monitoring points considered for use in the 2025 recalibration reported herein are presented in Table 3.1 and Table 3.2, for shallow and deep monitoring points, respectively. Ultimately data for only 38 transient monitoring points were used for calibration. As per notes provided in Table 3.2 data for the following monitoring points were excluded:

- Data for monitoring bores MB2 and MB3 were excluded as observed groundwater levels for these bores show recovering groundwater levels related to pilot testing and water extraction activities between 2011 and 2018 (Arrow Energy, 2024) which are not represented in the 2025 Bowen model; and
- Data for monitoring point M325_FL_1P was excluded due to observed groundwater levels being affected by sampling and erroneous measurements (Arrow Energy, 2019).

Early records for GR067V were also excluded as these are affected by depressurisation activities associated with the conversion of the bore to a monitoring point (Arrow Energy, 2024).

Observation weights were initially assigned based on the number of observations for each monitoring point and subsequently adjusted using the PEST utility PWTADJ1 to ensure that no single observation group dominates the calibration.

Table 3.1 Shallow groundwater monitoring points

Bore	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)	Network	Total depth (m)	Screened interval (mbgl)	Screened formation	Date of first measurement	Date of last measurement
aen1063	665553	7505403	BGP	52.6	39.6 – 45.7	Blackwater Group	30/11/2020	30/11/2023
aen1214	595555	7666510	BGP	37.32	-	Rangal Coal Measures	30/11/2020	30/11/2023
aen1234	640332	7559908	BGP	102	48.2 – 102.0	Blackwater Group	30/11/2020	30/11/2023
gw004a	604933	7590892	BGP	13.5	7.5 – 13.5	Tertiary Sediment	30/11/2019	30/11/2023
gw004b	604933	7590892	BGP	59	53.0 – 59.0	Fort Cooper Coal Measures	30/11/2019	30/11/2023
mb12	620847	7595279	BGP	59.1	56.0 – 59.0	Rewan Formation	30/06/2018	30/11/2023
an020f	623192	7569070	MGP	77	70.0 – 72.0	Rewan Formation	19/01/2016	23/05/2023
m225w	604808	7569886	MGP	34	23.0 – 34.0	Weathered Tertiary Basalt	12/05/2014	21/11/2023
m230w	605636	7570996	MGP	32	29.0 – 32.0	Weathered Tertiary Basalt	12/05/2014	22/11/2020
m229w	605218	7570555	MGP	23	14 - 23	Clayey sand (Tertiary sediment/alluvium)	24/11/2016	16/06/2017
m231w	606756	7569648	MGP	13.4	7.4 - 13.4	Weathered Tertiary basalt	12/05/2014	15/11/2016
m232w	606898	7570000	MGP	14.2	8.2 - 14.2	Quaternary alluvium	21/11/2016	15/06/2017
m234w	607536	7570127	MGP	17.2	11.2 - 17.2	Quaternary alluvium	12/05/2014	15/06/2017
m235w	607140	7570864	MGP	-	-	Weathered Tertiary basalt	20/11/2016	14/06/2017
m236w	607239	7571073	MGP	-	-	Weathered Tertiary basalt	21/11/2016	14/06/2017
m237w	607168	7571087	MGP	-	-	Quaternary alluvium	19/11/2016	14/06/2017
m345w	603623	7573671	MGP	32.3	21.8 - 30.8	Tertiary sediment/alluvium	12/05/2014	17/06/2017
an021f	623297	7569128	MGP	27	20.0 – 22.0	Tertiary Sediment	31/05/2016	30/11/2023
m222w	611811	7566589	MGP	30.2	20.0 – 26.0	Weathered Fort Cooper Coal Measures	30/06/2012	30/11/2023
m224w	611155	7567225	MGP	32.5	26.5 – 32.5	Quaternary Alluvium	30/06/2012	30/11/2023
m250w	608185	7582505	MGP	56.5	44.5 – 56.5	Tertiary Sediment	30/06/2012	30/11/2023
m300w	605636	7570996	MGP	30	24.0 – 30.0	Weathered Tertiary Basalt	31/10/2021	30/11/2023
m339w	603459	7572764	MGP	41	35.0 – 41.0	Weathered Tertiary Basalt	30/06/2012	30/11/2023
m340w	604903	7572726	MGP	27.3	19.3 – 27.3	Weathered Tertiary Basalt	30/06/2012	30/06/2017

Table 3.2 Deep groundwater monitoring points

Bore	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)	Network	Total depth (m)	Screened interval (mbgl)	Screened formation	Date of first measurement	Date of last measurement	Comment
gw007b	605488	7596712	BGP	181.5	175.5 - 181.5	Fort Cooper Coal Measures	30/11/2019	30/11/2022	-
mb1_fccm	609595	7592256	BGP	550	336 - 340	Fort Cooper Coal Measures	30/11/2019	31/12/2023	-
mb1_girrah	609595	7592256	BGP	550	-	Fort Cooper Coal Measures (Girrah Seam)	30/11/2019	31/12/2023	-
mb1_mcm	609595	7592256	BGP	550	423.9 - 506.6	Moranbah Coal Measures	30/11/2019	31/12/2023	-
mb2	608621	7601119	BGP	834	701.1 - 814.7	Moranbah Coal Measures	28/02/2019	31/12/2023	Excluded from calibration as groundwater levels are still recovering after pilot tests and water extraction at this location between 2012 and 2018 (Arrow Energy, 2024).
mb3	607616	7605553	BGP	796.3	712.3 - 717.9	Moranbah Coal Measures	28/02/2019	31/12/2023	Excluded from calibration as groundwater levels are still recovering due to pilot testing at this location in 2011 (Arrow Energy, 2024).
mb1_s	609595	7592256	BGP	60	45.0 - 50.0	Fort Cooper Coal Measures (Girrah Seam)	30/11/2019	30/11/2023	-
an019f	623219	7569209	MGP	290	269.0 - 271.0	Fort Cooper Coal Measures	12/11/2015	18/08/2023	-
gr067v	612935	7582334	MGP	610.9	543.2 - 610.9	Moranbah Coal Measures	27/02/2016	16/01/2024	Early observations discarded due to depressurisation activities in this bore associated with the conversion of the bore to a monitoring point (Arrow Energy, 2024).
m162gm	603365	7573356	MGP	276	252.0 - 256.0	Moranbah Coal Measures	10/12/2015	16/01/2024	-
m313_bk_1p	614825	7562084	MGP	532.4	507.0 - 510.0	Back Creek Group	4/09/2014	16/01/2024	-

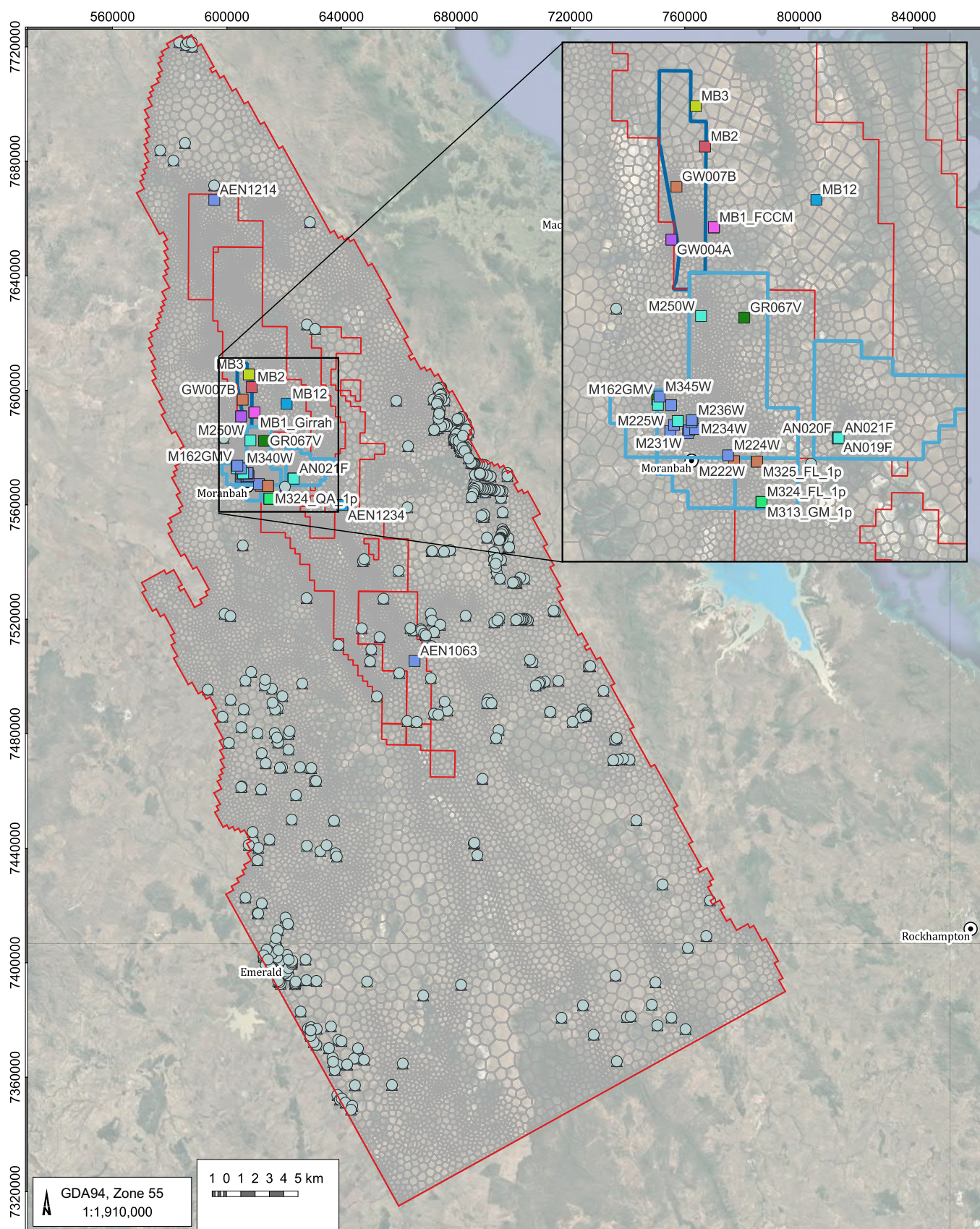
Bore	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)	Network	Total depth (m)	Screened interval (mbgl)	Screened formation	Date of first measurement	Date of last measurement	Comment
m313_gm_1p	614825	7562084	MGP	532.4	313.0 - 316.5	Moranbah Coal Measures (QA Seam)	4/09/2014	16/01/2024	-
m314_bk_1p	614324	7566535	MGP	560.5	551.5 - 553.5	Back Creek Group	5/09/2014	19/01/2024	-
m314_mcmq	614324	7566535	MGP	560.5	210.5 - 213.5	Moranbah Coal Measures (QA Seam)	5/09/2014	18/01/2024	-
m324_fl_1p	614828	7562106	MGP	240	163.0 - 166.0	Fort Cooper Coal Measures	6/09/2014	16/01/2024	-
m324_qa_1p	614828	7562106	MGP	240	187.0 - 190.0	Moranbah Coal Measures (QA Seam)	5/09/2014	16/01/2024	-
M325_FL_1P	614343	7566542	MGP	202.3	180.5 - 182.0	Fort Cooper Coal Measures	18/02/2015	19/01/2024	Excluded from calibration, local drawdown observed due to sampling and/or erroneous measurements (Arrow Energy, 2019).

3.3 Pilot points

As per the previous calibration (AGE, 2018), a total of 1,672 pilot points were used to calibrate the hydraulic properties of the 2025 Bowen Basin model, using 76 pilot points in each of the 22 model layers, the locations of which are presented in Figure 3.2. Values assigned to each pilot points were interpolated across the model domain in each layer of the model using ordinary automatic kriging through PLPROC (Watermark Numerical Computing, 2016). Pilot point multipliers were allowed to vary ± 2 orders of magnitude from the starting parameters and estimated hydraulic properties were capped based on the parameter bounds summarised in Table 3.3.

Table 3.3 General parameter constraints

Unit	Model Layers	Horizontal hydraulic conductivity Kx (m/day)	Horizontal hydraulic conductivity Kz (m/day)	Specific yield Sy (%)	Specific storage Ss (m^{-1})	Maximum anisotropy Kx:Kz
Alluvium, weathered materials	1	1.0E-05 – 150	1.0E-05 - 10	0.1 – 20	9.0E-07 - 2.1E-05	0.5
Tertiary Basalt	2	1.0E-05 – 100	1.0E-05 - 1	0.1 – 20	9.0E-07 - 2.1E-05	1
Sandstone	3	1.0E-05 - 1	1.0E-05 - 1	0.1 – 20	9.0E-07 - 2.1E-05	1
Interburden	4, 6, 12, 14, 16, 18, 20	8.6E-06 - 1.0E-02	1.0E-08 - 5.0E-03	0.1 – 6	7.0E-07 – 7.5E-05	0.5
Coal seams	5, 7, 8, 9, 10, 11, 13, 15, 17, 19, 21	8.6E-06 - 1.0E-01	8.6E-06 - 1.0E-01	0.1 – 6	2.0E-06 – 2.7E-05	1



LEGEND

- Populated place
- AGE mesh
- AGE model outline
- PL (QPM, MGP)
- PL (Arrow, BGP)
- ATP (Arrow, BGP)
- Steady state Targets
- Transient Targets
 - lay 1- Quaternary
 - lay 2 - Tertiary
 - lay 4 - Rewan
 - lay 5 - Leichardt seam
 - lay 8 - Fort Cooper Coal Measures
 - lay 9 - Fort Cooper Coal Measures
 - lay 10 - Fort Cooper Coal Measures
 - lay 11 - Q seam
 - lay 13 - P seam
 - lay 15 -GM seam
 - lay 16 - Interburden
 - lay 18 - Interburden
 - lay 22 - Permian basement

Bowen (BOW5000)

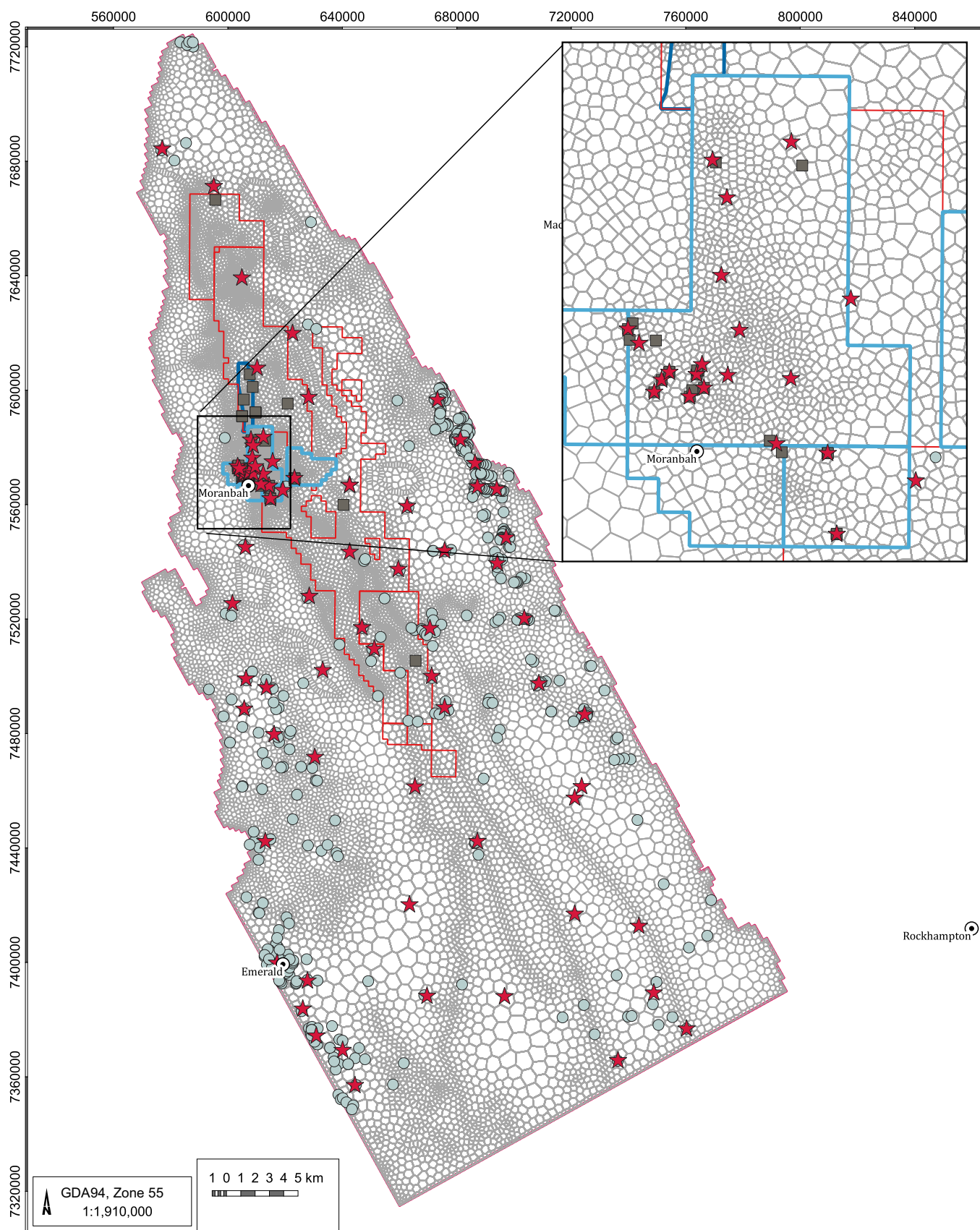
Groundwater level observation locations



AGE

DATE
30/01/2025

FIGURE No:
3.1



LEGEND

- ⊙ Populated place
- AGE mesh
- AGE model outline
- PL (QPM, MGP)
- PL (Arrow, BGP)
- ATP (Arrow, BGP)
- ★ Pilot Points multipliers
- Steady state targets
- Transient targets

Bowen (BOW5000)

Pilot point multiplier locations



AGE

DATE
30/01/2025

FIGURE No:
3.2

3.4 Calibration results

3.4.1 Groundwater levels

Figure 3.3 presents a comparison of observed and simulated groundwater levels resulting from the calibration as a scattergram. For both the steady-state simulation and transient simulation a high level of agreement between observed and modelled levels has been achieved as shown in Figure 3.3 and evidenced by the statistics presented in Table 3.4. In particular a scaled root mean square (SRMS) discrepancy between observed and simulated values of 2.9% has been achieved for the updated transient simulation. This transient SRMS statistic is substantially better than equivalent statistics related with either previous iteration of the model, which were 5.2 % in 2018 (AGE, 2018) and 13.7% in 2021.

Comparisons of observed and modelled head time series at each transient monitoring point used for model calibration are presented in Appendix A. In general, as per the overall statistics discussed above, a relatively good fit to the observed data has been achieved.

Table 3.4 Statistical analysis

Calibration performance measure	Transient data	Steady-state data
Sum of Residuals (SR) (m)	-33,875	4,195
Mean Sum of Residuals (MSR) (m)	-1.04	8.72
Scaled Mean Sum of Residuals (SMSR) (%)	-0.4	2.3
Sum of Squares (SSQ) (m)	1,462,409	234,329
Mean Sum of Squares (MSSQ) (m)	44.73	487.17
Root Mean Square (RMS) (m)	6.69	22.07
Root Mean Fraction Square (RMFS) (%)	0.5	0.9
Scaled RMFS (SRMFS) (%)	0.4	0.4
Scaled RMS (SRMS) (%)	2.9	5.8

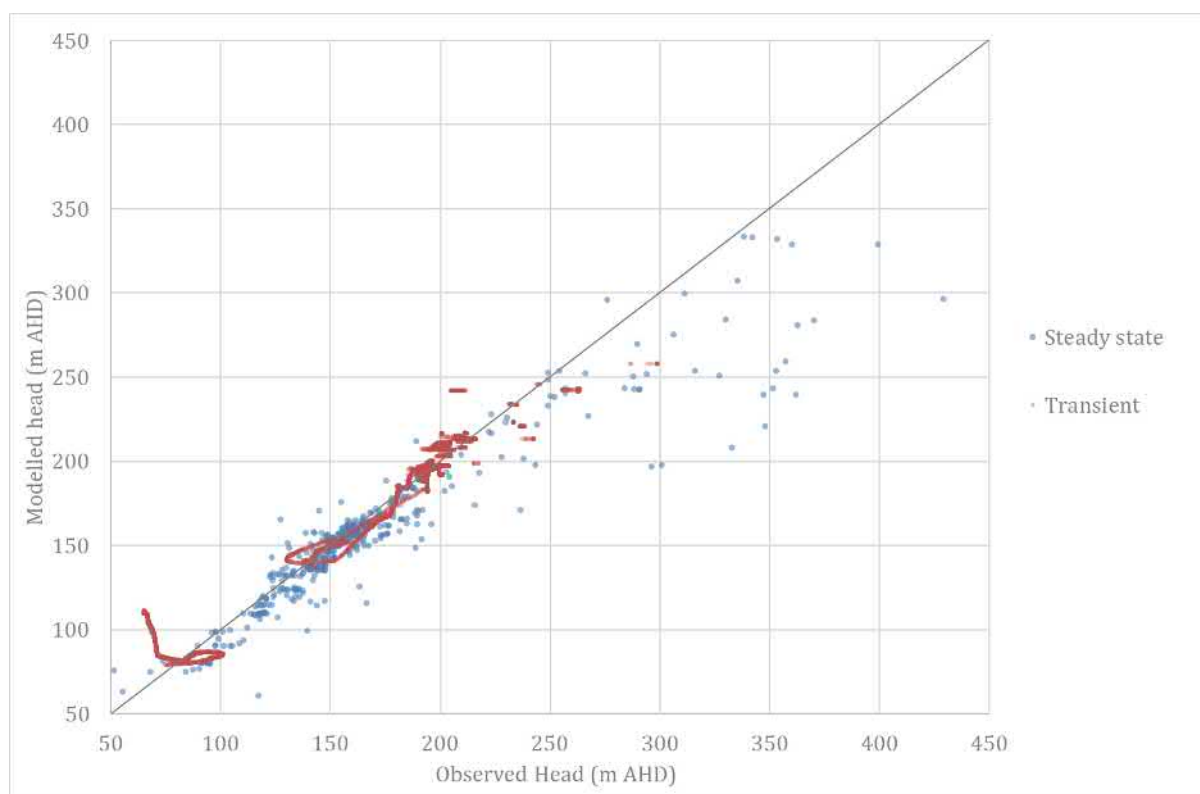


Figure 3.3 Scattergram measured vs. simulated groundwater levels - 2025 Bowen UWIR model

3.4.2 Modelled water balance

Table 3.5 shows the water budget for the steady state (pre-CSG) model. The mass balance error, that is, the difference between calculated model inflows and outflows at the completion of the steady state calibration was 0%. The maximum percent discrepancy at any time step in the transient simulation was also 0%. This value indicates that the model is stable and achieves an accurate numerical solution.

Table 3.5 Model water budget -steady state

Parameter	In (m ³ /day)	Out (m ³ /day)	In - Out (m ³ /day)
Rainfall recharge	211,021	0	211,021
Groundwater discharge to surface water courses	0	87,978	-87,978
Evapotranspiration	0	237,383	-237,383
In/outflow from/to lateral model boundaries	221,497	107,157	114,340
Total	432,518	432,518	0

3.4.3 CSG extraction

As discussed in Section 2.7 historic and future CSG extraction rates have been simulated in the model using actual and anticipated water extraction volumes provided by Arrow and QPME. The volumes have been input to the groundwater flow model via the MODFLOW WEL package and hence are referred to as “Model input” in Figure 3.4. Since MODFLOW automatically switches off extractions which occur from dry cells then in some situations the total modelled output (i.e. the amount actually extracted from the simulation) can be less than the input. As shown in Figure 3.4 this is not considered to be a significant source of error in this model since the modelled input and output time series plot on top of each other for the majority of the simulation period, hence confirming that the actual modelled extraction volumes are not materially different from those provided by Arrow and QPME. In addition, a comparison between total model input and output extraction volumes at the end of the simulation show only a 1% difference between the total model input extraction volume and the total volume actually extracted from the model.



Figure 3.4 Input extraction rates for the WEL-package vs. modelled CSG extraction rates

3.4.4 Calibrated hydraulic parameters

Table 3.6 summarises the average hydraulic conductivity, specific storage and specific yield for each geology unit in the model domain. The re-calibrated parameter values show the following minor changes compared to the previous calibrated values (AGE, 2018), which were re-used in 2021 (AGE, 2021) and adopted as initial values for this work:

- lower horizontal and vertical hydraulic conductivity (around 10 to 20% lower compared to the previously calibrated values for the Q and GM seam layers in the Moranbah Coal Measures (model layers 9 and 15, respectively); and
- increased vertical hydraulic conductivity for most layers by around 10% compared to the previous calibration, except for the Q and GM coal seam layers (see previous bullet point).

Table 3.6 Summary of calibrated hydraulic parameters

Layer	Primary formation	Unit	Hydraulic conductivity average and max-min range			Specific storage average and max-min range (m-1)	Specific yield average and max-min range (%)
			Horizontal (Kh) (m/day)	Vertical (Kv) (m/day)	Depth Dependency		
1	Quaternary Alluvium, weathered materials	Surficial coverage	8.32E+00 (8.40E-03 - 1.20E+02)	1.61E+00 (8.90E-05 - 1.00E+01)	No	2.0E-05 (2.0E-05 - 2.1E-05)	19.2% (18.0% - 20.0%)
2	Tertiary sediments (Duringa), Basalts (Anakie) & Moolayember	Tertiary, Triassic	5.00E+00 (1.50E-05 - 9.80E+01)	3.02E+00 (2.90E-09 - 3.20E+02)	No	1.6E-05 (9.9E-07 - 2.1E-05)	14.7% (5.0% - 50.0%)
3	Clematis Sandstone	Triassic	2.28E-02 (6.60E-03 - 6.80E-02)	2.48E-03 (3.90E-04 - 9.00E-03)	No	2.0E-05 (2.0E-05 - 2.1E-05)	17.0% (17.0% - 18.0%)
4	Rewan	Triassic	1.26E-03 (1.90E-04 - 1.00E-02)	2.39E-07 (3.70E-08 - 6.50E-06)	No	1.0E-06 (9.9E-07 - 1.0E-06)	6.0% (6.0% - 6.0%)
5	Rangal Coal Measures	Leichardt seam	2.62E-02 (8.60E-06 - 1.00E-01)	7.74E-03 (8.60E-06 - 6.50E-02)	Yes	2.0E-05 (2.0E-05 - 2.0E-05)	5.0% (5.0% - 5.0%)
6		Interburden	1.08E-04 (9.60E-05 - 1.20E-04)	1.11E-08 (1.00E-08 - 1.20E-08)	No	1.0E-06 (9.9E-07 - 1.1E-06)	6.0% (6.0% - 6.0%)
7		Vermont seam	2.15E-02 (8.60E-06 - 1.00E-01)	5.96E-03 (8.60E-06 - 6.60E-02)	Yes	2.0E-05 (2.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
8	Fort cooper coal measures	Girrah	1.05E-04 (8.50E-05 - 1.20E-04)	8.60E-06 (8.60E-06 - 8.60E-06)	No	2.0E-05 (2.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
9		Fccm	4.54E-03 (2.00E-03 - 9.40E-03)	8.95E-05 (3.80E-05 - 2.00E-04)	No	2.0E-05 (2.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
10		FHF	1.09E-04 (9.80E-05 - 1.20E-04)	8.60E-06 (8.60E-06 - 8.60E-06)	No	2.0E-05 (1.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
11	Moranbah Coal Measures	Q seam	1.37E-02 (8.60E-06 - 1.00E-01)	4.95E-03 (8.60E-06 - 1.00E-01)	Yes	1.9E-05 (9.0E-07 - 2.1E-05)	5.0% (5.0% - 5.0%)
12		Interburden	1.04E-04 (8.70E-05 - 1.20E-04)	2.30E-08 (1.90E-08 - 1.30E-07)	No	9.7E-07 (7.0E-07 - 1.1E-06)	5.0% (5.0% - 5.3%)
13		P seam	1.22E-02 (8.60E-06 - 1.00E-01)	4.71E-03 (8.60E-06 - 1.00E-01)	Yes	1.9E-05 (9.0E-07 - 2.3E-05)	5.0% (5.0% - 5.0%)
14		Interburden	1.01E-04 (1.20E-05 - 1.20E-04)	7.23E-08 (1.00E-08 - 8.70E-08)	No	9.7E-07 (7.0E-07 - 1.1E-06)	5.0% (5.0% - 5.3%)
15		GM seam	6.48E-03 (8.60E-06 - 1.00E-01)	1.48E-03 (8.60E-06 - 3.70E-02)	Yes	1.8E-05 (9.0E-07 - 2.7E-05)	5.0% (5.0% - 5.0%)
16		Interburden	1.07E-04 (8.00E-05 - 2.20E-04)	8.48E-08 (4.40E-08 - 1.30E-06)	No	1.3E-06 (8.7E-07 - 7.5E-05)	5.0% (5.0% - 5.3%)
17		GML seam	7.07E-03 (8.60E-06 - 1.00E-01)	1.76E-03 (8.60E-06 - 3.80E-02)	Yes	2.0E-05 (1.9E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)

Layer	Primary formation	Unit	Hydraulic conductivity average and max-min range			Specific storage average and max-min range (m-1)	Specific yield average and max-min range (%)
			Horizontal (Kh) (m/day)	Vertical (Kv) (m/day)	Depth Dependency		
18	Moranbah Coal Measures	Interburden	1.00E-04 (1.00E-04 - 1.00E-04)	7.00E-08 (7.00E-08 - 7.00E-08)	No	1.0E-06 (9.8E-07 - 1.1E-06)	5.0% (5.0% - 5.0%)
19		DYU seam	6.72E-03 (8.60E-06 - 1.00E-01)	1.70E-03 (8.60E-06 - 3.80E-02)	Yes	2.0E-05 (2.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
20		Interburden	1.06E-04 (6.20E-05 - 1.30E-04)	7.75E-08 (4.70E-08 - 9.90E-08)	No	1.0E-06 (9.9E-07 - 1.1E-06)	5.0% (5.0% - 5.3%)
21		DYR seam	6.64E-03 (8.60E-06 - 1.00E-01)	1.72E-03 (8.60E-06 - 4.00E-02)	Yes	2.0E-05 (2.0E-05 - 2.1E-05)	5.0% (5.0% - 5.0%)
22		Permian basement	4.66E-04 (2.50E-04 - 7.70E-04)	9.77E-06 (5.60E-06 - 1.80E-05)	No	1.0E-06 (9.9E-07 - 1.1E-06)	6.0% (6.0% - 6.0%)

4 Predictions

4.1 Impact calculations

The following three predictive model scenarios were undertaken for the purposes of estimating the cumulative impacts of the MGP and BGP and as well as the individual contribution of each:

1. A baseline or **No CSG scenario** which does not include and CSG related extraction.
2. An **MGP only scenario** which assumes that there is no extraction from CSG wells associated with the BGP project, note that any recorded actual extraction from BGP pilot wells is also excluded from this scenario.
3. A **Cumulative scenario** which includes actual historic and proposed future water extraction from the MGP and BGP projects at the rates shown in Figure 2.1.

Based on outputs from these three scenarios predicted drawdown impacts have been estimated as follows:

- cumulative drawdowns associated with the MGP and BGP have been calculated by subtracting the simulated heads in the 'Cumulative scenario' from the 'No CSG scenario' heads;
- drawdowns associated with the MGP only have been calculated by subtracting the simulated heads in the 'MGP only scenario' from the 'No CSG scenario'; and
- drawdowns associated with the BGP only have been calculated by subtracting the simulated heads in the 'Cumulative scenario' from the 'MGP only scenario'.

It is noted that the BGP only impacts in particular could have been calculated in a number of different ways, including by undertaking a further BGP only scenario and estimating BGP impacts by comparison of this run with the 'No CSG scenario'. The adopted approach whereby BGP only impacts have been calculated by comparison of the cumulative and MGP only scenario has several advantages over other approaches. In particular the adopted approach is consistent with methodologies applied by OGIA in the neighbouring Surat CMA UWIR (OGIA, 2021) and reflects the actual timing of operations in the Bowen Basin. As shown in Figure 2.1 field scale extraction from the MGP commenced in 2003 and an 18-year gap is anticipated between the conclusion of extraction from the MGP in 2028 and when the majority of field scale extraction starts from the BGP in 2046. Furthermore, the adopted approach also ensures that the sum of the estimated impacts of each individual project is at all times equal to and hence consistent with the estimated cumulative impact. This is unlikely to occur with other approaches.

4.2 Processing of predicted IAA and LAA areas

For UWIR reporting purposes four primary predictions are required based on groundwater flow modelling outputs these being the estimated extent of the immediately and long-term affected areas, the baseline assessment area and potentially impacted springs and other GDEs in each aquifer which in the case of the Bowen Basin can be further defined as follows:

- IAA (Immediately Affected Area) – areas where maximum cumulative and/or MGP/BGP only drawdown impacts exceed 5 m in consolidated units or 2 m for unconsolidated units within the next 3 years (i.e. January 2028).
- LAA (Long term Affected Area) – areas where maximum cumulative and/or MGP/BGP only drawdown impacts exceed 5 m in consolidated units or 2 m for unconsolidated units at any time in the future.
- Identification of baseline assessment areas in relevant aquifers (i.e. those areas where more than 1 m of drawdown is expected within the next 3 years (used for baseline assessment program planning).
- Springs and other GDEs where drawdown impacts of more than 0.2 m are predicted at any point in the future.

Since the Moranbah (MCM) and Rangal Coal Measures (RCM) span multiple model layers, drawdown impact results (e.g. IAA areas and LAA areas) for these units were generated by processing drawdown for each coal seam within the associated coal measure. These results were then subsequently combined and used to obtain a spatial composite of the maximum predicted drawdown in any of the coal layers. For example, the IAA and LAA areas for the RCM were computed by processing drawdown results in both modelled coal seam layers (i.e. layers 7 and 9) prior to further processing these results to identify the maximum drawdown within each cell.

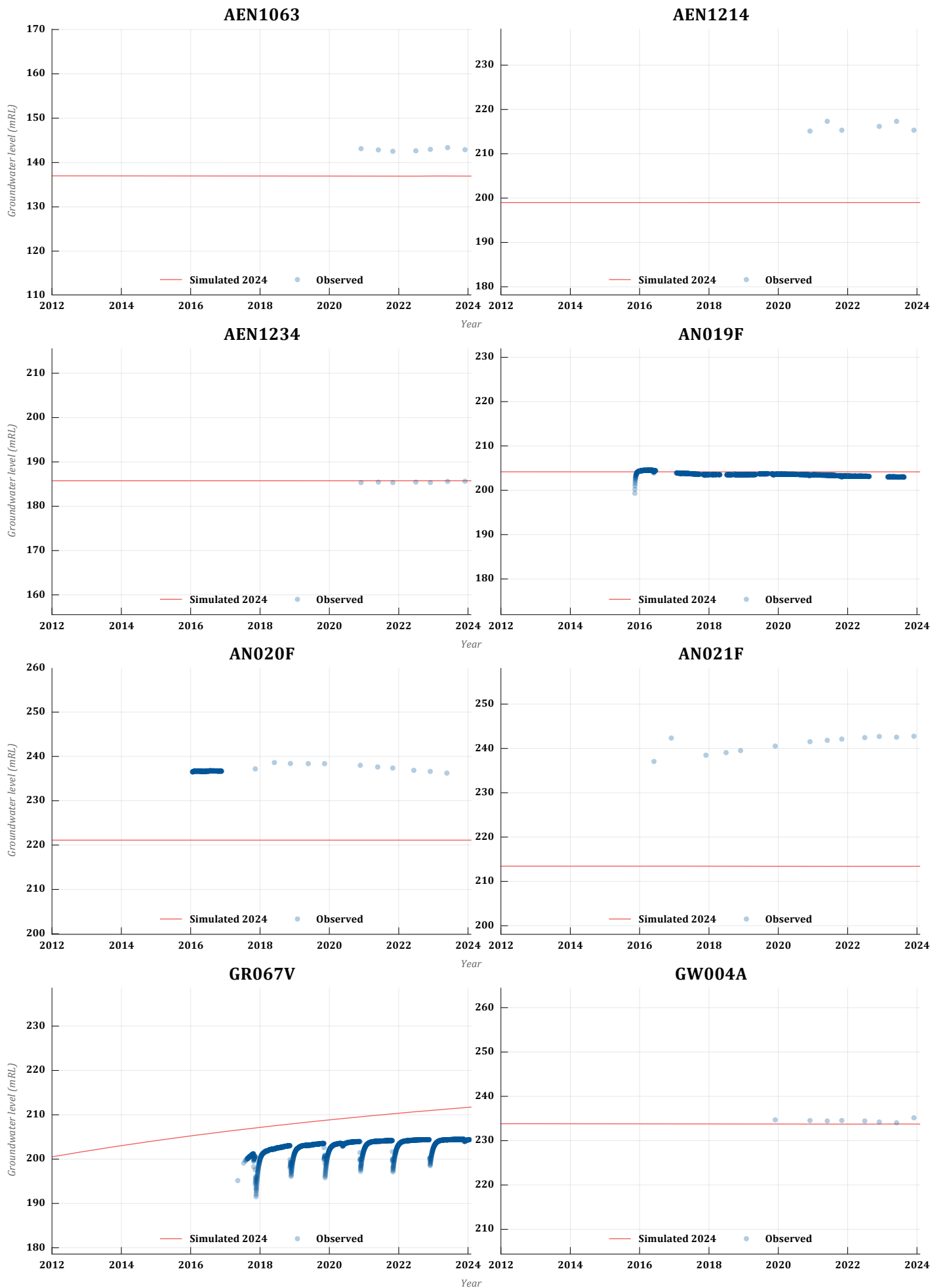
Note that to avoid duplication the aforementioned predictions are deliberately not included in this modelling report appendix as these will be presented in the main body of the respective UWIR's prepared by Arrow Energy and QPME. The text provided above is therefore intended to confirm the approach used to calculating the predictions presented in the UWIRs.

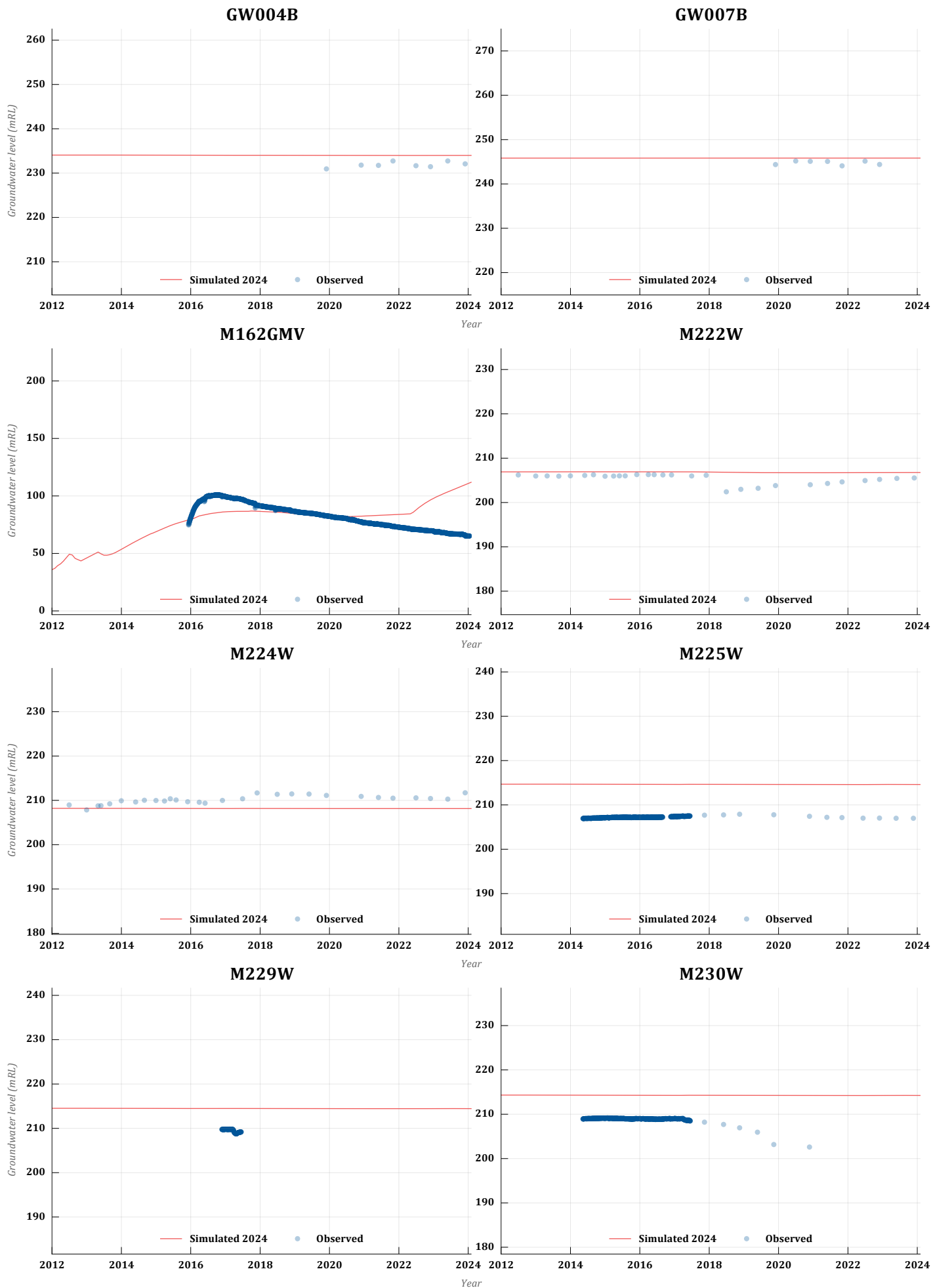
5 References

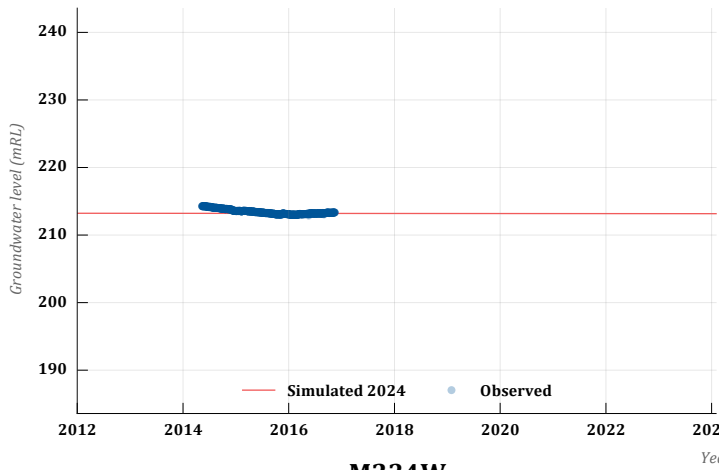
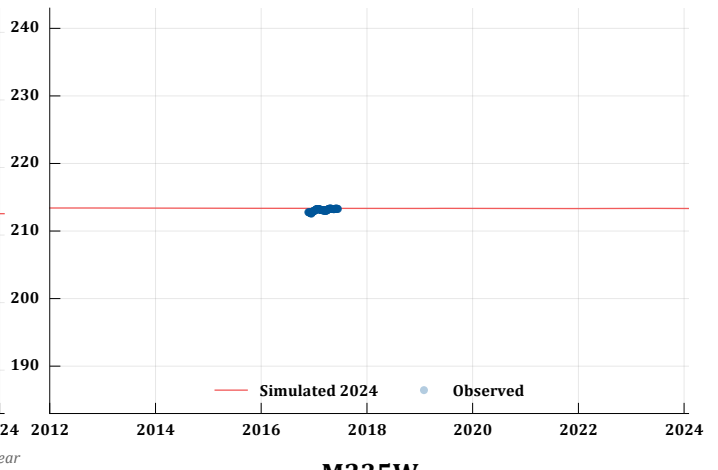
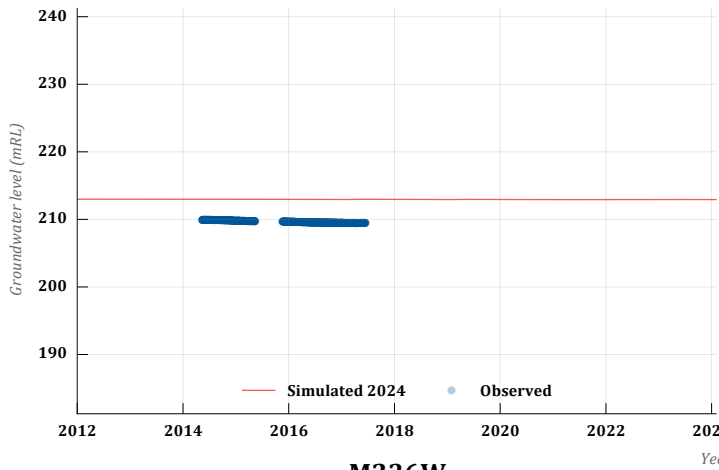
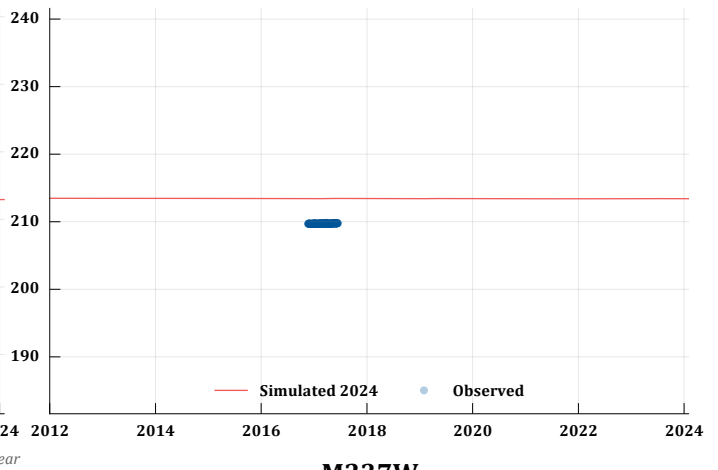
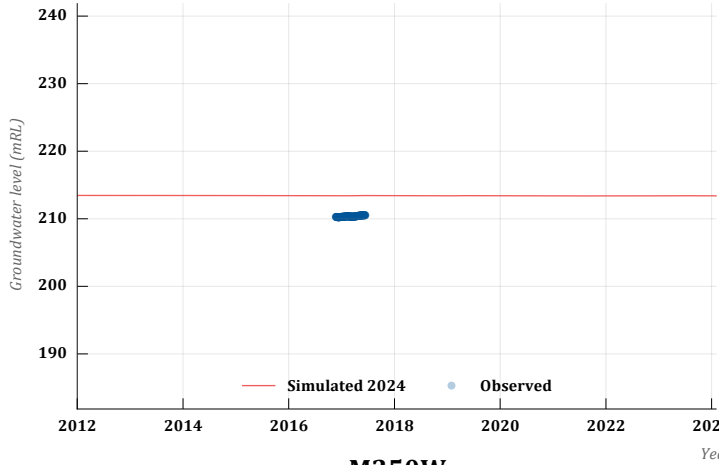
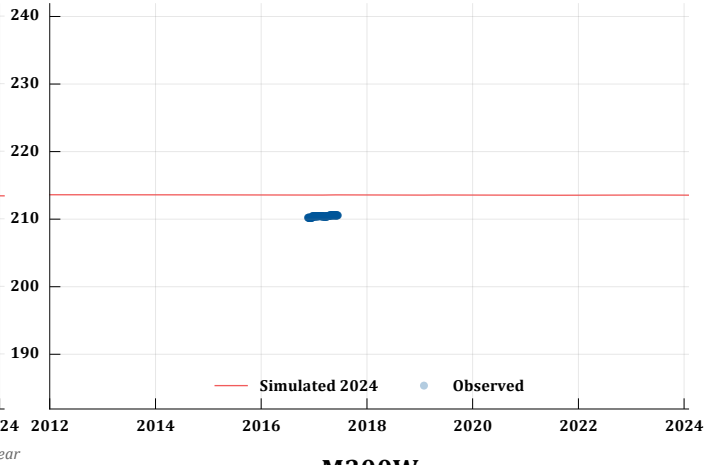
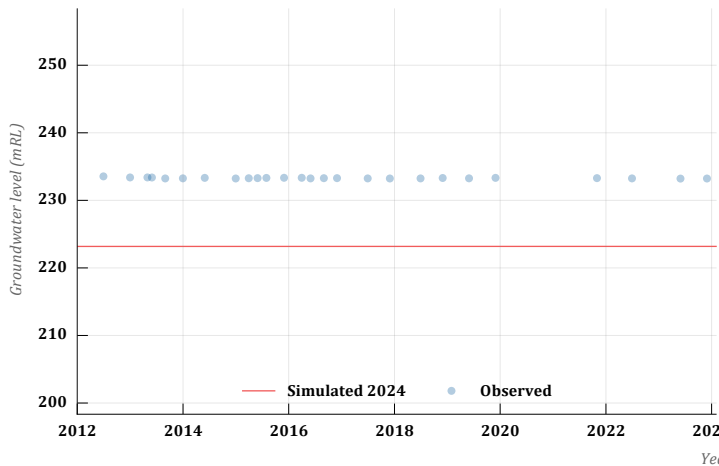
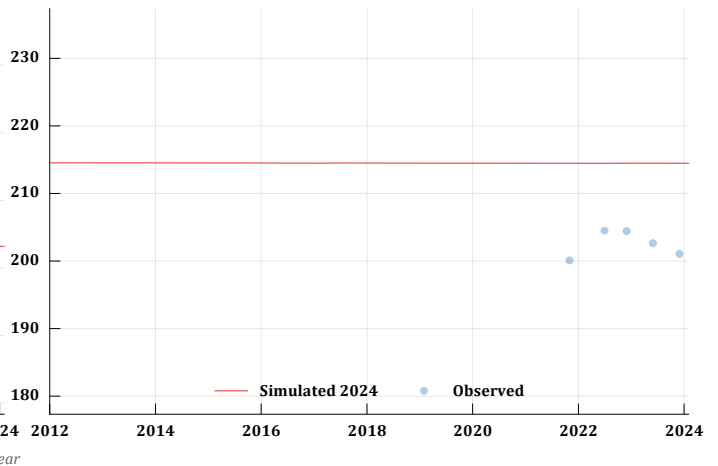
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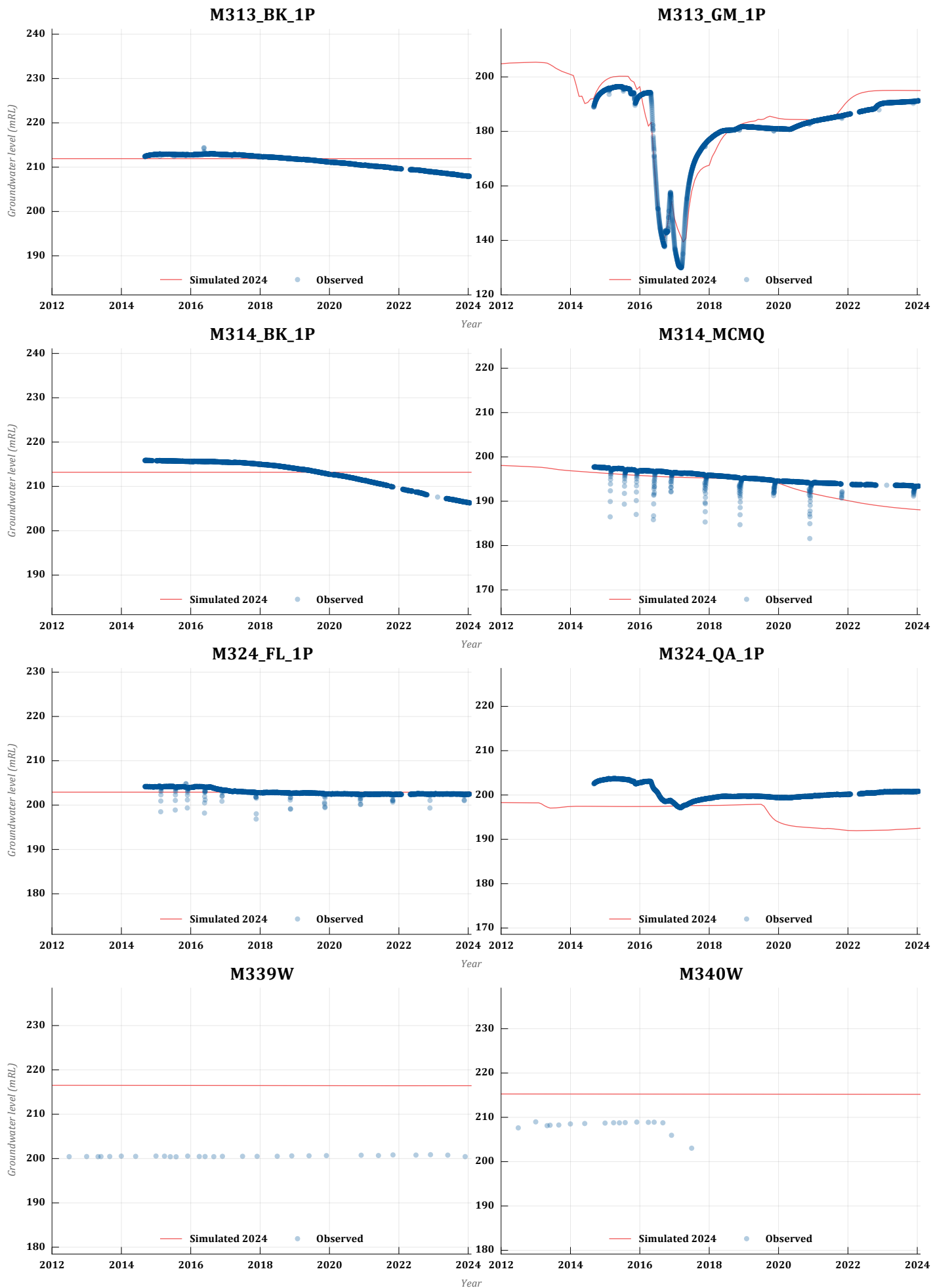
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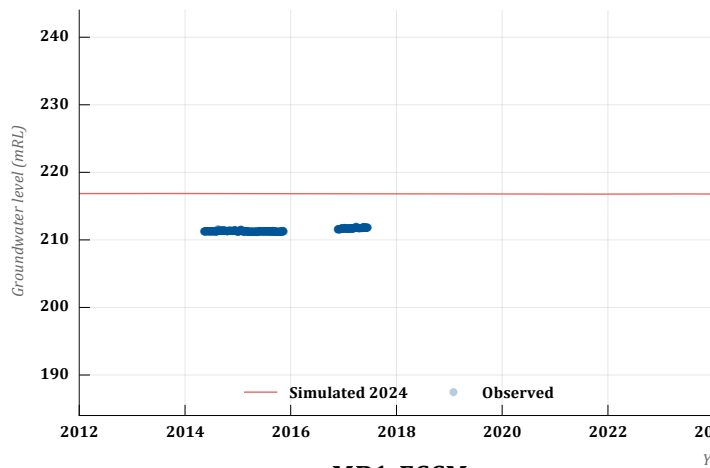
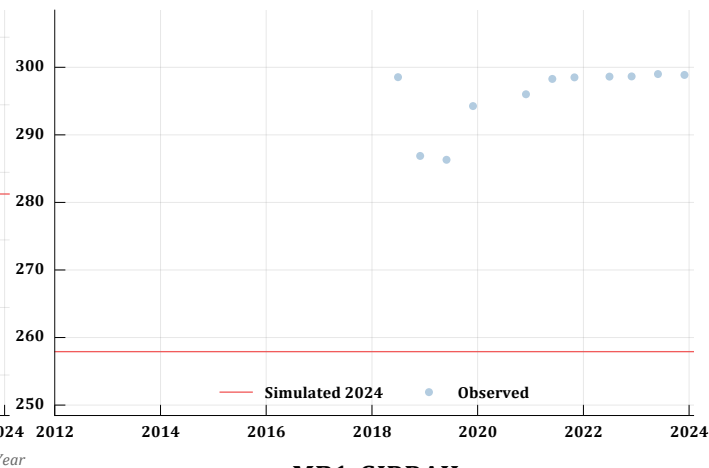
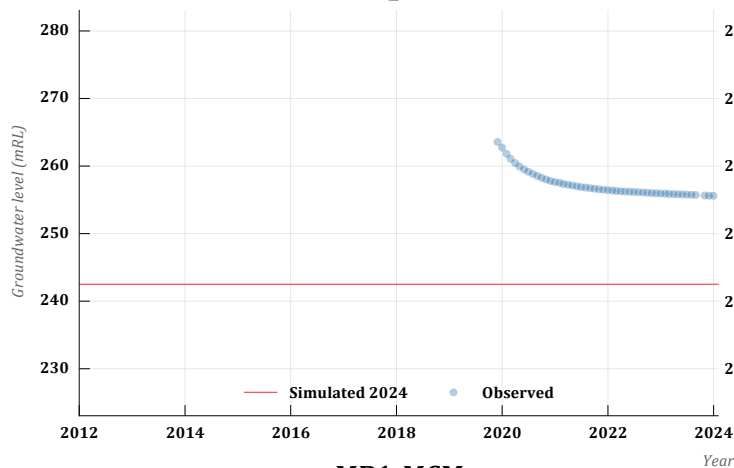
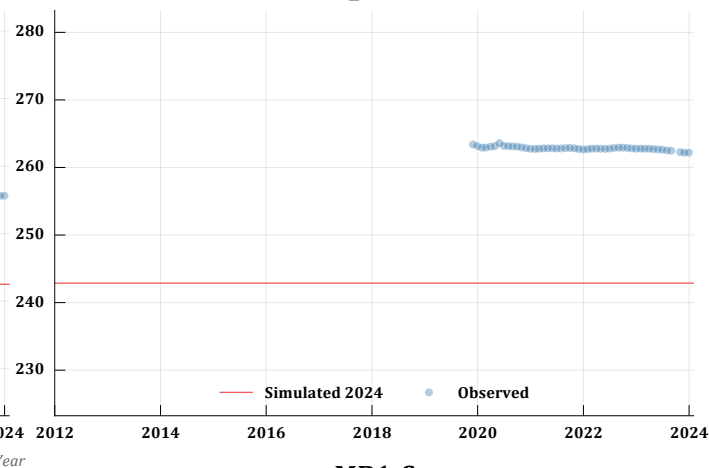
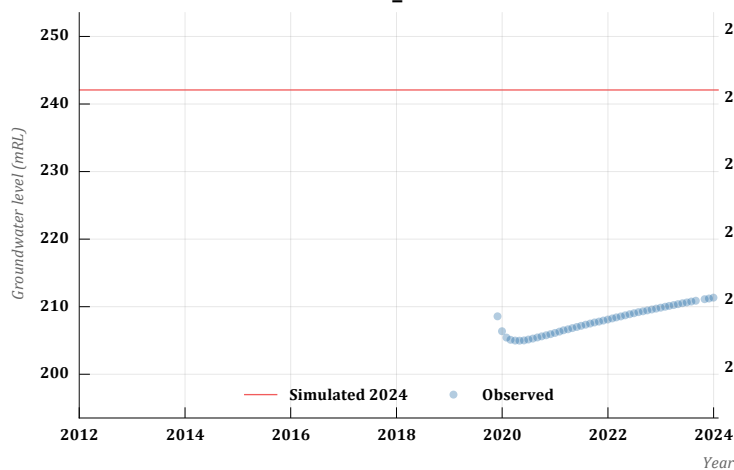
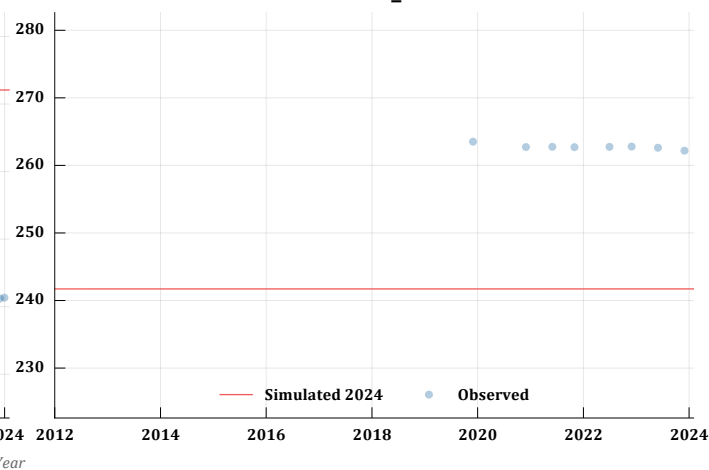
Groundwater Level Calibration Hydrographs





M231W**M232W****M234W****M235W****M236W****M237W****M250W****M300W**



M345W**MB12****MB1_FCCM****MB1_GIRRAH****MB1_MCM****MB1_S**

Appendix D

Baseline Assessment Plan



Australasian
Groundwater
& Environmental
Consultants

Report on

Baseline Assessment Plan For Petroleum Leases 191, 196, 223, 224

Prepared for
QPM Energy

Project No. BOW5001.002
January 2026

ageconsultants.com.au

ABN 64 080 238 642

Document details and history



Document details

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Baseline Assessment Plan

For Petroleum Leases 191, 196, 223, 224

1 Preamble

QPM Energy (QPME, ACN 125 368 658) purchased Petroleum Lease (PL) 191, 196, 223 and 224 associated with the Moranbah Gas Project (MGP) from Arrow Energy (CH4 and Arrow CSG) in mid-2023 and is the new registered holder of PL191, PL196, PL223 and PL224 (Registered Holders).

Although a Baseline Assessment Plan (BAP) was submitted by the previous tenure holder (Arrow Energy) and approved by DEHP in 2012, as a new registered holder of the MGP tenures, QPME is required to prepare their own BAP to meet its obligations under the *Water Act 2000* Chapter 3. The plan must identify completed baseline assessments and priority areas where water bores other than those already assessed are or may be located. It must also provide a timetable for the completion of assessments in these priority areas.

This BAP identifies the registered and other known water bores within priority areas in PL 191, 196, 223 and 224 and provides a timetable for the completion of baseline assessments in priority areas and other parts of the tenure. The priority area for the MGP baseline assessment is defined in Section 4 and a date by which baseline assessments will be completed for this area and in the remainder of the tenure has been defined in Section 8.

2 Acronyms and abbreviations

Acronyms or abbreviations used in this document are defined in Table 2.1

Table 2.1 Definitions and acronyms used in this report

Acronym / Abbreviation	Description
BAP	Baseline Assessment Plan
BAT	Baseline Assessment Timetable
BGP	Bowen Gas Project
CMA	Cumulative Management Area
CSG	Coal Seam Gas
DEHP	Department of Environment and Heritage Protection
DERM	Department of Environment and Resource Management
DETSI	Department of the Environment, Tourism, Science and Innovation
LAA	Long-term Affected Area
MGP	Moranbah Gas Project
ML	Megalitre
OGIA	Office of Groundwater Impact Assessment
PL	Petroleum Lease
QPME	QPM Energy
UWIR	Underground Water Impact Report

3 Identification of completed baseline assessments

QPME and the previous tenure holder of the MGP (Arrow Energy) have completed baseline assessments on MGP tenures PL 191, 196, 223 and 224. A list of completed baseline assessments for the MGP (see Section 4) can be found in Appendix A based on the following data sources:

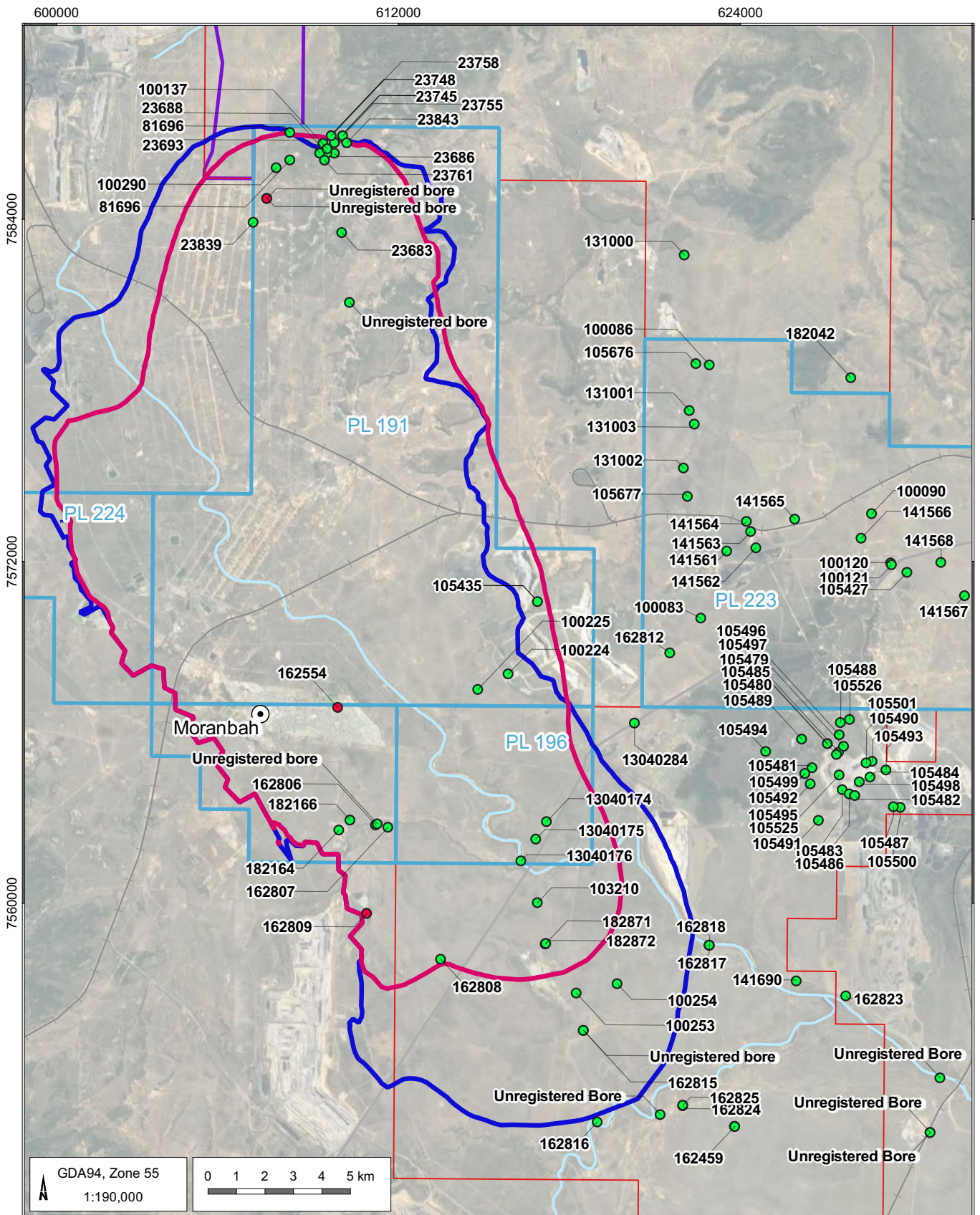
- the previous baseline assessment plan for the MGP (Document reference: 99-V-PL-0027_REV_1), which was submitted on 28 June 2012 by the previous tenure holder (Arrow Energy, 2012¹) and approved by DEHP to take effect on 3 July 2012;
- updated baseline assessment information for MGP tenures provided by Arrow Energy in February 2025; and
- baseline assessment information provided by the Office of Groundwater Impact Assessment (OGIA) in September 2025.

¹ Arrow Energy, 2012, Baseline Assessment Plan - For Petroleum Leases 191, 196, 223, 224, 99-V-PL-0027_REV_1.

4 Priority area for baseline assessment

As the registered tenure holder of PL191, PL196, PL223 and PL224, QPME is required to undertake baseline assessments for all water bores ahead of any predicted impacts occurring. As such baseline assessments will ultimately be required at all water bores which fall within the predicted Long-term Affected Area (LAA) associated with the MGP (AGE, 2025²), as shown in Figure 4.1. However, since baseline assessments are most valuable when they are undertaken immediately prior to impacts occurring then UWIR BAPs typically prioritise those areas where impacts are expected within the short term (i.e. within the next three years). Figure 4.1 therefore defines a priority area within which a groundwater pressure decline of more than 1 m is expected in the target coal seams within the next three years based on updated predictions reported in the 2025 UWIR for the MGP (AGE, 2025). As shown in Figure 4.1 and discussed further in Sections 5 and 8 baseline assessments have already been undertaken and submitted for all but three of the water bores located within this priority area. Where they haven't already been completed, baseline assessments for water bores located outside of the current priority area will be assessed during subsequent MGP UWIR cycles, as the area where more than 1 m of drawdown is predicted within the next three years expands.

² AGE, 2025, 2025 Bowen UWIR MGP, Prepared for QMP Energy (MGP Upstream) Pty Ltd.



LEGEND

- Populated place
- Qld rail network (DERM)
- Arterial roads (Qld)
- Major drainage
- Long-term Affected Area (LAA)
- Priority area for MGP baseline assessment

- PL (QPME, MGP)
- PL (Arrow, BGP)
- ATP (Arrow, BGP)

- MGP baseline assessment bores**
- Baseline assessment undertaken
 - Baseline assessment not undertaken

Baseline Assessment Plan MGP (MGP5001|002)

Priority area for the MGP baseline assessment and baseline assessment bores



AGE

DATE
28/01/2026

FIGURE No:
4.1

5 Rationale for baseline assessment timetable

Updated predicted MGP impacts on underground water levels are presented in the 2025 Underground Water Impact Report (UWIR) prepared for PL191, PL196, PL223 and PL224 (AGE, 2025). This report concluded that the impacts of production were well below trigger thresholds in all aquifers, other than the one from which water had been taken during production. The 2025 UWIR was submitted to DETSI on 3 April 2025 (reference number 101/0049307).

The previous baseline assessment plan (BAP) for PL191, PL196, PL223 and PL224 was submitted on 28 June 2012 by the previous tenure holder (Arrow Energy), which was approved by DEHP to take effect on 3 July 2012. As new tenure holder for the MGP tenures, QMPE has prepared an updated BAP which proposes that baseline assessments for all bores located within the priority area shown in Figure 4.1 be undertaken initially, with other bores located outside of this area assessed subsequently, as required, on the basis that impacts of more than 1 m are not predicted within the next three years.

For those bores which have not already been assessed then baseline assessments of water bores in the priority area will be undertaken by the date provided in the baseline assessment timetable (BAT) which is defined in Section 8. This BAT has been developed to as far as possible meet the requirements of Section 398 (1) of the *Water Act (2000)*, which require a baseline assessment to be undertaken for each water bore located in a priority area for the tenure by the earliest of the following:

- a) before production testing starts, if:
 - (i) the bore in the priority area is located within 2 km of the production testing; and
 - (ii) during the production testing, water will be taken from the aquifer supplying the water bore.
- b) before production of petroleum starts in the priority area; and
- c) the day after a period of 30 days, whether continuous or not, of undertaking production testing in the priority area.

As reported in the previous BAP for the MGP (Arrow Energy, 2012), the BAT also considers the logistics of undertaking baseline assessments including:

- resourcing including suitably qualified staff with the appropriate level of skill, experience and expertise along with equipment required;
- land access as required under the Water Act;
- establishment of assessment procedures as outlined in the DETSI Baseline Assessment Guidelines (DETSI, 2025³); and
- development of standard operating procedures and safety management documentation.

If water bores are identified during this process which are not registered with the Queensland Globe⁴, the following procedure will be followed:

1. a baseline assessment of the water bore will be undertaken as detailed above;
2. information collected from the baseline assessment will be reported in the approved form to the bore owner and OGIA; and
3. the locations of the unregistered water bores will be included in any future amendments of this BAP.

³ DETSI, 2025, Guideline Baseline assessments, ESR/2016/1999, Version 3.06.

⁴ Queensland Globe, Queensland Government, <https://qldglobe.information.qld.gov.au/>.

5.1 Bores located within the baseline assessment priority area

Based on data collected during previous baseline activities (provided by Arrow Energy in February 2025) and a search of QLD Globe, twenty-nine (29) water bores registered with Queensland Globe have been identified in the priority area along with a further five (5) unregistered bores. Details of these bores are provided in Appendix B, including confirmation of whether a bore assessment has been completed for these bores and successfully lodged with OGIA.

As listed in Appendix B and shown in Figure 4.1, based on information provided by OGIA there is no record of baseline assessment being submitted for the following three (3) bores located within the baseline priority area:

- RN162809, located off-tenure 0.9 km east from ATP 1103 and 1.9 km south from PL 224;
- RN162554 located on PL 224; and
- unregistered bore on PL 191 with bore identifier AEN1300 used by the previous tenure holder (Arrow Energy).

As detailed in Appendix B baseline assessments have therefore already been completed for 31 of 34 water bores within the current priority area.

5.2 Bores located within the Long-term Affected Area (LAA)

In addition to water bores located in the baseline assessment priority area, Figure 4.1 and Appendix A also identify a further three (3) registered water bores (RNs 23745, 23748 and 105435) that are located outside of the current priority area but within the LAA based on the updated impact predictions for the MGP (AGE, 2025). As such drawdowns of up to 5 m are expected in the targeted coal seams at these locations at some point in the future. It should be noted that unless these water bores also take water from the coal seams then they are unlikely to be affected by CSG extraction since there are no areas where drawdown impacts of more than 5 m are predicted in other aquifers. Nevertheless, baseline assessments are required for these bores to confirm their depths and other key information.

As detailed in Appendix A baseline assessments have already been completed and lodged with OGIA for these three LAA water bores.

5.3 Other bores located on MGP tenure but outside the priority and LAA areas

In addition to the bores located in the baseline assessment priority area and LAA, Figure 4.1 and Appendix A identify a further twenty (20) bores which are located on MGP tenure but outside of the current priority or LAA areas, all of which are located within PL 223. As these bores are located outside of the LAA area then drawdowns of less than 5 m are predicted in the targeted coal seams at these locations. Nevertheless, as shown in Figure 4.1 and based on information provided by the previous holder (Arrow), QPME understand that baseline assessments have also already been completed at all 20 of these bores, although this has yet to be confirmed by OGIA.

6 Rationale for adherence with the Water Act

The proposed strategy for baseline assessments set out in section 4.1.6 of the UWIR (AGE, 2025) complies with the *Water Act 2000* (Water Act) requirements for baseline assessments aligned with s. 378 (3). From a hydrogeological effects perspective all bores within the 5 m drawdown limits of the long-term affected area will be assessed during the project life cycle. It is simply a matter of when to best do the bore assessment. Towards the end of the project, the immediately affected area and the long-term affected area become the same area and at that time all necessary bores will be assessed. The UWIR for the Surat CMA (OGIA, 2021) sets the precedent for this approach: whereby bore assessments for bores within the long-term affected area are progressively included as the immediately affected area expands. In doing so, the baseline assessments are most effective as they are taken immediately before impacts are expected to occur. As the project evolves, the immediately affected area increases in size and captures all bores needing a baseline assessment in accordance with s. 378 (3).

To understand how the BAP adheres with s. 378 (3) of the Water Act, knowledge of how drawdown expands across a project life cycle is required. It is simply a matter of when a bore is tested, and not if it is tested. This ensures that baseline assessments are most effective and provide the best reference data upon which to assess the actual drawdown impact as they are realised.

7 Future production

Historical water production from the MGP was 6,114 ML up to the end of August 2024. In the next three years a further 318 ML (equivalent annual extract rate of 106 ML/yr) is expected to be extracted from the MGP as reported in the 2025 MGP UWIR (AGE, 2025).

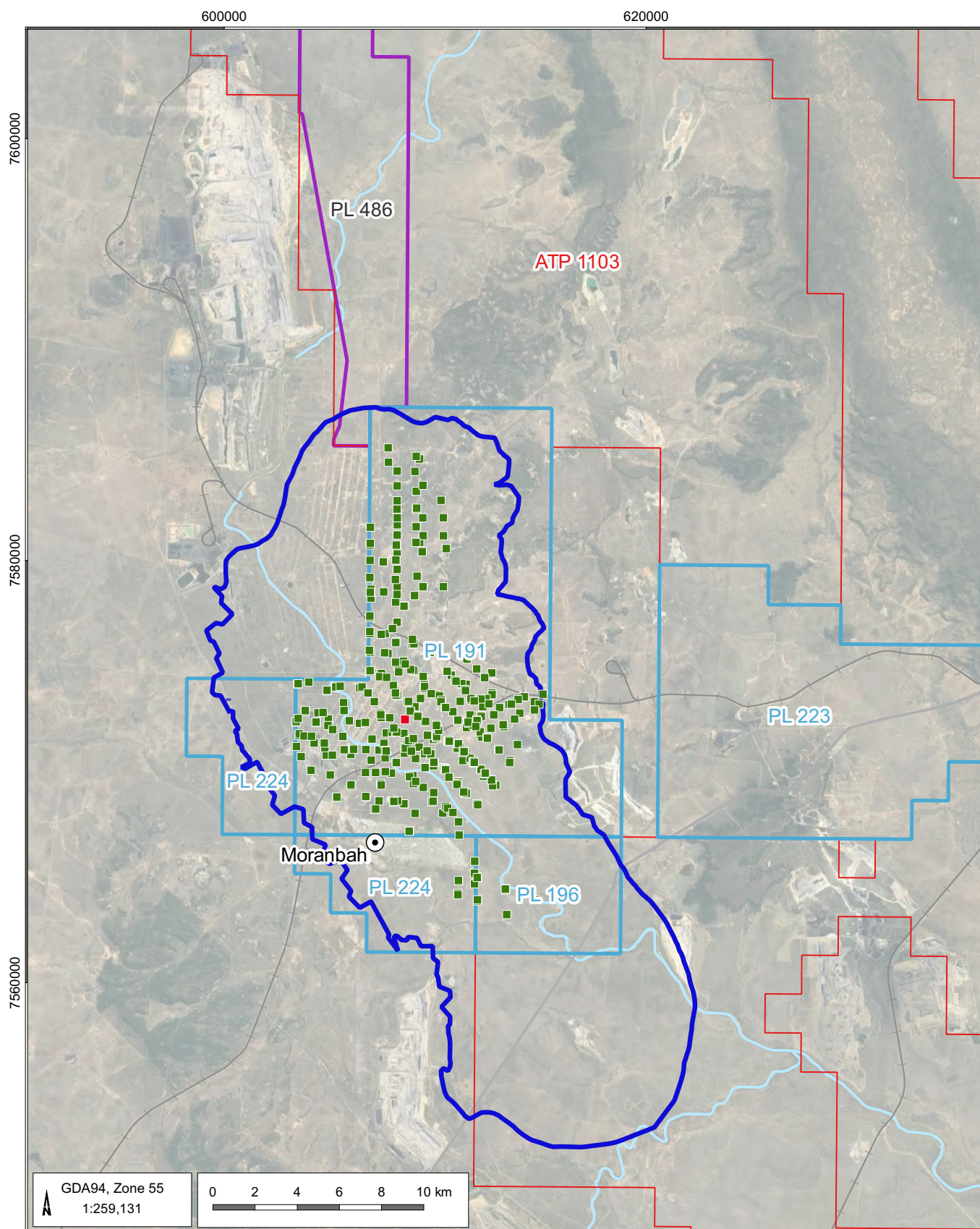
Figure 7.1 shows the locations of 384 existing and historical CSG production wells and one existing appraisal well used for these activities. No future wells are shown in Figure 7.1 since QPME does not plan to develop any new production or appraisal wells, including within PL223.

Production commencement dates for the wells shown in Figure 7.1 range between January 2001 and January 2022. It should be noted that production testing at a number of these wells commenced prior to the commencement of Section 398 of the Water Act (2000)⁵ and that baseline assessments in the MGP area were previously (until mid-2023) the responsibility of Arrow Energy. As discussed previously and documented in Figure 4.1 and Appendix A Arrow Energy has already completed baseline assessments for the majority of water bores present in MGP over the period June 2012 to August 2023. The BAT included in this plan, the first such plan developed by QPME, therefore seeks to fill any gaps in the previous baseline assessment activities as soon as possible. Baseline assessments at the following three bores located within the baseline assessment priority area which have not been previously assessed and are required to be completed (Figure 4.1):

- registered bore RN162554 (located on PL224);
- a further unregistered bore AEN1300 (located on PL191); and
- registered bore RN162809 (located south of PL224 but within the baseline priority and predicted LAA).

As shown in Figure 4.1 QPME understand that baseline assessments have already been undertaken for all other known water bores within the current priority area, the LAA and other tenure areas which form part the MGP. Baseline assessment reports for all bores within the current priority and LAA areas have also been collated by QPME from OGIA. The remaining baseline assessment reports relating to bores located within the remainder of the MGP project area will also be collated from OGIA as soon as possible.

⁵ Effective from March 2011 (Queensland Government Gazette, <https://www.publications.qld.gov.au/group/gazettes-2011>).



LEGEND

● Populated place

Existing and historical MGP well locations

- Appraisal
- Production

- Qld rail network (DERM)
- Arterial roads (Qld)
- Major drainage
- PL (QPME, MGP)
- PL (Arrow, BGP)
- ATP (Arrow, BGP)
- Priority area for MGP baseline assessment

Baseline Assessment Plan MGP
(MGP5001|002)

Historical and future MGP production and appraisal wells



AGE

DATE
21/01/2026

FIGURE No:
7.1

8 Baseline assessment timetable (BAT)

Table 8.1 shows the timetable for the completion of the baseline assessments for the remaining three bores which are located within the MGP baseline assessment priority area (Figure 4.1) and which haven't been previously assessed. As reported in Section 5 and Appendix B, two (2) registered bores and one (1) unregistered bore have been identified within the MGP baseline assessment priority area for which no baseline assessment has been undertaken to date (Registered bore RN162554, and Registered bore RN162809 and unregistered bore AEN1300).

These bores require immediate assessment to comply with Section 398 (1) of the Water Act (2000) and Table 8.1 highlights the earliest possible date for QPME to undertake the bore assessment given the logistical and procedural constraints specified in Section 5. As the sites are remote and Consultants need to be engaged and land access obtained, the date of April 30th 2026 is considered as the earliest the Baseline assessment could be completed.

As discussed above in Section 7 and shown in Figure 4.1 QPME understand that baseline assessments have already been undertaken for all other known water bores within the current priority area, the LAA and other tenure areas which form part the MGP. As summarised in Table 8.1 no further baseline assessment activities in either the LAA or other tenure areas are thought to be required at this stage, although baseline assessment reports have yet to be collated from OGIA for bores located outside of the LAA area. These reports will also be collated ASAP and any follow-on actions (e.g. repeat baseline assessments where OGIA are not in possession of the baseline assessment reports) addressed during subsequent MGP UWIR and BAP reporting iterations. As these bores are located outside of the predicted long term affected area and more than 2 km from any proposed or existing CSG wells then this timing is considered to be compliant with the requirements of the *Water Act 2000*.

Table 8.1 Baseline assessment timetable (BAT)

Zone	Timeframe	Status
Baseline assessment priority area	ASAP (30 April 2026)	Further baseline assessments at three bores to be completed
Long-Term Affected Area (LAA)	Not applicable, baseline assessments already completed with reports collated from OGIA	Completed
Remaining MGP tenure	Baseline assessment reports to be collated from OGIA ASAP (30 April 2026)	Baseline assessments completed, reports to be collated from OGIA

Appendix A

Completed assessments

Table A 1 Completed Baseline Assessments MGP

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Assessment date	Data source	Area
Unregistered bore	18SP208 194	Alan Williams	PL191	QPM Energy	607369.75	7584735.44	12/11/2012	OGIA data (Sept-25)	Baseline assessment Priority area
Unregistered bore	2RP9044 45	Ross Flohr	PL191	QPM Energy	610274.74	7581084.44	13/11/2012	OGIA data (Sept-25)	Baseline assessment Priority area
162815	8SP2773 84	Ken Braithwaite	ATP1103	Arrow Energy	618486.74	7555533.44	12/12/2012	OGIA data (Sept-25)	Baseline assessment Priority area
23683	11SP147 333	Michael Barker	PL191	QPM Energy	610002.70	7583536.21	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23686	18SP208 194	Alan Williams	PL191	QPM Energy	609746.96	7586320.75	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23688	18SP208 194	Alan Williams	PL191	QPM Energy	609488.56	7586322.42	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23693	18SP208 194	Alan Williams	PL191	QPM Energy	609230.15	7586324.19	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23761	18SP208 194	Alan Williams	PL191	QPM Energy	609400.77	7586077.15	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23839	11SP147 333	Alan Williams	PL191	QPM Energy	606894.93	7583898.28	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
23843	18SP208 194	Alan Williams	PL191	QPM Energy	610180.22	7586686.62	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
100137	18SP208 194	Alan Williams	PL191	QPM Energy	609489.72	7586476.18	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
81696	18SP208 194	Alan Williams	PL191	QPM Energy	608182.40	7587048.69	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
100253	8SP2773 84	BERYL ANNE NEILSEN	ATP1103	Arrow Energy	618233.38	7556848.52	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
100254	8SP2773 84	BERYL ANNE NEILSEN	ATP1103	Arrow Energy	619668.87	7557175.94	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Assessment date	Data source	Area
100290	18SP208 194	Alan Williams	PL191	QPM Energy	607705.05	7585812.18	25/11/2013	OGIA data (Sept-25)	Baseline assessment Priority area
100224	1SP1924 59	MICHAEL BARKER	PL191	QPM Energy	615843.67	7568049.16	17/03/2014	OGIA data (Sept-25)	Baseline assessment Priority area
100225	1SP1924 59	MICHAEL BARKER	PL191	QPM Energy	614778.72	7567503.62	14/03/2014	OGIA data (Sept-25)	Baseline assessment Priority area
13040174	6SP2600 61	Isaac Waters Pty Ltd	PL196	QPM Energy	617190.74	7562864.44	11/03/2014	OGIA data (Sept-25)	Baseline assessment Priority area
13040175	6SP2600 61	Isaac Waters Pty Ltd	PL196	QPM Energy	616813.74	7562252.44	11/03/2014	OGIA data (Sept-25)	Baseline assessment Priority area
13040176	6SP2600 61	Isaac Waters Pty Ltd	PL196	QPM Energy	616291.75	7561487.44	11/03/2014	OGIA data (Sept-25)	Baseline assessment Priority area
Unregistered bore	8SP2444 92	Beryl Neilsen	ATP1103	Arrow Energy	618482.76	7555539.40	27/07/2014	OGIA data (Sept-25)	Baseline assessment Priority area
103210	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	616869.90	7560019.97	22/08/2017	Arrow Energy data (Feb-25)	Baseline assessment Priority area
162806	2RP6169 87	Freehold	PL224	QPM Energy	611187.74	7562747.44	1/02/2022	Arrow Energy data (Feb-25)	Baseline assessment Priority area
182164	2RP6169 87	Freehold	PL224	QPM Energy	609901.74	7562569.44	1/02/2022	Arrow Energy data (Feb-25)	Baseline assessment Priority area
162807	2RP6169 87	Freehold	PL224	QPM Energy	611622.74	7562666.44	1/02/2022	Arrow Energy data (Feb-25)	Baseline assessment Priority area
182166	2RP6169 87	Freehold	PL224	QPM Energy	610291.74	7562920.44	1/02/2022	Arrow Energy data (Feb-25)	Baseline assessment Priority area
Unregistered bore	2RP6169 87	Freehold	PL224	QPM Energy	611249.38	7562786.02	3/02/2022	Arrow Energy data (Feb-25)	Baseline assessment Priority area
162808	6SP2600 61	Isaac Waters Pty Ltd	ATP1103	Arrow Energy	613473.55	7558037.20	31/07/2023	Arrow Energy data (Feb-25)	Baseline assessment Priority area
182871	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	617146.23	7558572.34	1/08/2023	Arrow Energy data (Feb-25)	Baseline assessment Priority area

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Assessment date	Data source	Area
182872	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	617165.65	7558589.58	1/08/2023	Arrow Energy data (Feb-25)	Baseline assessment Priority area
81696	18SP208 194	Alan Williams	PL191	QPM Energy	608182.47	7586083.12	27/06/2012	2012 Baseline Assessment Plan (Arrow, 2012)	Baseline assessment Priority area
23745	18SP208 194	Alan Williams	PL191	QPM Energy	609749.50	7586689.59	25/11/2013	OGIA data (Sept-25)	Long-Term Affected Area (LAA)
23748	18SP208 194	Alan Williams	PL191	QPM Energy	609347.41	7586661.58	25/11/2013	OGIA data (Sept-25)	Long-Term Affected Area (LAA)
105435	1SP1924 59	Ross Flohr	PL191	QPM Energy	616874.79	7570585.40	31/03/2014	OGIA data (Sept-25)	Long-Term Affected Area (LAA)
162812	5GV132	<i>Freehold</i>	PL223	QPM Energy	621517.74	7568785.44	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
100083	5GV132	<i>Freehold</i>	PL223	QPM Energy	622605.77	7570007.39	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141561	1SP1924 51	<i>Freehold</i>	PL223	QPM Energy	623516.24	7572358.42	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141562	1SP1924 51	<i>Freehold</i>	PL223	QPM Energy	624540.44	7572472.73	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
100120	100SP25 1730	<i>Freehold</i>	PL223	QPM Energy	629268.72	7571941.37	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
100121	100SP25 1730	<i>Freehold</i>	PL223	QPM Energy	629296.82	7571879.59	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
105427	1SP1877 62	<i>Freehold</i>	PL223	QPM Energy	629840.98	7571612.08	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Assessment date	Data source	Area
141567	1SP1879 62	Freehold	PL223	QPM Energy	631862.64	7570792.36	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141568	1SP1879 62	Freehold	PL223	QPM Energy	631032.40	7571961.74	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141563	100SP25 1730	Freehold	PL223	QPM Energy	624355.81	7573043.00	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141564	1SP1924 51	Freehold	PL223	QPM Energy	624207.72	7573400.21	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141565	1SP1924 51	Freehold	PL223	QPM Energy	625903.11	7573481.14	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
141566	100SP25 1730	Freehold	PL223	QPM Energy	628232.53	7572811.14	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
105677	4CP9032 81	Freehold	PL223	QPM Energy	622136.24	7574277.64	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
100086	4CP9032 81	Freehold	PL223	QPM Energy	622903.74	7578892.44	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
105676	4CP9032 81	Freehold	PL223	QPM Energy	622432.72	7578938.17	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
131001	4CP9032 81	Freehold	PL223	QPM Energy	622201.74	7577290.44	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
131002	4CP9032 81	Freehold	PL223	QPM Energy	621997.86	7575273.97	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Assessment date	Data source	Area
131003	4CP9032 81	<i>Freehold</i>	PL223	QPM Energy	622378.33	7576815.09	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas
100090	100SP25 1730	<i>Freehold</i>	PL223	QPM Energy	628599.69	7573672.26	TBC	Arrow Energy data (Feb-25)	On MGP tenure, but outside priority and LAA areas

Appendix B

Registered water bores in baseline assessment priority area

Table B 1 Registered and unregistered bores in baseline assessment priority area

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Bore assessment undertaken	Assessment date
Unregistered bore	18SP208194	Alan Williams	PL191	QPM Energy	607369.75	7584735.44	Yes	12/11/2012
Unregistered bore	2RP904445	Ross Flohr	PL191	QPM Energy	610274.74	7581084.44	Yes	13/11/2012
162815	8SP277384	Ken Braithwaite	ATP1103	Arrow Energy	618486.74	7555533.44	Yes	12/12/2012
23683	11SP147333	Michael Barker	PL191	QPM Energy	610002.70	7583536.21	Yes	25/11/2013
23686	18SP208194	Alan Williams	PL191	QPM Energy	609746.96	7586320.75	Yes	25/11/2013
23688	18SP208194	Alan Williams	PL191	QPM Energy	609488.56	7586322.42	Yes	25/11/2013
23693	18SP208194	Alan Williams	PL191	QPM Energy	609230.15	7586324.19	Yes	25/11/2013
23761	18SP208194	Alan Williams	PL191	QPM Energy	609400.77	7586077.15	Yes	25/11/2013
23839	11SP147333	Alan Williams	PL191	QPM Energy	606894.93	7583898.28	Yes	25/11/2013
23843	18SP208194	Alan Williams	PL191	QPM Energy	610180.22	7586686.62	Yes	25/11/2013
100137	18SP208194	Alan Williams	PL191	QPM Energy	609489.72	7586476.18	Yes	25/11/2013
81696	18SP208194	Alan Williams	PL191	QPM Energy	608182.40	7587048.69	Yes	25/11/2013
100253	8SP277384	BERYL ANNE NEILSEN	ATP1103	Arrow Energy	618233.38	7556848.52	Yes	25/11/2013
100254	8SP277384	BERYL ANNE NEILSEN	ATP1103	Arrow Energy	619668.87	7557175.94	Yes	25/11/2013
100290	18SP208194	Alan Williams	PL191	QPM Energy	607705.05	7585812.18	Yes	25/11/2013
100224	1SP192459	MICHAEL BARKER	PL191	QPM Energy	615843.67	7568049.16	Yes	17/03/2014
100225	1SP192459	MICHAEL BARKER	PL191	QPM Energy	614778.72	7567503.62	Yes	14/03/2014
13040174	6SP260061	Isaac Waters Pty Ltd	PL196	QPM Energy	617190.74	7562864.44	Yes	11/03/2014
13040175	6SP260061	Isaac Waters Pty Ltd	PL196	QPM Energy	616813.74	7562252.44	Yes	11/03/2014
13040176	6SP260061	Isaac Waters Pty Ltd	PL196	QPM Energy	616291.75	7561487.44	Yes	11/03/2014

RN	Lot & Plan	Current Owners	Tenure	Tenure holder	Easting (GDA2020, Z55)	Northing (GDA2020, Z55)	Bore assessment undertaken	Assessment date
Unregistered bore	8SP244492	Beryl Neilsen	ATP1103	Arrow Energy	618482.76	7555539.40	Yes	27/07/2014
103210	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	616869.90	7560019.97	Yes	22/08/2017
162806	2RP616987	<i>Freehold</i>	PL224	QPM Energy	611187.74	7562747.44	Yes	1/02/2022
182164	2RP616987	<i>Freehold</i>	PL224	QPM Energy	609901.74	7562569.44	Yes	1/02/2022
162807	2RP616987	<i>Freehold</i>	PL224	QPM Energy	611622.74	7562666.44	Yes	1/02/2022
182166	2RP616987	<i>Freehold</i>	PL224	QPM Energy	610291.74	7562920.44	Yes	1/02/2022
Unregistered bore	2RP616987	<i>Freehold</i>	PL224	QPM Energy	611249.38	7562786.02	Yes	3/02/2022
162808	6SP260061	Isaac Waters Pty Ltd	ATP1103	Arrow Energy	613473.55	7558037.20	Yes	31/07/2023
182871	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	617146.23	7558572.34	Yes	1/08/2023
182872	23GV148	Tony Peirce (Anglo Coal)	ATP1103	Arrow Energy	617165.65	7558589.58	Yes	1/08/2023
81696	18SP208194	Alan Williams	PL191	QPM Energy	608182.47	7586083.12	Yes	27/06/2012
162809	17GV130	BHP Coal Pty Ltd	Off tenure (closest tenure ATP1103)	Arrow Energy	610876.74	7559644.44	No	-
162554	4CP847481	<i>Freehold</i>	PL224	QPM Energy	609861.74	7566873.44	No	-
Unregistered bore	18SP208194	Alan Williams	PL191	QPM Energy	607372.79	7584732.20	No	-