(1) What is size of the Gasifier void/s at the Linc Energy Site?

The size of each gasifier was informed from Perkins[1] (2018) map (shown in Figure 1 below) and intercepted by the model cells as shown in Figure 3-5 of the model report. The simulated area of each gasifier is as follows:

G1 = 10,981 m2 operated from 1999 to 2002

G2 = 6,039 m2 operated in 2007

G3 = 8,236 m2 operated from 2008 to 2009

G4 = 10,432 m2 operated from 2010 to 2012

G5 = 27,452 m2 operated from 2011 to 2013

AECOM (2018) calculated the gasifier volumes as burn cavities which has been created due to UCG process:

G1 = 10,000 m3

G2 = 500 m3

G3 = 1,700 m3

G4 = 9,000 m3

G5 = 12,000 m3

AECOM (2018) reported that the operation of the gasifiers led to dewatering of groundwater resources, alteration of the geology by thermal alteration of the lithology, fracturing of the target coal seams due to operation above confining or hydrostatic pressure, and collapse of surrounding rock into the burn cavity. In the present modelling work, the alteration of the host rock as a result of gasifiers operation has been taken into account by assuming the altered zones around the gasifiers. The volume of altered rock associated with each gasifier was estimated by multiplying the mapped surface areas (Perkins, 2018) by the thickness of the Macalister coal seam at each location. The seam has an average thickness of approximately 12.3 m.

G1 = 132,244 m3

G2 = 68,074 m3

G3 = 92,138 m3

G4 = 131,343 m3

G5 = 361,215 m3

These volumes, represent zones of altered rock (or zones of hydraulic property change) within the Macalister coal seam at the gasifier locations, interpreted to have been produced by historical gasifier operations. It should be noted that these altered rock volumes do not represent 100% void space or fully drained volumes. Instead, hydraulic properties including horizontal and vertical hydraulic conductivities, specific storage and yield are derived during transient calibration. Changes in hydraulic properties resulting from historical UCG activities are applied to the affected hydrostratigraphic units (HSUs) in the numerical model, including the Macalister coal seam, the Kogan interburden, and the Springbok Sandstone. The discharge during gasifier operation stress periods from the altered rock volumes is calibrated and validated against groundwater level observations in

[1] Perkins, G (2018). Underground coal gasification – Part I: Field demonstrations and process performance. Progress in Energy and Combustion Science, Volume 67, pp. 158-187. https://doi.org/10.1016/j.pecs.2018.02.004 .

monitoring bores within Lot 40 DY85. This approach is further supported by the model water balance, which indicates that discharge associated with the gasifiers is very small relative to other outflow fluxes in the system.

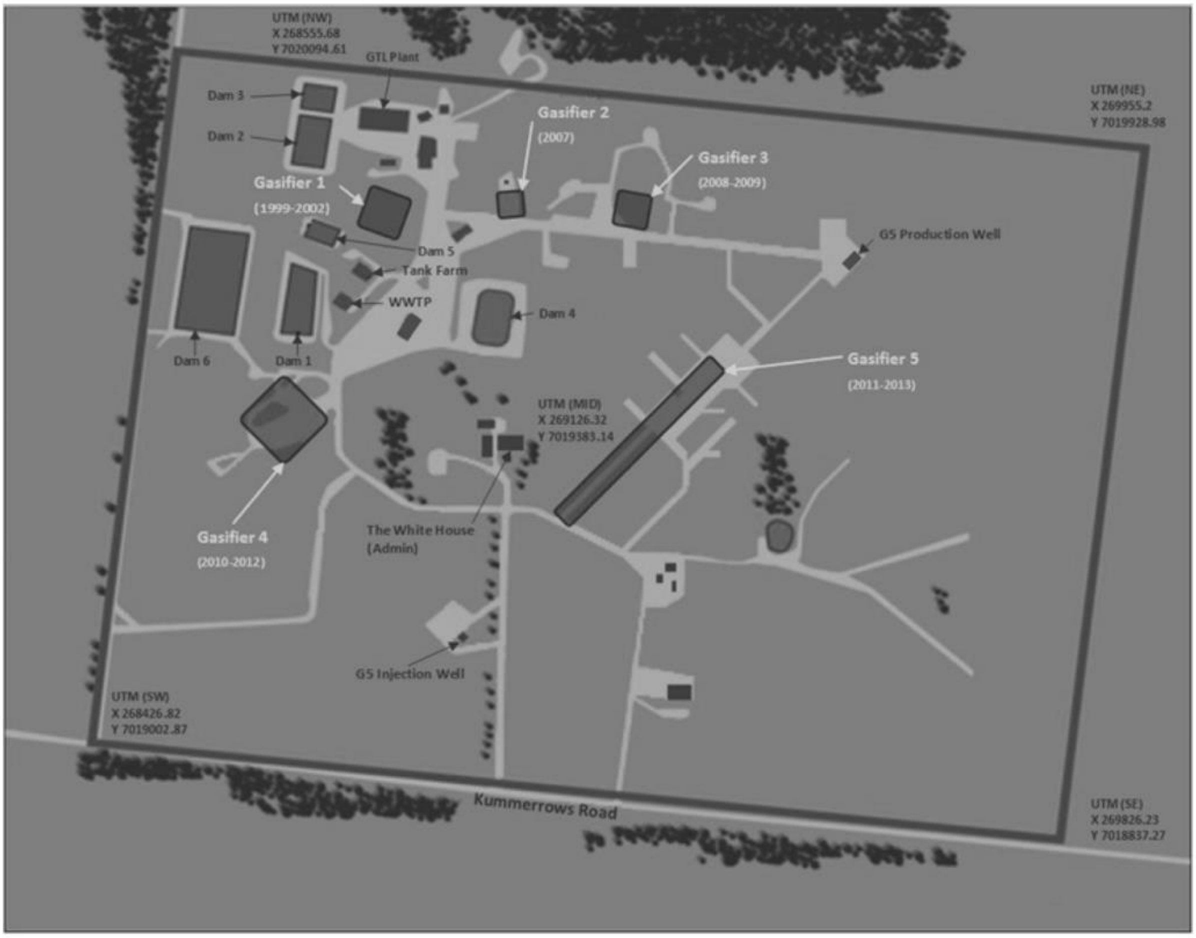

Figure 1 - Plot plan of the Chinchilla Demonstration Facility showing the locations of Gasifiers 1 to 5 (from Perkins, 2018)

(2) What is the nearest distance between the proposed well/s (Stage 2) to the site boundary (Lot 40 DY 85)?

The nearest Stage 2 well is located approximately 3.1 km and the site boundary. This is a deviated well orientated toward the site boundary, with the open interval extending from the Macalister seam (about 2.8 km from Lot 40 DY 85 site boundary and at a depth of approximately 170mbgl) to the Condamine seam (about 2.2 km from the site boundary at a depth of approximately 580mbgl). It is noted that the Walloon Coal Measures contain significant interbedded aquitards between the coal seams, such that production from coal seams deeper than the Macalister seam has limited impact on potential contaminant movement in the Macalister coal seam or overlying Springbok Sandstone.

(3) Are these newly proposed 55 wells FDP supplied to OGIA for the groundwater impact assessment as part of the UWIR? The abstraction rate/s applied in the model may need to be verified with OGIA.

Yes. As part of regulatory requirements, Arrow has an obligation to submit actual and proposed development data to OGIA. Actual data includes providing detailed information on CSG wells—such as their production history and production rates—on a biannual basis, with submissions due by the end of March and September each year. For proposed production wells such as the Stage 2 wells, Arrow provides location of wellhead and production interval, as well as proposed production commencement and end dates; however, does not provide forecast abstraction rates.

It is noted that the UWIR model (OGIA, 2021) is developed for a regional assessment, with a coarser discretisation and layering than the FDP model. The UWIR model does not use abstraction rates directly, but employs a descending drain approach, and therefore OGIA does not request forecast abstraction rates from CSG companies. See for example Section 6.3.2.4 of https://www.ogia.water.qld.gov.au/__data/assets/pdf_file/0004/2105464/modelling-cumulative-gw-n-subs.pdf

(4) Using the "well package" for the proposed Arrow CSG FDP and "drain package" for non-Arrow CSG appears to be inconsistent, it requires further explanation/justification.

The modelling approach was designed to represent both site-scale and regional groundwater abstraction as accurately as possible, based on available data and model alignment requirements.

At the PL253 (site) scale, Arrow wells with available abstraction rates were simulated using the WEL Package with the proposed pumping rates applied directly. This approach ensures consistency between the actual proposed and simulated abstraction and avoids the need to approximate equivalent drain elevations.

At the regional scale, non-Arrow CSG abstraction was represented using drain boundary conditions consistent with the OGIA regional groundwater model. Drain elevations derived from the OGIA model were applied and maintained consistently across all Arrow FDP scenarios (Scenarios 1 to 3) to preserve alignment with the regional groundwater level conditions represented, including regional groundwater flow directions. Any approximation associated with the use of drain elevations is not expected to influence the incremental impact assessment of the proposed Arrow field development, as this representation is applied consistently across all scenarios and is therefore accounted for within the incremental assessment.

(5) Poor cross-sectional display of the conceptual model diagram (figure 2-1). CSM display needs to be improved. The conceptual model should display void at the Linc Site, site boundary, major hydro-stratigraphic units, monitoring wells, current hydraulic head in the monitoring well (in mAHD), current plume extent and key groundwater receptors (e.g. water

supply wells). A minimum of two cross-sections (one east-west and another north-south) would be required.

Under the Australian groundwater modelling guidelines (Barnett et al., 2012), the groundwater model presented here is deemed to be Class 2 with many attributes of a Class 3 model.

Two cross-sections (Figure 2 and Figure 3) have been added to expand on the conceptual site model (CSM) presented in Section 2.1 of the EA amendment report.

The cross-sections explicitly incorporate the legacy of UCG operations. Note that the initial contaminant placement at the Linc site did not occur via groundwater flow, but rather through high pressure, high temperature gas-phase migration and subsequent condensation within and adjacent to the gasifier voids. This is consistent with the site conceptualisation, where UCG operations (1999–2013) resulted in hydrocarbon by-products being introduced into surrounding strata under elevated pressure and temperature conditions, with associated fracturing and disturbance of overlying units (Section 2.1 of the report). To reflect this, the cross-sections (Figure 2 and Figure 3) include:

- The gasifiers and overlying altered zone, representing thermally and mechanically modified strata with changed hydraulic properties due to UCG-induced fracturing and material removal (consistent with Section 3.1.3.7 of the report),
- Major hydro stratigraphic units (18 layers represented in the groundwater model, consistent with Section 3.1.2),
- Monitoring wells, with current hydraulic heads (mAHD) based on end 2025 conditions (consistent with Section 2.4.1),
- The current plume extent, which reflects initial contaminant placement mechanisms (gas-phase migration and condensation during UCG operations) and attenuation, and
- Key groundwater receptors (e.g. landholder bore RN147004).

Overall, Figures 2 and 3 integrate the EA amendment CSM (Section 2.1 of the report), including the gasifiers, altered zone, hydrostratigraphy, monitoring data (heads), plume extent, and receptors (see also answer to question 9 below on potential groundwater receptors).

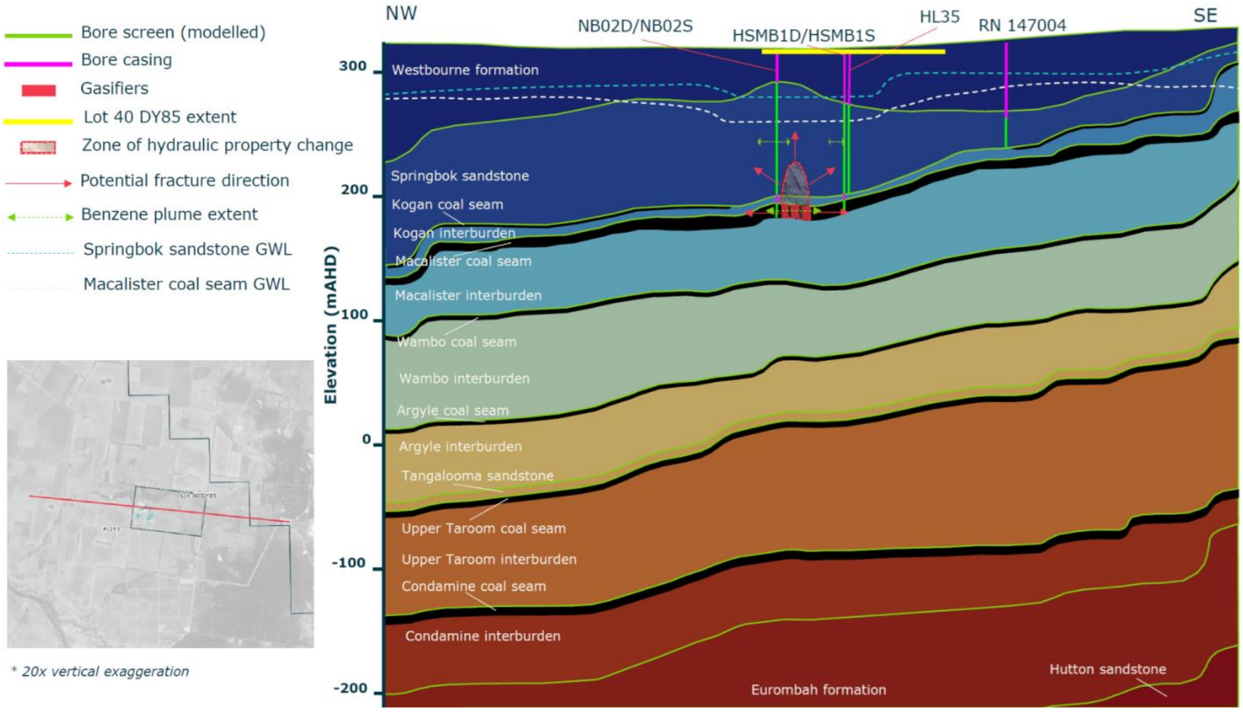

Figure 2 – Northwest-southeast cross-section of HSUs, groundwater levels and concentration at the end of 2025

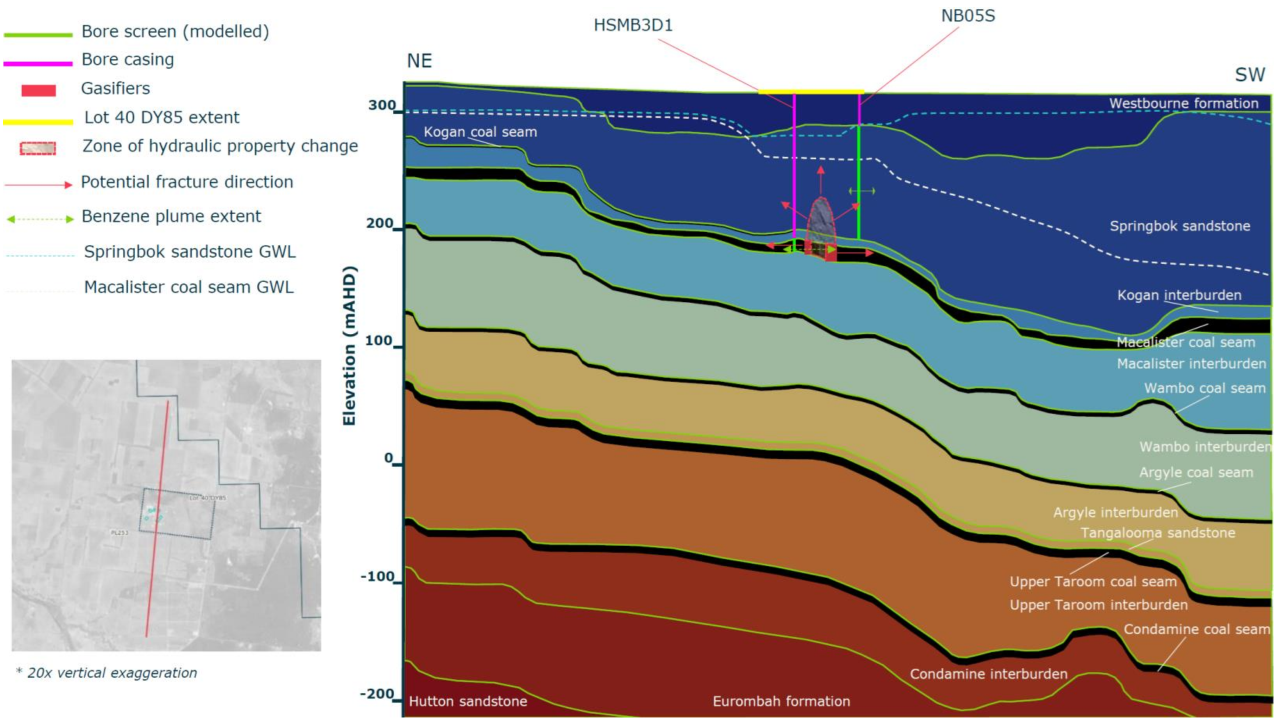

Figure 3 – Northeast-southwest cross-section of HSUs, groundwater levels and concentration at the end of 2025

(6) Model class and confidence level has not been provided.

Under the Australian groundwater modelling guidelines (Barnett et al., 2012), the groundwater model presented here is deemed to be Class 2 with many attributes of a Class 3 model.

Several factors are considered in determining the model confidence-level:

- available data,
- calibration procedures,
- comparative duration of stresses during calibration and predictive periods,
- consistency between calibration and predictive analysis, and
- level of stresses.

Class 2 and 3 models are suitable for assessing higher risk developments in higher value aquifers. A comparison against the performance indicators for individual model classes is presented in Table 1. The following symbols were used in the assessment of each classification:

- ~ shows the indictor is partially achieved, and
- √ shows the indictor is achieved.

Additionally, the main aspects of the PL253 Clynes Road FDP model is summarised in Table 2.

Model purpose and class

The PL253 Clynes Road FDP model is used to:

- Assess groundwater impacts of CSG development,
- Predict future groundwater levels and contaminant migration to 2225,
- Support regulatory approval, and
- Perform risk based impact assessment using posterior ensemble of calibrated models.

Model complexity indicators

The PL253 Clynes Road FDP model demonstrates high structural and numerical complexity:

- MODFLOW 6, 18 layers based on Arrow's latest geology model, transient to year 2225,
- Coupled:
    - Groundwater flow,
    - Particle tracking,
    - Contaminant transport (BTEX/PAH),
- Ensemble calibration:
    - 364 calibrated realisations,
- Advanced calibration and uncertainty analysis:
    - PEST-ENSI + PESTPP-IES, and
    - Probabilistic outputs (P5–P95).

Calibration performance and confidence level

Model performance metrics:

- SRMS ≤ 10% target achieved; reference case = 5.4%,
- All 364 realisations meet calibration criteria,
- Calibration targets include:
    - Heads
    - Vertical head difference
    - Time-series trends
    - Concentrations (benzene, naphthalene)

Predictive uncertainty analysis

The PL253 Clynes Road FDP model uncertainty handled via:

- Ensemble-based parameter estimation,
- Probabilistic outputs (P5, P50, P95),
- Scenario comparison (approved vs proposed),
- Conservative components:
    - Particle tracking (no attenuation), and
    - Long-term forecasts (200 years).

Table 1 - Model confidence level classification

Confidence level	Data		Calibration		Prediction		Key Indicators	
Class 1		Poor groundwater head observations		Not possible		Predictive >> Calibration		Predictive > 10x calibration period
		Sparse metered observations and measurements		Unacceptable error statistic		Long stress periods	✓	Stresses < 5x higher
		No metered usage		Inadequate data distribution		Poor/no validation		Mass balance > 1% or exceeds 5% once off
		No local climate data Poor aquifer geometry		Targets incompatible with model purpose.		Transient prediction but steady-state calibration		Properties range outside conceptualisation No review by Hydrogeologist
Class 2	✓	Average groundwater head observations	✓	Partial validation		Predictive > Calibration		Predictive 3-10x calibration period
	✓	Moderate metered observations and measurements	✓	Reasonable error statistic, partial errors	~	Long stress periods		Stresses = 2-5x higher
				Long-term trends not replicated	~	Ok validation	✓	Mass balance <1% of total
	~	Some baseflow and climatic data		Historic data match, not present	✓	Transient calibration and prediction		Some properties range outside conceptualisation.
	✓	Some high-resolution topographic DEM &/or some aquifer geometry	~	No use of targets compatible with model purpose (heads & fluxes)		Poor match to observations if stress is extended		Some coarse discretisation in key areas of grid or at key times
							✓	Reviewed by Hydrogeologist
Class 3	✓	Good groundwater head observations	✓	Adequate performance stats	~	Predictive ~ Calibration	✓	Predictive <3x calibration period
	~	Reliable metered observations and measurements	~	Most long-term trends replicated	✓	Similar stress periods to calibration	✓	Stresses < 2x

Table 2 - Main aspects of the PL253 Clynes Road FDP model

Model aspect	Description
Model class	Class 2-3 (predictive, impact assessment, regulatory decision support)
Model complexity	High (coupled flow + particle tracking + transport + ensemble calibration)
Calibration quality	Good (SRMS ≈ 5.4% reference case, multiple datasets matched)
Uncertainty treatment	Advanced (ensemble + probabilistic outputs)
Confidence level	Moderate–High (fit-for-purpose, uncertainty acknowledged)

(7) Water balance and mass balance components are missing from the report (these should be provided at least for P50 scenario).

The water balance components have been extracted from the P50 model based on the maximum particle movement from the gasifiers at the Springbok Sandstone (shown in Figure 5-6 of the model report) and presented in Table 3.

The mass balance error defined as the difference between model inflows and outflows is one of the parameters that is used to quantify the accuracy of the numerical model solutions during internal iterations. The Australian groundwater modelling guidelines (Barnett et al, 2012) recommends a 2% threshold for acceptable mass balance discrepancy at any time step in a transient simulation. This model is well within the guideline criterion, with a mass balance error of 0.0% during all the time steps.

Table 3 - Steady-state, calibration, prediction and post-mining recovery water balance (ML/day)

Water balance component	Steady state			History-matching			Prediction			Recovery		
	in	out	in - out	in	out	in - out	in	out	in - out	in	out	in - out
Recharge	10.0	0.0	10.0	10.0	0.0	10.0	10.0	0.0	10.0	10.0	0.0	10.0
Surface drainage	0.0	-9.6	-9.6	0.0	-9.5	-9.5	0.0	-9.0	-9.0	0.0	-8.7	-8.7
Throughflow	1.7	-2.1	-0.4	33.9	-5.4	28.5	59.8	-4.9	54.9	16.8	-7.5	9.3
Gasifier discharge	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Drain abstraction (non-Arrow)	0.0	0.0	0.0	0.0	-167.3	-167.3	0.0	-154.5	-154.5	0.0	0.0	0.0
Arrow wells abstractions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.4	-2.4	0.0	0.0	0.0
Storage – specific storage	0.0	0.0	0.0	113.7	-1.0	112.7	73.5	-14.0	59.5	1.7	-19.8	-18.1
Storage – specific yield	0.0	0.0	0.0	26.1	-0.4	25.7	47.3	-5.8	41.5	13.9	-6.4	7.5
Total	**11.7**	**-11.7**	**0.0**	**183.7**	**-183.7**	**0.0**	**190.6**	**-190.6**	**0.0**	**42.4**	**-42.4**	**0.0**

(8) How the model calibrated parameters (figure 4-7) compare with the calibrated model parameters by OGIA? A table with P50, P5 and P95 calibrated parameters by OGIA and the current model would have been useful and would be required.

The calibrated (posterior) hydraulic property ranges from ensemble P5, P50 and P95, are compared with the available parameter bounds from OGIA (2019) in Table 4 to Table 6. Comparison of ensemble posterior hydraulic property ranges (median P5, P50 and P95) with OGIA (2019) parameter bounds indicates that the posterior ensemble of models is generally consistent with OGIA in terms of order of magnitude. For Kh, Kv and Ss, the calibrated ranges mostly fall within, or remain close to, the OGIA bounds, with some wider upper ranges in local units. This reflects site scale refinements near Lot 40 DY85 and historical UCG activities rather than departures in conceptual scale.

It is important to note that the two models are developed at different scales and levels of geological detail. The PL253 model incorporates discrete representation of coal seams and interburden layers, enabling more detailed vertical heterogeneity and localised parameter variability. In contrast, the OGIA model is a regional-scale model with more simplified layering and parameterisation appropriate for basin-scale assessments.

Overall, the comparison demonstrates that, despite differences in scale, layering and modelling objectives, the calibrated parameters of the current model fall within a reasonable range of the OGIA values. This provides confidence that the model is appropriately parameterised and consistent with regional hydrogeological understanding, while also capturing site-specific conditions relevant to assessing the potential impacts of the Clynes Road development.

Table 4 – Calibrated (posterior) horizontal hydraulic conductivity ranges of ensemble (m/day)

Layer*	HSU	P5			P50			P95			OGIA (2019)	
		Median	Min	Max	Median	Min	Max	Median	Min	Max	Min	Max
1	Condamine Alv	9.42E-01	1.00E-01	5.00E+01	1.58E+01	1.00E-01	5.00E+01	5.00E+01	3.18E-01	5.00E+01	1.90E+00	4.00E+01
1	Gubb. Sst	1.00E-04	1.00E-04	5.00E-01	5.33E-04	1.00E-04	5.00E-01	1.38E-02	7.86E-04	5.00E-01	5.00E-02	9.34E+00
2	Westbourne Fm	1.00E-03	1.00E-03	1.25E-01	1.47E-03	1.00E-03	9.76E-01	2.40E-02	1.00E-03	1.00E+00	6.75E-05	1.29E-03
3	Springbok Sst	2.42E-04	1.00E-04	5.00E-01	4.11E-03	1.00E-04	5.00E-01	7.85E-02	1.00E-04	5.00E-01	1.15E-04	4.48E-03
4	Kogan C	4.34E-03	1.00E-03	3.00E-01	5.52E-02	1.00E-03	3.00E-01	3.00E-01	1.88E-03	3.00E-01	-	-
5	Kogan IB	7.61E-05	1.00E-05	1.00E-01	8.23E-04	1.00E-05	1.00E-01	1.33E-02	1.15E-05	1.00E-01	2.43E-04	2.83E-03
6	Macalister C	4.91E-03	1.00E-03	3.00E-01	5.31E-02	1.00E-03	3.00E-01	3.00E-01	1.00E-03	3.00E-01	1.10E-05	2.71E-02
7	Macalister IB	1.04E-04	1.00E-05	1.00E-01	7.67E-04	1.00E-05	1.00E-01	1.10E-02	1.00E-05	1.00E-01	-	-
8	Wambo C	6.17E-03	1.00E-03	3.00E-01	9.22E-02	1.00E-03	3.00E-01	3.00E-01	2.34E-03	3.00E-01	2.32E-06	3.14E-02
9	Wambo IB	2.43E-04	1.00E-05	1.00E-01	4.91E-03	1.00E-05	1.00E-01	9.74E-02	1.00E-05	1.00E-01	-	-
10	Argyle C	1.05E-02	1.00E-03	3.00E-01	1.82E-01	1.00E-03	3.00E-01	3.00E-01	2.53E-03	3.00E-01	2.32E-06	3.14E-02
11	Argyle IB	5.65E-04	1.00E-05	1.00E-01	6.17E-03	1.00E-05	1.00E-01	8.38E-02	1.00E-05	1.00E-01	-	-
12	Tangalooma Sst	2.50E-04	1.00E-04	5.00E-01	5.19E-03	1.00E-04	5.00E-01	1.05E-01	1.00E-04	5.00E-01	-	-
13	Upper Taroom C	1.05E-02	1.00E-03	3.00E-01	1.56E-01	1.00E-03	3.00E-01	3.00E-01	3.12E-03	3.00E-01	-	-
14	Upper Taroom IB	6.09E-04	1.00E-05	1.00E-01	4.55E-03	1.00E-05	1.00E-01	6.65E-02	1.26E-05	1.00E-01	-	-
15	Condamine C	1.17E-02	1.00E-03	3.00E-01	1.75E-01	1.00E-03	3.00E-01	3.00E-01	1.00E-03	3.00E-01	1.14E-06	4.87E-02
16	Condamine IB	6.83E-04	1.00E-05	1.00E-01	5.89E-03	1.00E-05	1.00E-01	8.67E-02	4.08E-05	1.00E-01	-	-
17	Eurombah Fm	1.00E-05	1.00E-05	1.00E-01	6.54E-05	1.00E-05	1.00E-01	1.52E-03	1.00E-05	1.00E-01	1.35E-03	1.00E+01
18	Hutton Sst	1.88E-03	1.00E-04	5.00E-01	4.31E-02	1.00E-04	5.00E-01	5.00E-01	1.00E-04	5.00E-01	1.32E-04	1.00E+01

** The model HSUs were matched with OGIA model layers based on the HSU elevation surfaces*

Table 5 – Calibrated (posterior) vertical hydraulic conductivity ranges of ensemble (m/day)

Layer*	HSU	P5			P50			P95			OGIA (2019)	
		Median	Min	Max	Median	Min	Max	Median	Min	Max	Min	Max
1	Condamine Alv	8.53E-02	1.00E-02	2.50E+01	2.31E+00	1.00E-02	2.50E+01	2.50E+01	7.09E-02	2.50E+01	1.90E+00	4.00E+01
1	Gubb. Sst	1.00E-05	1.00E-05	1.22E-03	1.00E-05	1.00E-05	5.00E-02	2.35E-05	1.00E-05	5.00E-02	1.00E-05	1.19E-02
2	Westbourne Fm	1.00E-05	1.00E-05	2.87E-04	1.00E-05	1.00E-05	2.51E-03	2.70E-04	1.00E-05	7.31E-02	1.09E-07	1.20E-06
3	Springbok Sst	1.00E-05	1.00E-05	6.86E-03	1.00E-05	1.00E-05	3.36E-02	3.04E-05	1.00E-05	5.00E-02	3.05E-08	1.45E-06
4	Kogan C	8.03E-05	1.00E-05	6.35E-02	1.53E-03	1.00E-05	1.00E-01	3.34E-02	6.75E-05	1.00E-01	-	-
5	Kogan IB	7.61E-06	1.00E-06	2.61E-03	1.00E-05	1.00E-06	1.00E-02	9.41E-05	1.15E-06	1.00E-02	3.09E-07	2.80E-05
6	Macalister C	6.82E-04	1.00E-05	1.00E-01	1.32E-02	2.38E-05	1.00E-01	1.00E-01	1.95E-04	1.00E-01	1.02E-08	1.00E-06
7	Macalister IB	1.00E-05	1.00E-06	2.08E-04	1.00E-05	1.00E-06	6.80E-04	1.00E-05	1.00E-06	1.23E-03	-	-
8	Wambo C	1.74E-04	1.00E-05	1.00E-01	3.70E-03	1.62E-05	1.00E-01	8.99E-02	1.89E-04	1.00E-01	3.81E-09	1.00E-06
9	Wambo IB	1.00E-05	1.00E-06	1.26E-04	1.00E-05	1.00E-06	3.09E-03	4.59E-05	1.00E-06	1.00E-02	-	-
10	Argyle C	4.83E-04	1.00E-05	1.00E-01	1.38E-02	3.57E-05	1.00E-01	1.00E-01	4.62E-04	1.00E-01	3.81E-09	1.00E-06
11	Argyle IB	1.00E-05	1.00E-06	2.38E-03	4.09E-05	1.00E-06	1.00E-02	1.32E-03	1.00E-06	1.00E-02	-	-
12	Tangalooma Sst	1.00E-05	1.00E-05	1.18E-03	1.00E-05	1.00E-05	8.02E-03	8.62E-05	1.00E-05	5.00E-02	-	-
13	Upper Taroom C	2.63E-04	1.00E-05	1.00E-01	5.82E-03	2.10E-05	1.00E-01	1.00E-01	2.31E-04	1.00E-01	-	-
14	Upper Taroom IB	1.00E-05	1.00E-06	1.00E-02	8.62E-05	1.00E-06	1.00E-02	2.04E-03	1.26E-06	1.00E-02	-	-
15	Condamine C	1.04E-03	1.00E-05	1.00E-01	2.70E-02	2.37E-05	1.00E-01	1.00E-01	3.22E-04	1.00E-01	1.27E-09	1.00E-06
16	Condamine IB	1.00E-05	1.00E-06	5.60E-03	5.41E-05	1.00E-06	1.00E-02	1.65E-03	4.08E-06	1.00E-02	-	-
17	Eurombah Fm	1.00E-06	1.00E-06	2.30E-04	6.54E-06	1.00E-06	2.74E-03	1.00E-05	1.00E-06	1.00E-02	7.62E-08	1.08E-05
18	Hutton Sst	1.00E-05	1.00E-05	8.66E-03	8.23E-05	1.00E-05	5.00E-02	6.00E-03	1.00E-05	5.00E-02	1.14E-08	1.00E-06

Table 6 – Calibrated (posterior) specific storage ranges of ensemble (/m)

Layer*	HSU	P5			P50			P95			OGIA (2019)	
		Median	Min	Max	Median	Min	Max	Median	Min	Max	Min	Max
1	Condamine Alv	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	1.00E-03	1.25E-01
1	Gubb. Sst	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-06	5.00E-07	1.33E-05
2	Westbourne Fm	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	2.32E-05	1.09E-06	1.33E-05
3	Springbok Sst	7.61E-07	2.30E-07	1.00E-05	1.00E-05	2.76E-07	1.00E-05	1.00E-05	1.59E-06	1.00E-05	1.18E-06	1.33E-05
4	Kogan C	4.99E-07	2.30E-07	3.70E-05	1.03E-05	2.30E-07	3.70E-05	3.70E-05	5.10E-06	3.70E-05	-	-
5	Kogan IB	3.40E-07	2.30E-07	7.50E-06	3.51E-06	2.30E-07	7.50E-06	7.50E-06	3.55E-06	7.50E-06	8.95E-07	1.33E-05
6	Macalister C	2.30E-07	2.30E-07	1.32E-05	3.98E-06	2.30E-07	3.70E-05	3.70E-05	1.79E-06	3.70E-05	3.26E-07	1.33E-05
7	Macalister IB	4.01E-07	2.30E-07	7.50E-06	4.69E-06	2.30E-07	7.50E-06	7.50E-06	2.47E-06	7.50E-06	-	-
8	Wambo C	9.37E-07	2.30E-07	3.70E-05	1.97E-05	3.00E-07	3.70E-05	3.70E-05	1.09E-05	3.70E-05	2.50E-07	1.33E-05
9	Wambo IB	4.97E-07	2.30E-07	7.50E-06	6.46E-06	2.30E-07	7.50E-06	7.50E-06	1.59E-06	7.50E-06	-	-
10	Argyle C	1.21E-06	2.30E-07	3.70E-05	2.59E-05	7.00E-07	3.70E-05	3.70E-05	1.32E-05	3.70E-05	2.50E-07	1.33E-05
11	Argyle IB	1.02E-06	2.30E-07	7.50E-06	7.50E-06	3.42E-07	7.50E-06	7.50E-06	3.22E-06	7.50E-06	-	-
12	Tangalooma Sst	8.30E-07	2.30E-07	1.00E-05	1.00E-05	3.02E-07	1.00E-05	1.00E-05	4.29E-06	1.00E-05	-	-
13	Upper Taroom C	2.30E-07	2.30E-07	1.51E-05	2.94E-06	2.30E-07	3.70E-05	3.70E-05	1.22E-06	3.70E-05	-	-
14	Upper Taroom IB	2.81E-07	2.30E-07	7.50E-06	3.02E-06	2.30E-07	7.50E-06	7.50E-06	1.01E-06	7.50E-06	-	-
15	Condamine C	2.30E-07	2.30E-07	3.70E-05	4.12E-06	2.30E-07	3.70E-05	3.70E-05	7.22E-07	3.70E-05	6.59E-07	1.33E-05
16	Condamine IB	1.95E-06	3.48E-07	7.50E-06	7.50E-06	9.52E-07	7.50E-06	7.50E-06	7.50E-06	7.50E-06	-	-
17	Eurombah Fm	3.73E-07	2.30E-07	5.00E-06	3.44E-06	2.53E-07	5.00E-06	5.00E-06	2.54E-06	5.00E-06	8.04E-07	1.33E-05
18	Hutton Sst	1.49E-06	2.31E-07	1.00E-05	1.00E-05	4.98E-07	1.00E-05	1.00E-05	4.22E-06	1.00E-05	7.80E-07	1.33E-05

(9) Hydraulic parameters above the Gasifier were changed, however, changed parameters (or factor of change) have not been presented.

Changes to hydraulic properties associated with historical UCG operations were applied to the affected HSUs, including the Springbok Sandstone, Kogan Interburden, and Macalister Coal seam. These changes were implemented on a gasifier specific basis to allow localised impacts to be represented independently for each gasifier footprint.

In contrast to the deterministic approach, which assigns increased hydraulic properties to the zone above the gasifier, the present study represented potential changes in hydraulic parameters above the gasifiers using a probabilistic framework based on history matching and uncertainty analysis. Across five gasifiers, three HSUs, and four hydraulic property groups, a total of 60 parameters were included in the history matching and uncertainty analysis. The hydraulic properties considered were horizontal hydraulic conductivity (kh), vertical hydraulic conductivity (kv), specific storage (ss), and specific yield (sy). Parameter naming conventions include reference to gasifier number (G1 to G5) and HSU (s for Springbok sandstone, ki for Kogan Interburden, and m for Macalister Coal seam). The prior and posterior distributions of these parameters are provided in the attached document "Gasifiers_hyd_prop_dist.pdf" *(DETSI Comment: document renamed "hydraulic parameters output for question 9")*

(10) Location of fault/s should be displayed on a map together with the monitoring bores and groundwater receptors.

When assessing the EA Amendment application, section 5.9 of the EA Amendment Application Supporting Information Report and Appendix E "Response to Section 126A of the EP Act 1994 – Requirements for site-specific and amendment applications – underground water rights" need to be considered, not just the groundwater model presented in the Worley Consulting report PL253 Groundwater Impact Assessment - Clynes Road FDP.

The location of inferred faults, location of Arrow monitoring bores, and consideration of potential receptors such as springs and terrestrial groundwater dependent ecosystems are presented in these other documents. It is noted that landholder water bores in proximity to Lot 40 DY85 presented in Figure 15 of Appendix E (such as RN15868, RN15811 and RN147607) have been "Made Good" under Chapter 3 of the Water Act 2000, with the bores being plugged and abandoned and so are not potential receptors. Only one spring has been identified on PL253, located approximately 8.3km west of Lot 40 DY85 (Figure 14), and is sourced from local groundwater systems perched in Cenozoic sediments above the Surat Basin formations, and is not considered a potential groundwater receptor for contaminants from the former UCG site contaminants. Whilst a derived GDE with low confidence has been attributed to a section of vegetation in a drainage line in the north of Lot 40 DY85 (Figure 14), depth to groundwater (>20m below ground level) of the Surat Basin formations is beyond vegetation rooting depth, and if the vegetation is reliant on groundwater it likely will be from a shallow perched groundwater system disconnected from the deeper regional system of the Springbok Sandstone or Walloon Coal Measures.

(11) Timing of horizontal hydraulic gradient reversal has not presented in the report.

To assess the timing of horizontal hydraulic gradient reversal, median groundwater level contours for the Springbok sandstone and Macalister coal seam, constructed using simulated groundwater levels, were presented across the posterior ensemble at selected times during the abstraction and recovery periods (Figure 4 and Figure 5). Flow reversal was identified where outward hydraulic gradients developed along a substantial portion of the Lot 40 DY85 boundary.

In the Springbok Sandstone (Figure 4), inward flow toward Lot 40 DY85 persists through to the end of the recovery period (2225). This is due to the vertical flow direction between the Springbok sandstone and the underlying Macalister coal seam (near historical gasifiers) driven by CSG abstraction and ongoing recovery within the WCM.

In the Macalister coal seam (Figure 5), model results indicate that flow reversal occurred prior to 2026, consistent with recent observed groundwater levels. Groundwater flow enters Lot 40 DY85 from the northern and eastern boundaries and exits at the southwestern corner. From the end of peak abstraction (2030) through to the end of the recovery period, the direction of flow leaving the site shifts progressively toward the south.

Time slices of horizontal hydraulic gradients across Lot 40 DY85 during the predictive period (Table 5 2 of the modelling report) indicate some uncertainty in quantifying groundwater flow directions, reflecting the complex flow regime observed in the monitoring data. As discussed in Section 5.2 of the EA amendment report, the comparison of summary statistics between the two FDP scenarios (i.e., with and without Clynes Road wells) indicates that incremental changes in hydraulic gradients across these boundary sections are negligible, with differences generally within 1%. These results suggest that it is unlikely that the proposed Clynes Road wells materially alter regional groundwater flow directions or hydraulic gradients at the boundaries of Lot 40 DY85.

In summary, while model results suggest that horizontal gradient reversal in the Macalister Coal Seam likely occurred prior to the commencement of production, and that inward flow persists in the Springbok Sandstone throughout the simulation period, there is inherent uncertainty in both the timing and spatial expression of flow directions. Overall, groundwater flow behaviour at Lot 40 DY85 is dynamic and reflects a combination of natural conditions, operational stresses, and gradual system recovery.

It should be noted that although groundwater within the Macalister coal seam is predicted to exit Lot 40 DY85 at the southwestern corner during the production phase, this does not imply that existing on-site contaminants will migrate significantly beyond the Lot 40 DY85 boundary. This conclusion is supported by particle tracking and contaminant transport modelling. Specifically, modelling predicted that it is highly unlikely (probability <5%) that, by the end of the recovery period in 2225, particles released at or near the gasifier locations will travel beyond approximately 1,250 m from the Lot 40 DY85 boundary within the Macalister coal seam (Section 5.4 of the report). Furthermore, the proposed Clynes Road wells are expected to result in only a minor increase in particle travel distance, with a maximum incremental increase of approximately 55 m within the Macalister coal seam.

Contaminant fate and transport modelling also indicated that, based on the ensemble median (P50), benzene concentrations in the Macalister coal seam are predicted to attenuate below the limit of reporting (LOR) by approximately 2035, while naphthalene concentrations have already fallen below the LOR as of April 2024 (refer to Section 5.6 of the report). Additionally, residual concentrations during the abstraction period are predicted to remain confined to areas proximal to the former gasifier locations, consistent with observed monitoring data.

Figure 4 – Median groundwater levels around Lot 40 DY85 in the Springbok sandstone

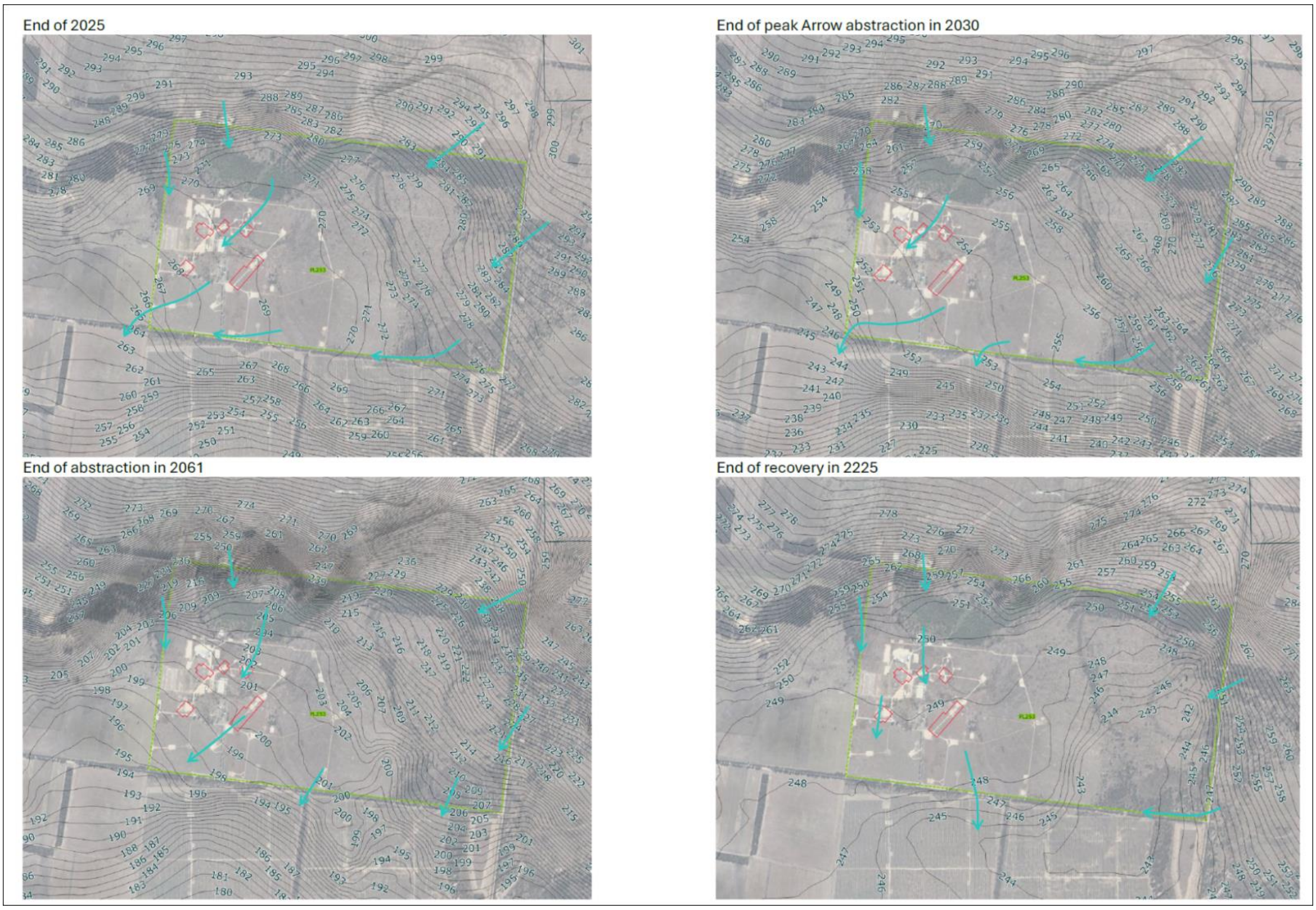

Figure 5 – Median groundwater levels around Lot 40 DY85 in the Macalister coal seam

(12) As per the report, the vertical gradient reversal is not expected in between the McAlister Seam and Springbok. What about the vertical gradient between the McAlister Seam and the underlying formation?

The vertical hydraulic gradient between the Macalister coal seam and the underlying Wambo coal seam has been evaluated using monitoring bore pairs Hopeland 20 – Hopeland 21 and Hopeland 23 – Hopeland 24. Hopeland 20 (HL20) and Hopeland 23 (HL23) are screened within the Macalister coal seam, while Hopeland 21 (HL21) and Hopeland 24 (HL24) are screened within the Wambo coal seam. These paired installations are therefore suitable for assessing vertical hydraulic gradients between the two hydrostratigraphic units. The monitoring bores are located to the east and southwest of Lot 40 DY85, adjacent to but outside the site boundary.

Groundwater level data collected between 2020 and 2025 indicate a negative vertical head difference at both bore pairs, reflecting an upward hydraulic gradient from the Wambo coal seam toward the Macalister coal seam. These observations are consistent with pre-development conditions and indicate upward flow potential prior to commencement of coal seam gas (CSG) production. This is also consistent with observations by OGIA:

> *"In terms of vertical hydraulic gradients, under pre-development conditions, similar to the relationship observed between formations, an upward gradient would be expected between the subunits of the Walloon Coal Measures – from the Taroom Coal Measures to the Juandah Coal Measures. Due to the high permeability contrast between the coal and the matrix (or interburden), horizontal flow dominates within these formations, with vertical flow being restricted."* (Regional flow systems and potentiometry in Queensland's Surat and southern Bowen basins, OGIA, December 2021).

To further assess the vertical gradient between the Macalister and Wambo coal seams, simulated vertical head differences are presented for three distinct phases: pre-development (pre-2026), production/depressurisation (2026 to approximately 2060), and post-closure recovery (post-2060) for the monitoring bore pairs (Figure 6).

During the pre-development phase, the simulated vertical head difference remains negative, consistent with observed data, confirming an upward gradient from the Wambo coal seam to the Macalister coal seam. This agreement indicates that the model is satisfactorily calibrated and capable of reproducing the existing flow regime.

Following the commencement of CSG extraction from the coal seams in 2026, the model predicts a rapid transition to a positive vertical head difference. This indicates a reversal of the natural gradient, with a downward hydraulic gradient from the Macalister coal seam to the Wambo coal seam during the production phase. The largest head differences, and therefore the strongest downward gradients, occur during the mid-production period, as demonstrated by the HL20–HL21 and HL23–HL24 bore pairs. This reversal of hydraulic gradient in the coal seams is also observed by OGIA:

> *"In the confined parts of the groundwater system, prior to CSG development, groundwater potential or the head gradient was generally upward through the WCM, from the TCM up to the UJCM. Depressurisation has developed more rapidly in the TCM, reversing the hydraulic gradient and creating a general downward flow potential within the WCM in these areas."* (Analysis of groundwater level trends to identify impacts from coal seam gas, OGIA, October 2025).

Although a downward hydraulic gradient from the Macalister coal seam to the Wambo coal seam may develop during the production phase, this does not indicate that groundwater can flow from the Macalister coal seam to the Wambo coal seam. This is because low permeable interburden (Macalister IB in the model) acts as an aquitard, separating the two units.

During the post-closure recovery phase (post-2060), simulated vertical head differences gradually decline toward zero. This suggests a progressive weakening of the induced downward gradient, with the potential for the system to approach near-equilibrium conditions and, depending on recovery rates, partially re-establish the natural upward gradient.

In summary, monitoring data indicate that under pre-development conditions there is a slight upward vertical hydraulic gradient from the Wambo seam to the Macalister seam. Model predictions indicate that groundwater extraction from the Macalister seam (2026 to approximately 2060) will reverse this natural gradient, resulting in a downward hydraulic gradient during the production phase. This reversal is driven by depressurisation associated with water production and induces downward leakage across the interburden. Following cessation of pumping, the gradient progressively weakens during the recovery phase, with the system trending toward near-equilibrium conditions and potential partial re-establishment of the natural upward gradient. Overall, the results indicate that inter-seam hydraulic interactions are transient and primarily controlled by operational stresses.

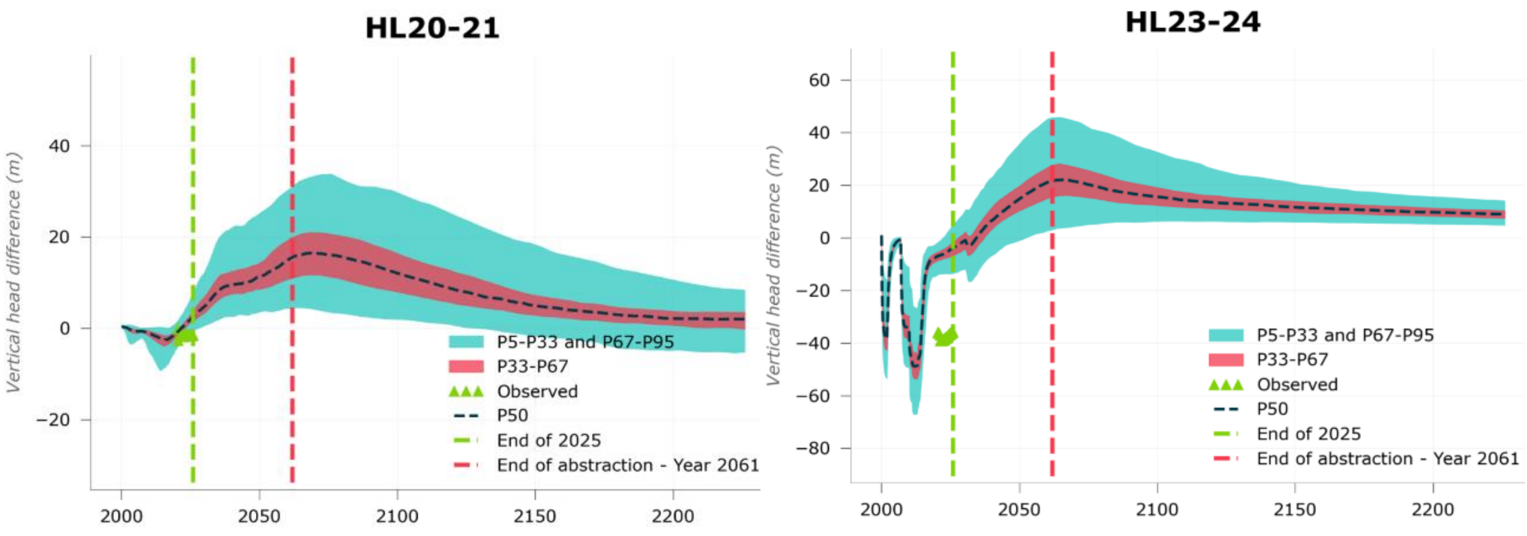

Figure 6 - Predicted vertical hydraulic gradient between the Macalister coal seam and Wambo coal seam at paired monitoring locations

(13) QOIs (Quantities of Interest) are limited to incremental change between two FDPs. That means total travel distances for the two scenarios, time of hydraulic gradient reversal, groundwater impacts (including total drawdown) on receptors, have not been considered as part of the QOIs?

The EA Amendment seeks approval for an additional 55 CSG wells (Clynes Road) to the CSG development (Kogan Creek) already authorised under EA0001401 for PL253. While the impact assessment focuses on the incremental changes between approved (scenario 2) and additional proposed wells (scenario 3), all prediction results are presented for scenario 3. This includes groundwater levels, particle tracking and contaminant transport and fate predictions (e.g. Figure 5-1, Figure 5-2, Figure 5-6, Figure 5-7, Figure 5-8, Tables 5-3 and 5-4 of the report).

(14) Groundwater Impact Assessment reporting is limited to incremental change in between the two FDPs scenarios, actual impact assessment on the groundwater receptors is missing. Maximum travel distance of particle for P50 is reported, however, the same for P5 and P95 has not been reported.

As above on proximity of groundwater receptors to Lot 40 DY85, noting P5 and P95 results are presented in the report (Tables 5-3, 5-4, and particle tracking probability maps in Figures 5-6 to 5-8).