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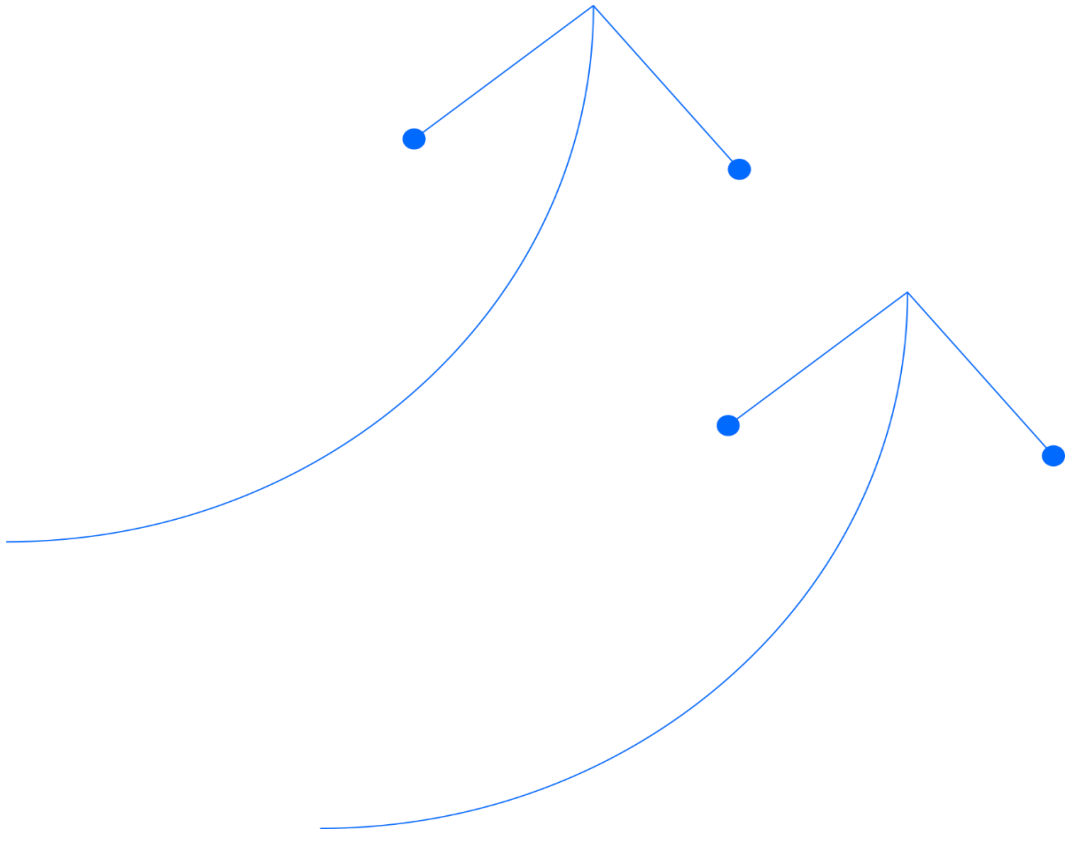
Santos

Annual Monitoring and Verification Report

Moomba CCS Project
Cooper-Eromanga Basin, South Australia
Gas Storage Licence 1, 2, 3 & 4 (AAL 298)

1 February 2024 to 31 January 2025



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Abbreviations

Item	Definition
1D / 2D / 3D / 4D	One / two / three / four dimensional
AAL	Associated activities licence
ACCU	Australian carbon credit unit
AS	Australian standard
BHP	Bottom hole pressure
CCS	Carbon capture and storage
CER	Clean Energy Regulator
CO2	Carbon dioxide
DEM	Department for Energy and Mining (South Australia)
DEW	Department for Environment and Water (South Australia)
DHG	Down-hole gauge
DN	Nominal diameter
EPA	Environment Protection Authority (South Australia)
EIR	Environment impact report
FDP	Field development plan
GIS	Geographic information system
GSL	Gas storage licence
H_2O	Water
H_2S	Hydrogen sulphide
InSAR	Interferometric synthetic aperture radar
ISO	International Organization for Standardization
JV	Joint venture
KPI	Key performance indicator
LOC	Loss of containment
M&V	Monitoring and verification
mD	Millidarcy
MD	Measured depth
mmscf	Million standard cubic feet
NGER	National greenhouse and energy reporting
P&A	Plugged and abandoned
PNL	Pulsed neutron log
PVT	Pressure, volume, temperature
SA	South Australia
SEO	Statement of environmental objectives
SGS	Static gradient survey
TEG	Tri-ethylene glycol
THP	Tubing head pressure

1. Introduction

This Annual Monitoring and Verification (M&V) Report details the work conducted within the Gas Storage Licences (GSL) 1, 2, 3 and 4 and Associated Activities Licence (AAL) 298 located in the South Australian Cooper and Eromanga Basins. This is the first annual report for the Moomba Carbon Capture and Storage (CCS) project and is required to be submitted 6 months after first injection. Subsequent reports will be submitted annually. Covering the period 1 February 2024 to 31 January 2025, this report includes the Moomba CCS project activities and milestones required in accordance with the Moomba CCS project – Strzelecki and Marabooka Toolachee monitoring and verification plan (Santos, 2024) (M&V plan), as follows:

- Summary of major project activities and milestones;
- Summary of any incident reports;
- Summary and interpretation of M&V activities;
- Comparison of performance against M&V KPIs;
- CO2 injection rate and storage inventory; and
- Update of containment risk assessment.

The Moomba CCS project completed construction in 2024 and commenced commissioning and project startup in September 2024. The first CO2 was captured for the purpose of permanent storage on 27 September 2024 and the captured CO2 was first injected into the wells and reservoir for permanent storage on 30 September 2024.

Early well injection and reservoir injection performance are consistent with pre-project forecasts. Baseline, operational monitoring and environmental assurance monitoring activities have been completed in line with the M&V plan schedule.

This report demonstrates that M&V plan KPIs have been met, the storage complex is behaving as expected at this early stage of the project, and injected CO2 is fully contained within the target storage reservoir. Containment risks have not changed with the new project data.

The M&V plan has been reviewed by an independent third-party expert who concluded it remains fit for purpose and there will be no revision to the plan.

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All operational activity has been conducted using the standards, systems and procedures in alignment with all other Santos operated activities in the Cooper Basin. For further detail regarding Santos' standards, systems and procedures, refer to the Santos 2024 Sustainability Report and Corporate Governance Statement found in the Santos Limited 2024 Annual Report here.

2. Licence Summary

2.1. Licencees

Gas Storage Licences 1, 2, 3 and 4 were granted on 17 February 2022, with interests in the titles now defined as 66.6% and 33.4% shown in Table 1.

Historically, the Licences were held by the South Australian Cooper Basin Joint Venture (SACB JV). A Deed of Assignment and Assumption dated 23 May 2023 between Alliance Petroleum Australia Pty Ltd, Basin Oil Pty Ltd, Bridge Oil Developments Pty Limited, Reef Oil Pty Ltd, Santos (BOL) Pty Ltd, Santos (NARNL Cooper) Pty Lt, Santos Petroleum Pty Ltd, Vamgas Pty Ltd, Beach Energy (Operations) Limited, Delhi Petroleum Pty Ltd, Santos Limited and Beach Energy Limited was entered on the public register on 16 June 2023, that assigned Santos 66.6% interest and Beach 33.4% in GSLs 1 - 4 and AAL 298.

Table 1 Current title holders: GSL 1 - 4, AAL 298

Company Name	Percentage Interest (%)	ACN
Santos Limited	66.6 %	007 550 923
Beach Energy Limited	33.4 %	007 617 969

2.2. Location

The Group GSLs are located in the Cooper/Eromanga Basin, South Australia and cover approximately 556.6km^2 (Figure 1). The Moomba CCS project Storage Complex area is shown in blue on the map.

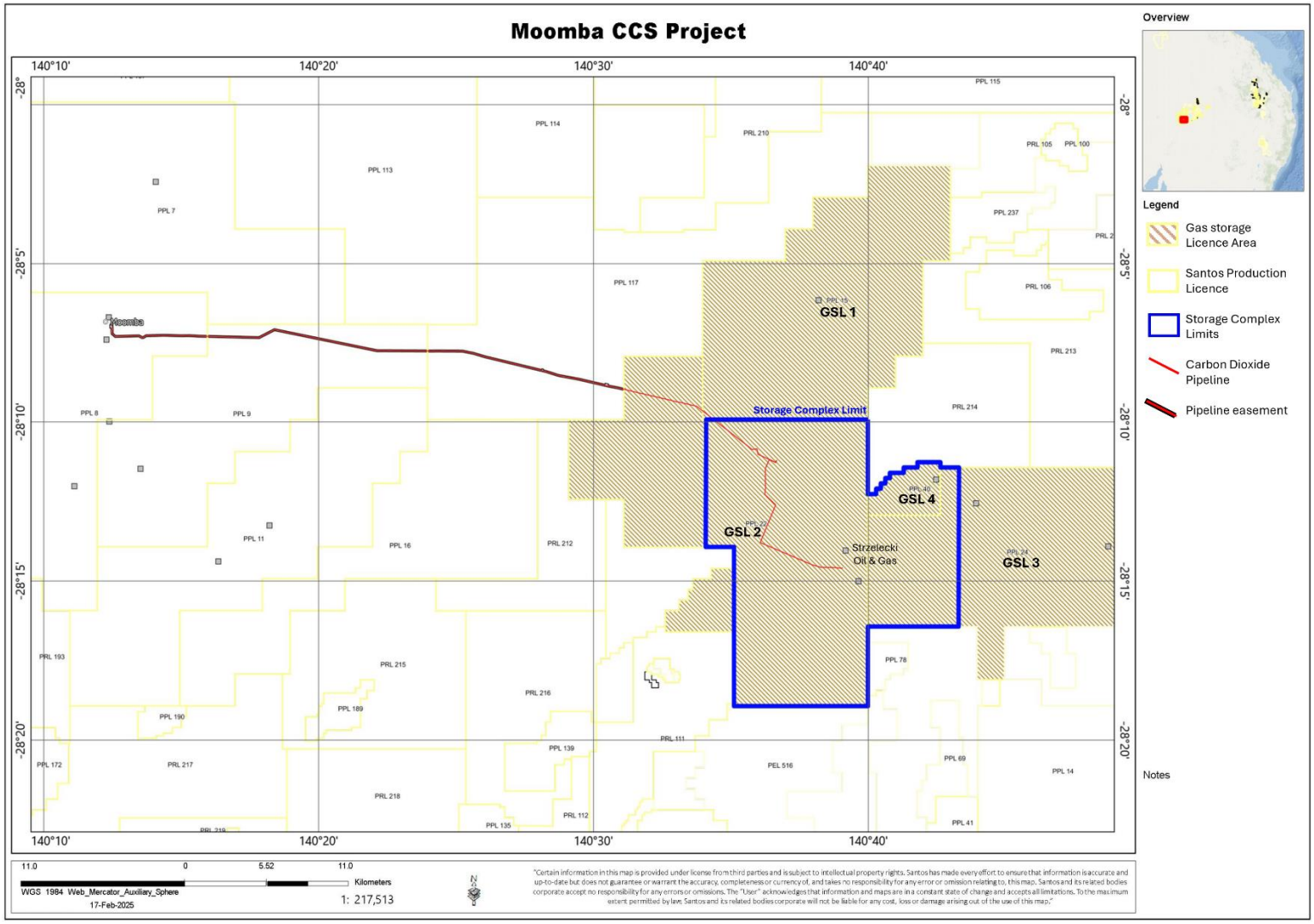

Figure 1 Location of group GSLs

3. Regulated Activities

During the reporting period, the regulated activities conducted included:

- Ongoing project appraisal and definition;
- Baseline data captured for the M&V plan;
- Seismic monitoring and calibrations;
- Well drilled and completed;
- Cased hole activities associated with the M&V plan including well integrity;
- Pipeline construction activities;
- Construction of the CCS compression facility;
- Commissioning and startup of the facilities and first injection of CO2 into the storage reservoir; and
- Monitoring of CO2 injection and reservoir surveillance activities in accordance with the M&V plan.

3.1. Geological and Geophysical Studies

Geological and geophysical desktop studies were undertaken to review and integrate data acquired in the recently drilled injector wells, including Strzelecki 37 drilled during the reporting period.

3.2. Geochemical, Gravity, Magnetic and Other Surveys

No geochemical, gravity, magnetic or other surveys were undertaken during the reporting period 1 February 2024 to 31 January 2025. Prior to the reporting period, baseline analysis of ground displacement over the storage complex was completed (March 2023), incorporating radar satellite imagery acquired between December 2016 and October 2022.

3.3. Seismic Monitoring

During the reporting period, the seismic monitoring stations and analysis parameters were updated and calibrated. This involved the following activities:

- Software updates to sensors to improve functionality and reporting;
- Maintenance of the sensors, including resolution of a communication issue at MBA-3 station;
- Installing USB data backup at each site to mitigate communications outages;
- Testing and re-assessing thresholds for triggering;
- Assessing the sensitivity of the array to re-affirm chosen parameters;
- Ongoing seismic monitoring pre- and post-injection;
- Confirming the array can detect the same earthquake events as registered by Geoscience Australia's passive seismic array;
- Monitoring a perforation event at Strzelecki 37 to confirm detection and geolocation; and
- Assessing seismicity throughout the period and especially from injection start.

3.4. Drilling and Related Activities

Ongoing operation and maintenance of wells and associated infrastructure occurred during the period. Strzelecki 37 as a new injector well was drilled and completed during the period.

Table 2 Wells drilled and completed during the reporting period

Permit	Well Name	Type	Rig	Date Spudded	Rig Release Date	Status at Rig release
GSL 2	Strzelecki 37	Storage Well Gas Injector	SLR 183	20 July 2024	31 July 2024	Gas Injector

3.5. Well Completion, Workover, Suspension and Abandonment

During the reporting period, several workover and cased hole activities were undertaken in GSL 2 as part of the Moomba CCS project. These activities are listed in Table 3 and Table 4.

Table 3 Well completions and workovers within GSL 2

Permit	Well Name	End Date	Details
GSL 2	Strzelecki 37	14 August 2024	Rig – Injector Original Completion

Table 4 Cased hole wireline activities within GSL 2 & 3

Permit	Well Name	Date	Details
GSL 2	Marabooka 19	24 June 2024	S-line - Drift / Gyro Survey
GSL 2	Marabooka 4	9 September 2024	S-line - Drift / Static Gradient Survey
GSL 2	Marabooka 4	22 September 2024	E-line - RPM-C - PLT Logging
GSL 2	Strzelecki 10	24 August 2024	S-line - Drift
GSL 2	Strzelecki 10	17 September 2024	E-line - Drift & RPM-C Logging
GSL 2	Strzelecki 10	19 September 2024	E-line - EmDEX & MIT Logging
GSL 2	Strzelecki 10	22 September 2024	S-line - Set PPS Memory gauges on XN Lock mandrel Gauge Hanger
GSL 2	Strzelecki 10	14 December 2024	S-line - Pull PPS Gauges-XN gauge hanger
GSL 2	Strzelecki 15	28 February 2024	S-line - Plug Set [Inconel plug]
GSL 2	Strzelecki 15	12 March 2024	S-line - Plug Set [Inconel plug] - Revisit
GSL 2	Strzelecki 33	19 July 2024	S-line - Drift/SGS
GSL 2	Strzelecki 33	20 July 2024	E-line - RPM/ PLT Logging
GSL 2	Strzelecki 33	29 July 2024	E-line - MVRT Logging
GSL 2	Strzelecki 33	14 September 2024	E-line - RPM -PLT Logging [Revisit]
GSL 2	Strzelecki 35	20 June 2024	S-line - Drift / Gyro Survey
GSL 2	Strzelecki 36	22 June 2024	S-line - Drift / Gyro Survey

Permit	Well Name	Date	Details
GSL 2	Strzelecki 37	22 July 2024	E-line - OH Logging
GSL 2	Strzelecki 37	4 August 2024	E-line - CBL
GSL 2	Strzelecki 37	6 August 2024	S-line - Drift / Gyro
GSL 2	Strzelecki 37	11 August 2024	E-line - GRCCL Correlation Log
GSL 2	Strzelecki 37	12 August 2024	S-line - 2.813" Selective Test Tool / Set Packer
GSL 2	Strzelecki Northeast 1	21 July 2024	S-line - Drift & Broach / Static Gradient
GSL 2	Strzelecki Northeast 1	30 October 2024	S-line – Drift
GSL 2	Nanima 1	13 September 2024	S-line - Pull PX Plug
GSL 2	Nanima 1	21 September 2024	S-line - Pull PX Plug [Revisit HD Unit]
GSL 2	Nanima 1	23 September 2024	S-line - Pull PX Plug [Revisit HD Unit]
GSL 2	Nanima 1	24 September 2024	S-line - Bailing Ops
GSL 2	Nanima 1	15 October 2024	S-line - Post Fishing Static Gradient Survey
GSL 2	Wanara 1	16 September 2024	S-line - Set PPS Memory gauges on XN Lock mandrel Gauge Hanger
GSL 2	Wanara 1	15 December 2024	S-line - Pull PPS gauges & Gauge Hanger
GSL 3	Marana 2	20 July 2024	S-line – Drift
GSL 3	Marana 2	20 September 2024	E-line - RPM-C-PLT Logging

Well integrity monitoring and maintenance activities completed during the reporting period are set out in Table 5 for all non-P&A wells within the storage complex. As per CCS well integrity review document, all wells within the GSL 2 and 3 which have been drilled through the Toolachee Formation are planned to be monitored with surveillance and maintenance activities. As exceptions, wells that are plugged and abandoned are exempt from monitoring and maintenance. Strzelecki 12, which is a Hutton monitoring well, is not drilled to the Toolachee Formation but is added to this monitoring schedule.

Table 5 Monitoring and maintenance activities within GSL 2 & 3

Well Name	Date Completed	Details
Strzelecki 22	21 December 2024	Pressure Survey
Strzelecki 27	21 December 2024	Pressure Survey
Strzelecki 12	19 December 2024	Pressure Survey
Strzelecki 13	19 December 2024	Pressure Survey
Strzelecki 19	19 December 2024	Pressure Survey
Strzelecki 20	19 December 2024	Pressure Survey
Strzelecki 9	19 December 2024	Pressure Survey
Strzelecki 28	19 December 2024	Pressure Survey
Strzelecki 6	19 December 2024	Pressure Survey
Strzelecki 7	19 December 2024	Pressure Survey
Strzelecki 21	19 December 2024	Pressure Survey
Marabooka 2	19 December 2024	Pressure Survey

Well Name	Date Completed	Details
Marabooka 4	19 December 2024	Pressure Survey
Marabooka 6	19 December 2024	Pressure Survey
Marana 1	8 November 2024	Pressure Survey
Marabooka 19	19 October 2024	Pressure Survey
Marabooka 8	19 October 2024	Pressure Survey
Marabooka 3	19 October 2024	Pressure Survey
Wanara 1	17 October 2024	Pressure Survey
Strzelecki 15	17 October 2024	Pressure Survey
Strzelecki 17	17 October 2024	Pressure Survey
Strzelecki 3	16 October 2024	Pressure Survey
Strzelecki 5	16 October 2024	Pressure Survey
Strzelecki 23	16 October 2024	Pressure Survey
Strzelecki 36	10 October 2024	Pressure Survey
Strzelecki Northeast 1	10 October 2024	Pressure Survey
Strzelecki 1	10 October 2024	Pressure Survey
Strzelecki 10	10 October 2024	Pressure Survey
Strzelecki 14DW1	10 October 2024	Pressure Survey
Marana 2	10 October 2024	Pressure Survey
Nanima 1	10 October 2024	Pressure Survey
Nanima 2	10 October 2024	Pressure Survey
Strzelecki 24	10 October 2024	Pressure Survey
Strzelecki 33	10 October 2024	Pressure Survey
Strzelecki 34	10 October 2024	Pressure Survey
Strzelecki 35	10 October 2024	Pressure Survey
Strzelecki 15	19 December 2024	Well Integrity Check
Marabooka 6	19 December 2024	Well Integrity Check
Marabooka 4	18 December 2024	Well Integrity Check
Strzelecki 25	16 December 2024	Well Integrity Check
Strzelecki 33	16 December 2024	Well Integrity Check
Strzelecki Northeast 1	15 December 2024	Well Integrity Check
Strzelecki 3	15 December 2024	Well Integrity Check
Strzelecki 32	14 December 2024	Well Integrity Check
Strzelecki 37	24 October 2024	Well Integrity Check
Marabooka 19	24 October 2024	Well Integrity Check
Strzelecki 36	22 October 2024	Well Integrity Check
Strzelecki 37	22 October 2024	Well Integrity Check
Strzelecki 34	20 October 2024	Well Integrity Check
Strzelecki 35	20 October 2024	Well Integrity Check

3.6. Seismic Data Acquisition, Processing and Reprocessing

No seismic data acquisition, processing or reprocessing was undertaken during the reporting period 12 months ending 31 January 2025. Refer to section 3.3 for seismic monitoring.

3.7. Pipeline Construction and Operation

During the reporting period, the 'Moomba to Cross Border CO2 Pipeline' was constructed. This construction was in line with planned operations in Q3 2024. The pipeline connects to the injection wells. No other pipelines were constructed.

3.8. Moomba CCS Compression Facility

During the current reporting period construction of the Moomba CCS Compression Facility progressed significantly and was completed in Q3 2024. This involved the following major activities:

- Gas Generator installation;
- Mechanical completion pipeline;
- HV energisation into CCS main switch board from new power generation;
- Mechanical completion CCS facility;
- Ready For Start Up completed;
- Facility pressurisation with CO2;
- Compressor start up commissioning;
- Wet CO2 introduced into CCS from the Moomba CO2 trains and forward flow into export pipeline;
- Various other operational and commissioning activities; and
- Operations acceptance.

3.9. Civil Works

During the reporting period to 31 January 2025, within GSL 1 – 4 the Strzelecki 37 Injector Lease pad was constructed. Additionally, backfill activities for Marabooka 19, Strzelecki 34, Strzelecki 35 and Strzelecki 36 were also completed.

4. Injection Well Performance

4.1. Injection Data Reporting

The Moomba CCS project captured the first CO2 for the purpose of permanent storage on 27 September 2024 with the measurement of first CO2 across the facilities transfer meter ("capture point") and into the pipeline for transportation to the injection site on that date. The captured CO2 was first injected into the wells and reservoir for permanent storage on 30 September 2024.

The monthly injected CO2 volumes for the Moomba CCS project are totalled below in Table 6 and Table 7. Variations in totals are due to project commissioning, startup and operational and facilities optimisation.

Table 6 Mass of total injected CO2 stream (thousand tonnes)

Month	Marabooka 19	Strzelecki 34	Strzelecki 35	Strzelecki 36	Strzelecki 37	Total
Sept 2024	0.0	0.0	0.0	0.7	0.0	0.7
Oct 2024	29.0	16.7	23.8	15.1	11.4	96.0
Nov 2024	29.1	23.7	17.2	16.9	16.4	103.3
Dec 2024	34.5	25.5	18.3	18.0	20.2	116.5
Jan 2025	44.4	15.0	22.4	20.5	23.1	125.3

Table 7 Volume of total injected CO2 stream (mmscf)

Month	Marabooka 19	Strzelecki 34	Strzelecki 35	Strzelecki 36	Strzelecki 37	Total
Sept 2024	0.0	0.0	0.0	12.4	0.0	12.4
Oct 2024	549.5	316.8	451.2	286.6	216.1	1820.3
Nov 2024	553.7	452.5	328.6	321.7	311.9	1968.4
Dec 2024	657.7	486.1	348.2	343.7	384.4	2219.9
Jan 2025	845.7	285.0	426.3	389.9	440.4	2387.4

Monthly injection stream composition data is set out in Table 8 below. The Moomba CCS facilities have delivered a high-quality CO2 stream with all components meeting the compositional operating envelope requirements of the M&V plan.

Table 8 CO2 injection stream composition (monthly average mole%)

Month	CO2	CH4	C2 to N2 *	H2S	H2O
Sept 2024	98.45	0.70	0.85	<0.007	<0.014
Oct 2024	99.03	0.77	0.20	<0.007	<0.014
Nov 2024	99.22	0.72	0.06	<0.007	<0.014
Dec 2024	99.19	0.71	0.10	<0.007	<0.014
Jan 2025	99.23	0.68	0.09	<0.007	<0.014

*(C2 to N2) = C2, C3, C4+ and N2

4.2. Well Injectivity

The Moomba CCS project commenced injection into the wells and reservoir at low rates on 30 September 2024, then ramped up quickly in early October 2024 to project nameplate capacity of 84 mmscf/d (1.7 million tonnes per annum of CO2-equivalent) and has been consistently injecting at stabilised rates since that date, limited only by CO2 availability. Figure 2 compares CO2 injection rate vs available CO2 since injection start up. The green line in this figure 'well injectivity' represents the estimated maximum total project injection rate potential of all five wells. Well injectivity increased in the early stages of the project as injected CO2 displaced formation fluids and

improved the relative permeability of the reservoir in the near-wellbore region. Injectivity is currently higher than actual injection rate due to the low pressure of the depleted storage reservoir but will slowly decrease over the coming months and years as reservoir pressure increases in line with reservoir model forecasts.

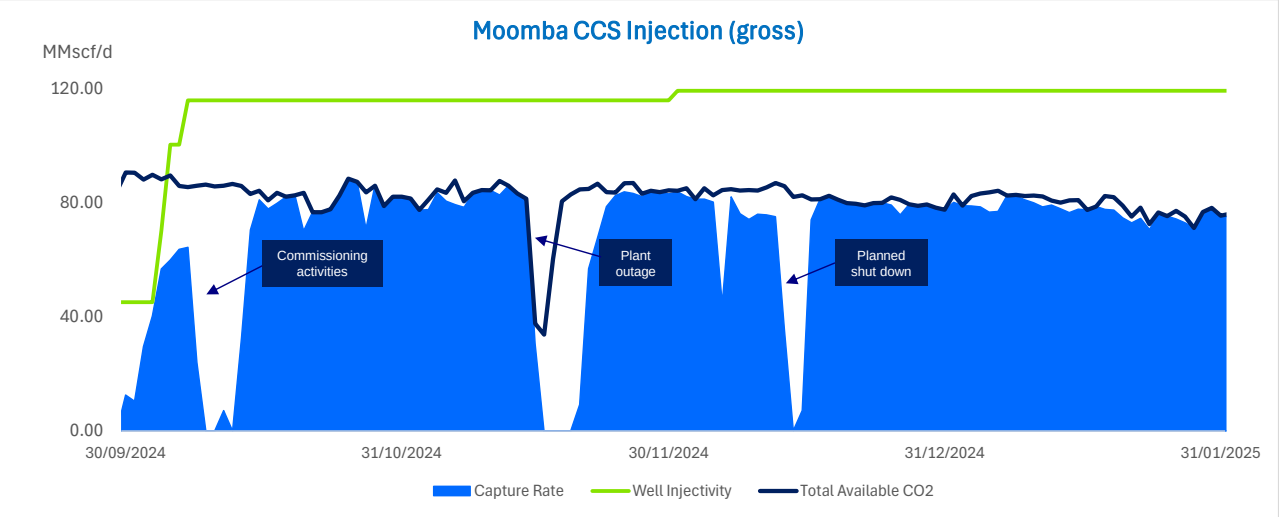

Figure 2 Moomba CCS injection performance vs well injectivity and available CO2

The following figures show well performance for each injection well, including injection rate, bottomhole pressure (BHP), tubing head pressure (THP) as well as operating envelope for BHP and THP constraints. The data are presented on a daily average basis since start of injection until the end of January 2025. Well injection rates were varied during the project commissioning, startup and initial injection phases in response to well and reservoir injectivity, but in the later part of the reporting period changes in well injection rates are related to surface facilities optimisation and pipeline operational considerations, not well injection constraints.

The bottomhole pressure constraint for the wells is calculated from a pressure gradient of 0.54 psi/ft at the top of the perforation depth and is based on a Geomechanics study as outlined in the M&V plan. The THP constraint for all wells is a constant value of 2,120 psi (also set out in the M&V plan).

Figure 3 shows injection performance in Strzelecki 34. The current average BHP and THP are approximately 1,600 psi and 1,400 psi respectively, within the BHP and THP constraints. The well injection rate has peaked to 20 mmscf/d but is currently injecting at approximately 6 mmscf/d due to operational considerations unrelated to well or reservoir injectivity.

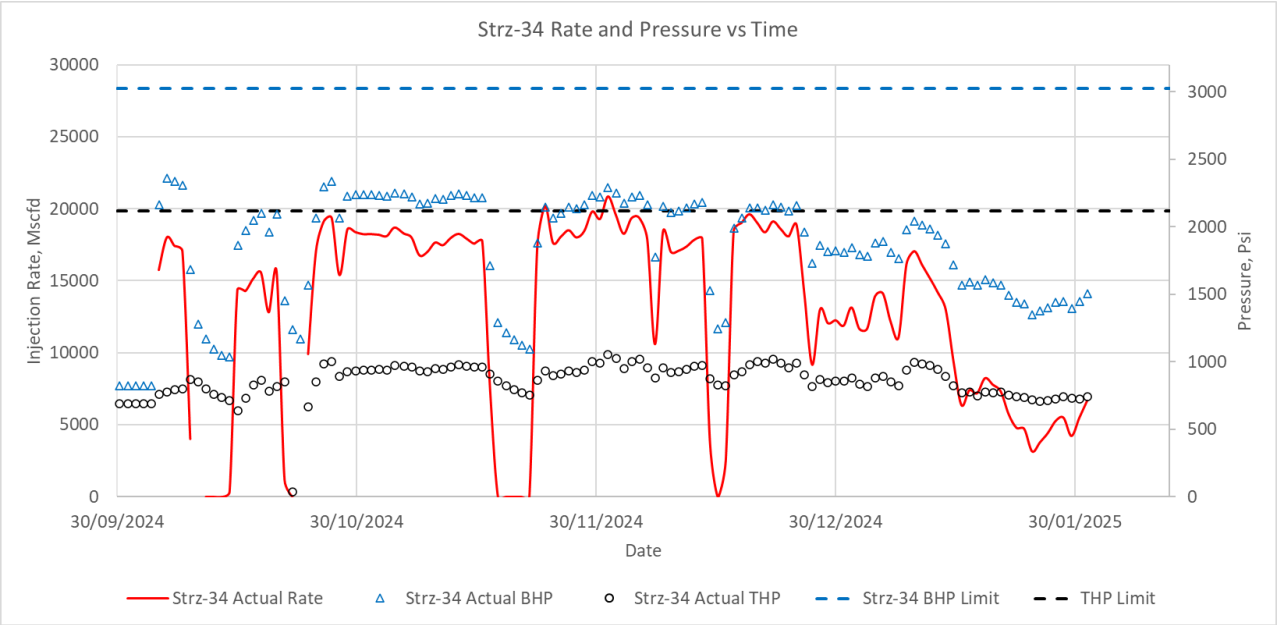

Figure 3 Strzelecki 34 injection performance chart

Figure 4 outlines the injection performance for Strzelecki 35 which is the best injection well in Strzelecki in terms of injectivity. The peak injection rate in this well was approximately 28 mmscf/d in October with minimal change in bottomhole pressure. The well is currently injecting at a reduced rate of approximately 15 mmscf/d, with rate being managed to assist operational system optimisation. As can be seen in the data, the BHP in this well is not as sensitive as other Strzelecki wells to injection rate which is an indication of the good quality reservoir encountered by the well. The current BHP and THP are around 600 and 900 psi respectively less than the constraints of the well. Based on BHP observations, it is interpreted that one of the sands in Strzelecki 35 is at higher pressure than other injector wells. This will be investigated further as part of the new reservoir modelling workflow.

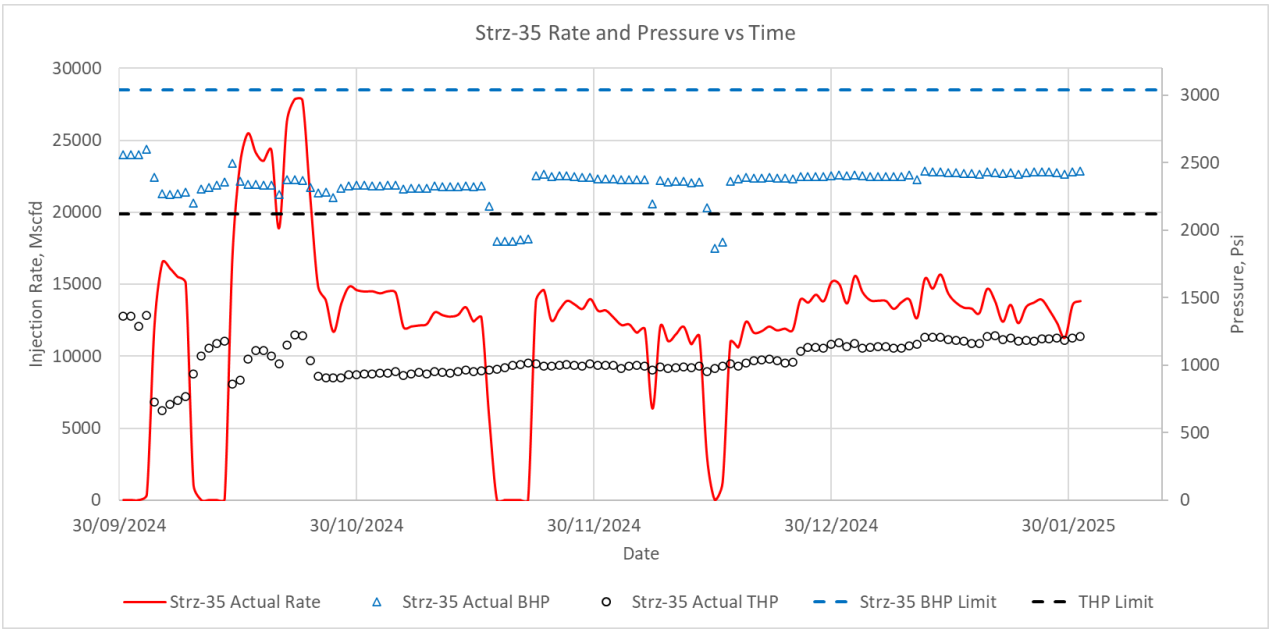

Figure 4 Strzelecki 35 injection performance chart

Figure 5 shows injection performance in Strzelecki 36. This well is the poorest injector amongst the five wells. The maximum injection rate experienced in this well was approximately 14 mmscf/d and the current rate is also approximately 14 mmscf/d. The BHP operational constraint in Strzelecki 36 is set to 3,100 psi with current BHP being around 2,700 psi. The current THP is around 800 psi lower than THP constraint in the well.

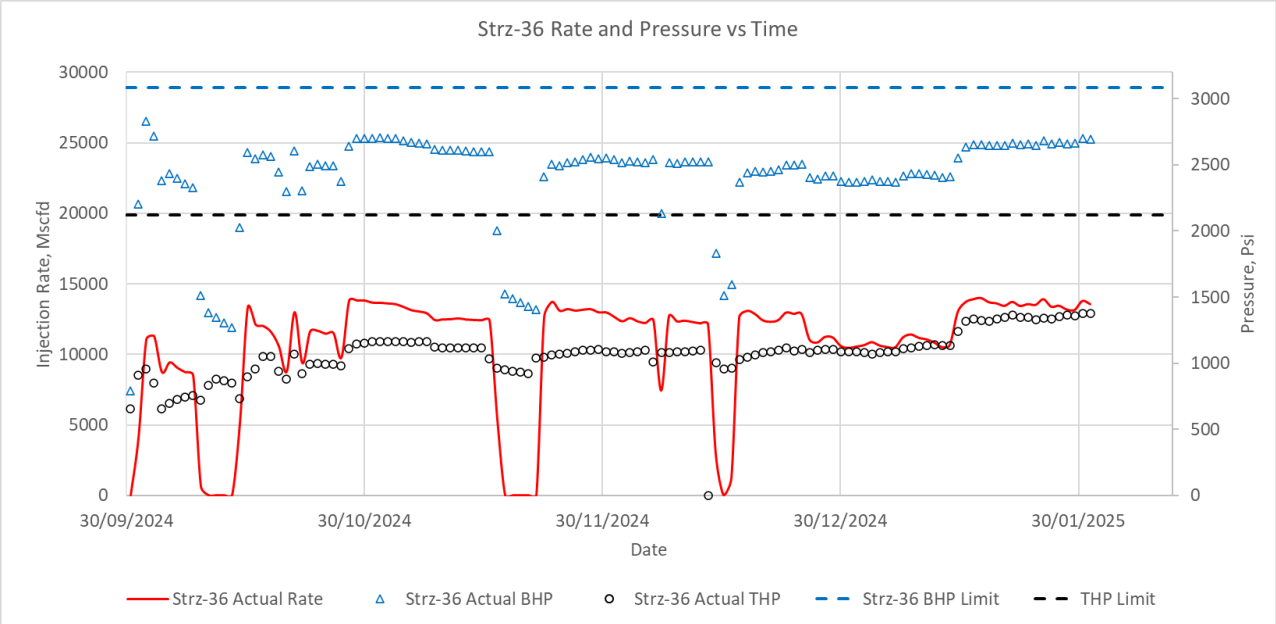

Figure 5 Strzelecki 36 injection performance chart

Strzelecki 37 shows a more improved performance than Strzelecki 36 with a peak injection rate of 16 mmscf/d (Figure 6). The current BHP is around 700 psi lower than maximum allowed BHP in this well and the current THP is around 900 psi lower than 2,120 psi limit. There is an unperforated interval in Strzelecki 37 (Toolachee Lower) that can be added later in the life of the well to improve the injectivity when reservoir pressure has increased.

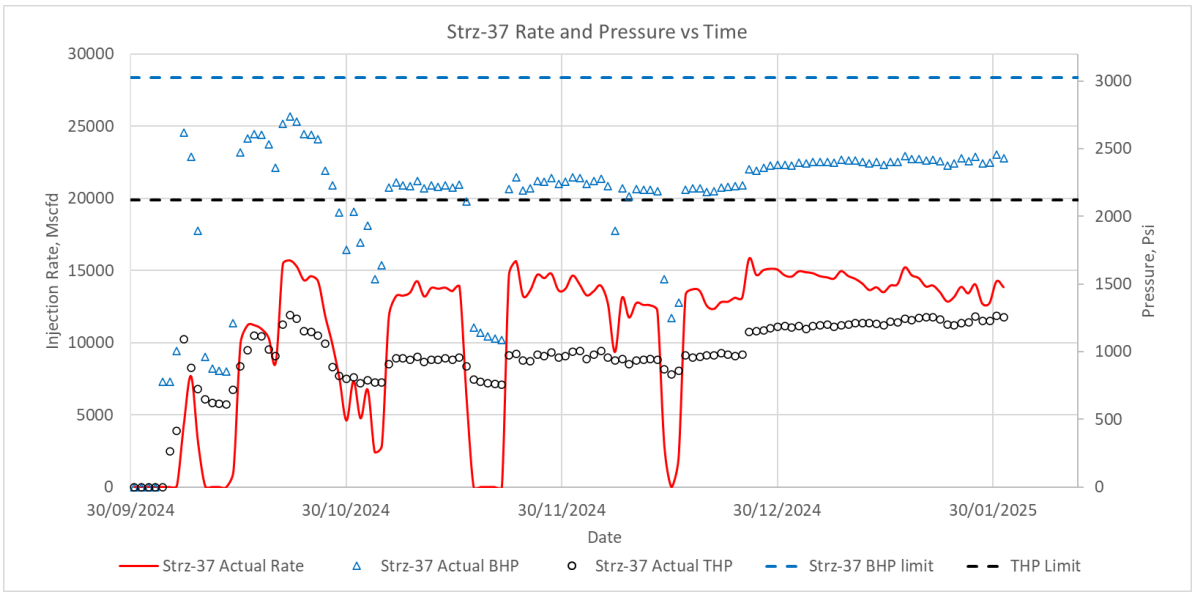

Figure 6 Strzelecki 37 injection performance chart

Marabooka 19 is the best injector amongst the five wells. The well's peak injection rate has been managed to a maximum of approximately 30 mmscf/d due to tubing velocity constraints, although the well is capable of higher rate. The current BHP and THP are at 1,700 and 1,200 psi respectively which are around 1,400 and 900 psi lower than corresponding limits. Marabooka 19 injection performance is shown in Figure 7.

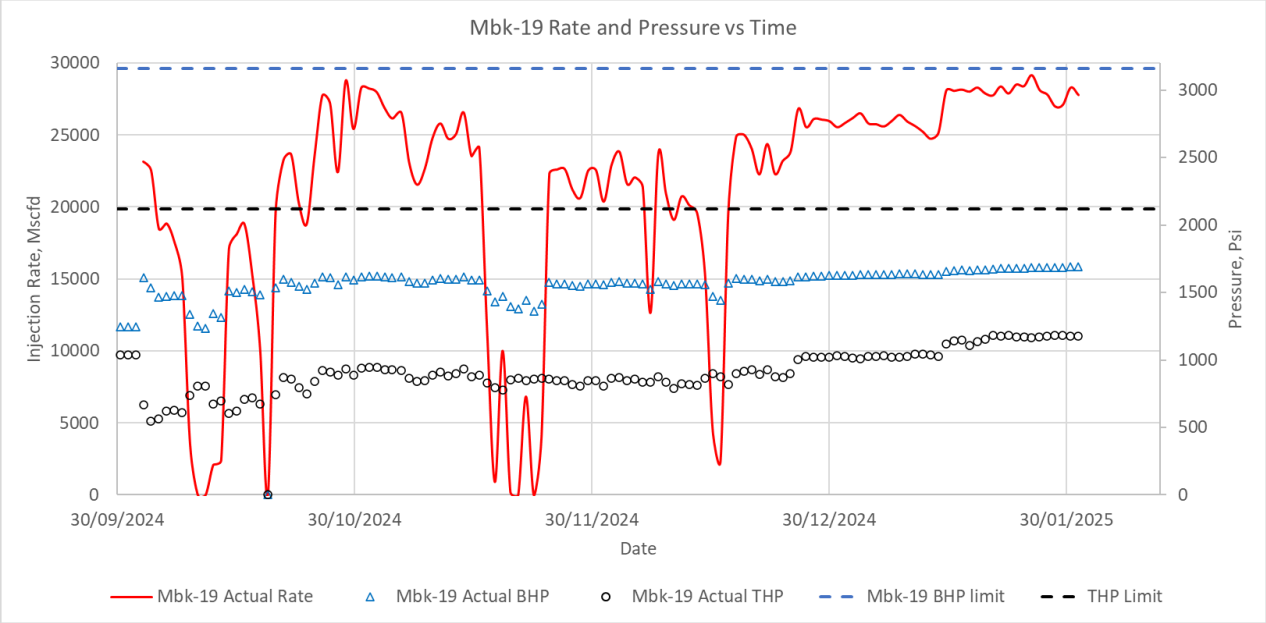

Figure 7 Marabooka 19 injection performance chart

Average monthly injectivity performance for all injector wells is shown in Figure 8 (injectivity index). Marabooka 19 displays the best injectivity out of the five wells which is consistent with expectations given the high reservoir quality intersected by the well. This is followed by Strzelecki 35 and Strzelecki 34 as the next best injectors, with Strzelecki 36 and Strzelecki 37 having the lowest injectivity at project startup, but still in line with project expectations.

The small decline in injectivity observed for some of the wells in Figure 8 is due to a modest uplift in reservoir pressure around these wells, as expected from the volume of CO2 injected to date.

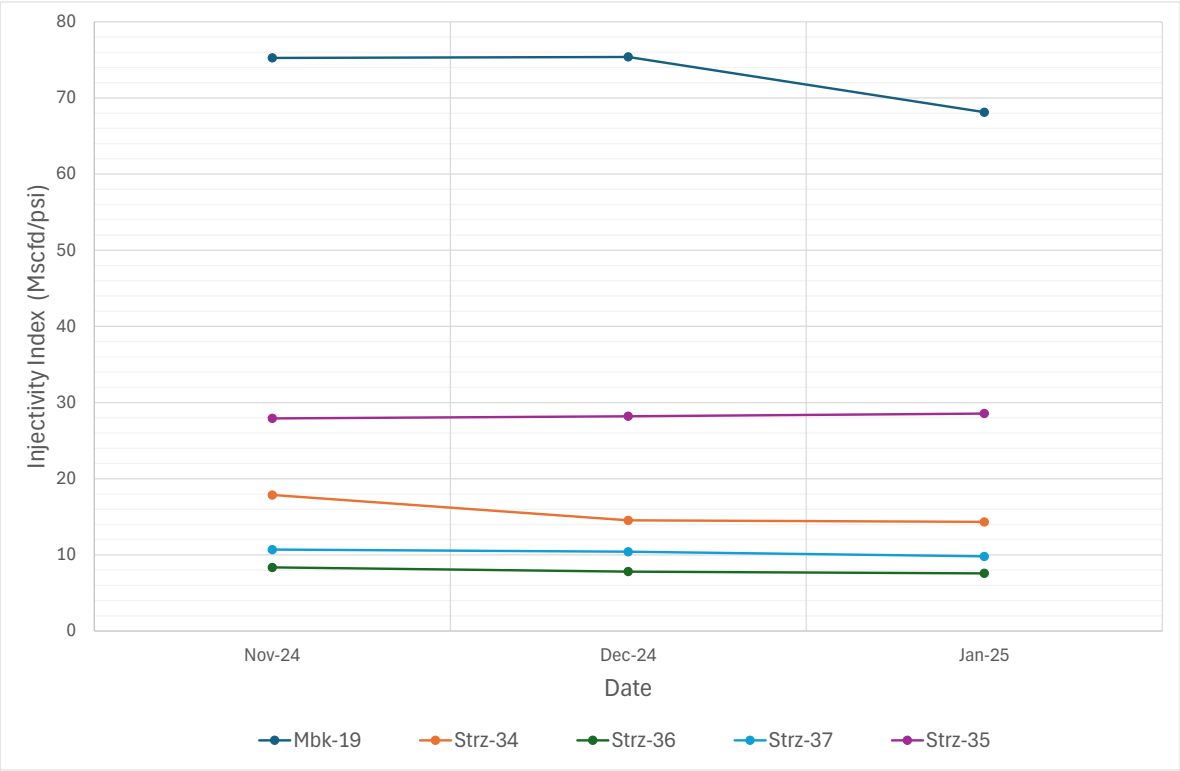

Figure 8 Injectivity performance per well

4.3. Well Temperature

Surface and bottomhole temperatures for all five injectors are shown in Figure 9 and Figure 10 respectively for the duration of the reporting period. The surface temperature measure point is on the lease skid, upstream of the choke and is marked as 'inlet temperature' on Figure 9. Based on continuous measurements on site, wellhead temperature is between 5 to 10°C lower than inlet temperature as a function of rate and wellhead pressure. Wellhead temperature data are well within the minimum and maximum constraint range specified in the M&V plan (-29 and 65°C respectively).

Marabooka 19 inlet temperature (Figure 9) is higher than other injection wells since the well is located closer to the Moomba CCS Compression Facility. The CO2 experiences a small temperature drop as it travels between Marabooka 19 and the Strzelecki wells.

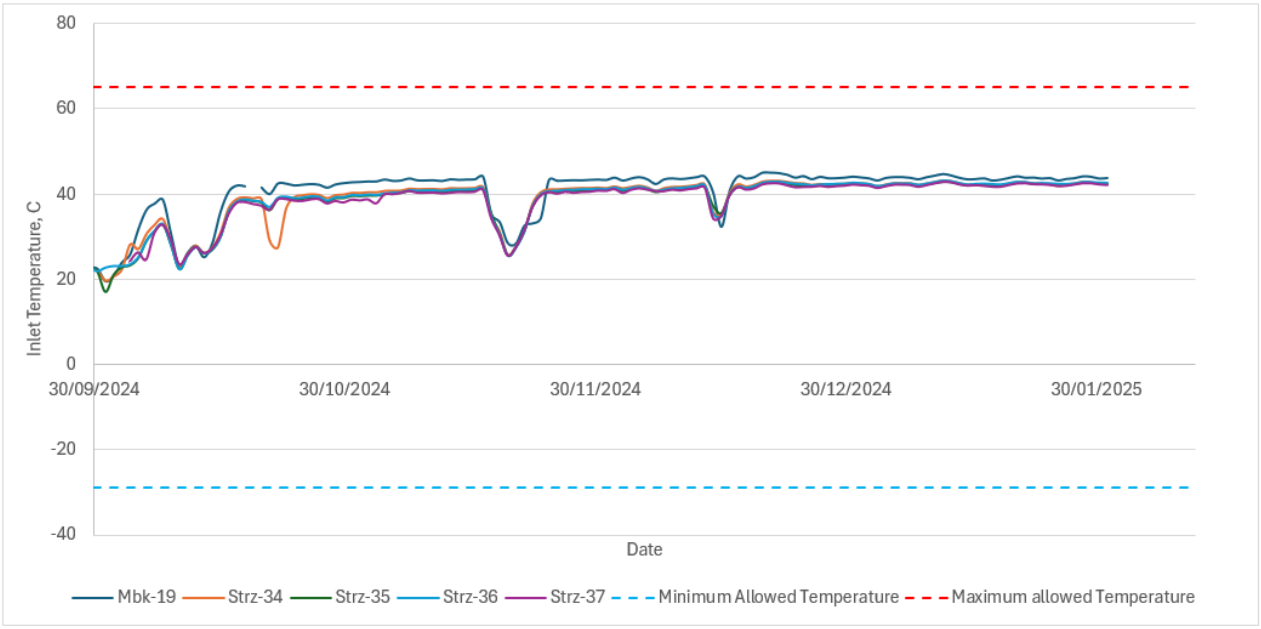

Figure 9 Surface temperature in all injection wells

Permanent downhole gauges installed in each injector well are continuously measuring bottomhole temperature and these data are shown in Figure 10. As can be seen in the plot, the temperature per well data are well above the minimum bottomhole temperature specified in the M&V plan (0°C). Marabooka 19 has the lowest bottomhole temperature among all injectors which is due to its higher injection rate than the other wells.

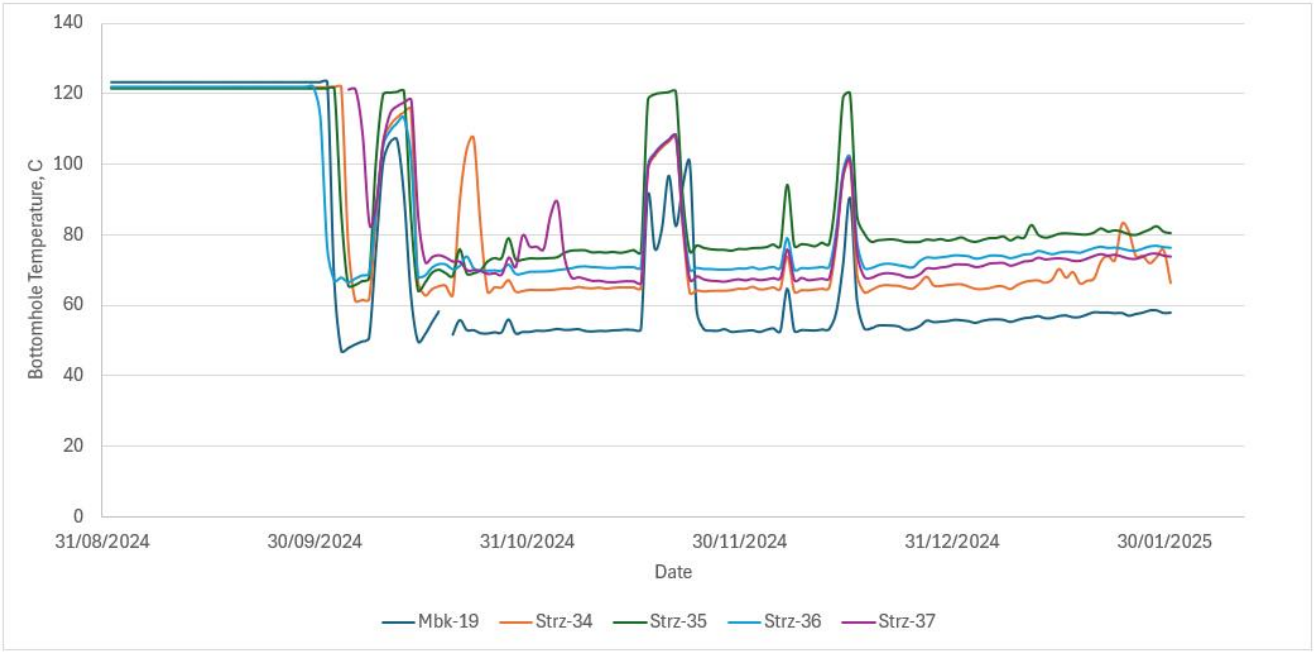

Figure 10 Bottomhole temperature in all injection wells

4.4. Modelling Update

Overall, well injection performance is within the range of reservoir model predictions and monitoring well pressure responses to injected CO2 are consistent with expectations at this early stage of the project.

A fully integrated reservoir model workflow was completed for Strzelecki and Marabooka fields to support a suitable field development plan for the Moomba CCS project. The workflow included static and dynamic modelling phases and was matched to the extensive production and pressure history of both fields. The history match was good with minimal modifications, giving confidence in the predictions of the model.

Since that time there have been five new injector wells drilled and extensive data acquired including open hole logs, sand-by-sand formation pressure data (FMT), image logs, nitrogen injectivity tests, and production logging during nitrogen injection (PLT).

Furthermore, actual CO2 injection and monitoring well data is now available, as set out in this report, and with these new data there is an opportunity to update and improve the reservoir model to better match:

- New well log data;
- Individual sand-by-sand pressure data;
- Gas water contact movement;
- Well injectivity; and
- Monitoring well pressure data.

A comprehensive new static and dynamic workflow has commenced (as per M&V plan requirements) to update the reservoir model using the recently acquired data. The modelling is expected to be finalised during 2025.

5. Compliance Summary

5.1. Incidents

There were no loss of containment incidents during the reporting period. The storage complex is behaving as expected and injected CO2 is fully contained within the target storage reservoir.

In the unlikely event that an incident occurs, all reporting would be completed in accordance with the relevant regulatory requirements, including the *Energy Resources Act 2000* and associated *Energy Resources Regulations 2013*.

5.2. M&V Operational Monitoring and Performance KPIs

As required by the M&V plan, an Annual Report must contain:

"Comparison of performance against M&V KPIs; CO2 injection rate and storage inventory; Summary and interpretation of M&V activities"

Operational monitoring is required to quantify volume of CO2 stored in the subsurface, verify location of CO2 within the target storage reservoir and inform ongoing storage reservoir modelling.

Operational monitoring comprises the following elements:

- Injection telemetry – gathering surface flow, pressure and temperature data during CO2 injection;
- Reservoir surveillance – gathering subsurface reservoir data and conducting modelling to monitor the movement of the CO2 and confirm location of CO2 within the storage complex; and
- Well integrity – inspection of surface equipment and gathering downhole data to monitor the integrity of wells which intersect the storage complex.

All operational monitoring activities have been completed during the reporting period, in line with the M&V plan schedule.

5.2.1. M&V Performance Targets

Key performance indicators (KPIs) are defined in the M&V plan. The KPIs have been selected to clearly focus on the most important aspects of M&V plan performance (Table 9).

All KPIs have been satisfied, and containment thresholds remain at 'green' levels for the reporting period.

Table 9 Key performance indicators for the M&V plan

KPI number	KPI name	Definition	Compliance
1	Measurement accuracy	The maximum uncertainty in total flow rate measurement is not greater than ±1.5%.	Satisfied
2	Operating envelope	Operate within the composition limits (section 1.2 of M&V plan) and injection condition limits (section 9.1 of M&V plan) at least 99% of the time.	Satisfied
3	Vertical containment	CO2 stays contained within the target Toolachee injection reservoir. Containment threshold remains at 'green' level, as defined in section 3.5 of M&V plan.	Green
4	Lateral containment	CO2 stays contained within the target Toolachee injection reservoir. Containment threshold remains at 'green' level, as defined in section 3.5 of M&V plan.	Green
5	Monitoring activity schedule	Monitoring and verification activities will be at least 90% compliant with the planned activity schedule, as defined in section 5.4 of M&V plan	Satisfied

Measurement accuracy has satisfied the requirements of the M&V plan and KPI number 1 has been met. Santos has demonstrated in section 5.2.3 of this report that Coriolis meters are calibrated and verified to show a high level of accuracy and the continuous gas analyser is operating within the prescribed limits.

The project has been operating within the required operating envelope and KPI number 2 has been met. Refer section 4 outlining injection wells flowrate, pressure and temperature, and measured CO2 stream composition.

Vertical containment is confirmed, the threshold remains at 'green' level and KPI number 3 has been met, as evidenced by the Hutton Sandstone pressure measurement at Strzelecki 12 (section 5.3.2).

Lateral containment is confirmed, the threshold remains at 'green' level and KPI number 4 has been met. Pressure observations seen at monitoring wells are in line with expectation and the reservoir model (section 5.2). The CO2 plume lateral extent is likely to be proximal to the injection wells at this early stage of the project.

KPI number 5 has been met. Monitoring activities have been completed in compliance with M&V plan requirements and are summarised in Table 10.

5.2.2. Operational Monitoring

A summary of operational monitoring activities is set out in Table 10. As can be seen in the table, the project has met the operational requirements of the M&V plan; all downhole gauges are installed and fully functioning, all baseline logging, pressure acquisition and other activities are complete and the data is of good quality, and well integrity status shows a high level of compliance well above the 90% requirement. These activities are further analysed in detail in the following sections.

Corrosion logs on key indicator wells are acquired to be used for future comparison. CBL data that is currently available on key indicator wells deemed acceptable to be used for comparison with future repeat logs.

Table 10 Schedule of monitoring activities

No.	Location	Type	Activity	Zone	Status of Baseline Activity
1	Marabooka 19	I	Downhole P/T gauge	TO	Installed
			Injection telemetry	TO	Installed
2	Strzelecki 34	I	Downhole P/T gauge	TO	Installed
			Injection telemetry	TO	Installed
3	Strzelecki 35	I	Downhole P/T gauge	TO	Installed
			Injection telemetry	TO	Installed
4	Strzelecki 36	I	Downhole P/T gauge	TO	Installed
			Injection telemetry	TO	Installed
5	Strzelecki 37	I	Downhole P/T gauge	TO	Installed
			Injection telemetry	TO	Installed
6	Marabooka 4	O	SGS	TO	Acquired
7	Marabooka 5	O	Downhole hole P/T gauge	TO	Installed
			PNL	TO	Acquired
8	Strzelecki 10	O	SGS	TO	Acquired
			PNL	TO	Acquired
9	Strzelecki 24	O	Downhole P/T gauge	TO	Installed
10	Strzelecki 33	O	PNL	TO	Acquired

No.	Location	Type	Activity	Zone	Status of Baseline Activity
11	Strzelecki NE 1	O	SGS	PA	Acquired
12	Marana 2	O	SGS	TO	Acquired
			PNL	TO	Acquired
13	Nanima 2	O	Downhole P/T gauge	TO	Installed
			PNL	TO	Acquired
14	Wanara 1	O	SGS	TO	Acquired
			PNL	TO	Acquired
15	Field	F	InSAR surface displacement study		Baseline analysis performed
16	Field	F	Induced seismicity monitoring		Ongoing monitoring
17	All wells	W	Annulus pressure monitoring		95% activities completed
18	All wells	W	Well integrity inspection		97% activities completed
19	Risk based, 1-3 wells	W	Cement evaluation		Baseline available
20	Risk based, 1-3 wells	W	Casing / tubing evaluation		Acquired

Type:

+ I = injection well
+ O = observation well
+ W = general well
+ F = field wide
+ G = groundwater

Zone:

+ TO = Toolachee Formation
+ HU = Hutton Sandstone
+ PA = Patchawarra Formation
+ PO = Poolowanna Formation
+ SU = surficial aquifer

5.2.3. Metering and Measurement Accuracy

The following points give confidence that the Moomba CCS metering is working within the prescribed measurement accuracy of +/-1.5%:

- The two Coriolis flow meters used for custody transfer measurement at the capture point were factory calibrated prior to installation on 30 April 2024 and the calibration results are within the uncertainty limits.
- The first of a 3-monthly accuracy verification test program was completed satisfactorily in February 2025.
- When the two flow meters were aligned in series mode, the difference in readings between the two meters over a period of approximately 4 hours on 16 February 2025 was well within the uncertainty limits.
- CO2 stream gas samples are routinely taken at the capture point and compositional analysis completed for all components. These samples confirm the accuracy of the continuous gas analyser is within the prescribed limits.

5.2.4. Seismicity Monitoring

An eight geophone micro-seismic array has been continuously monitoring for seismic activity throughout the reporting period. Since the commencement of CO2 injection, there have been no seismic events detected within the storage complex.

The geophones record all ground movements, including minor movements associated with surface activities such as drilling rig or heavy equipment activity. Ground movements that trigger three or more sensors are processed to validate the movement and filter out noise. The number of processed ground movements is presented in Figure 11 for the period 1 April 2024 to 31 January 2025, with the increased movements associated with Strzelecki 37 drilling highlighted. Since the commencement of injection, the number of detected ground movements per day have been reducing.

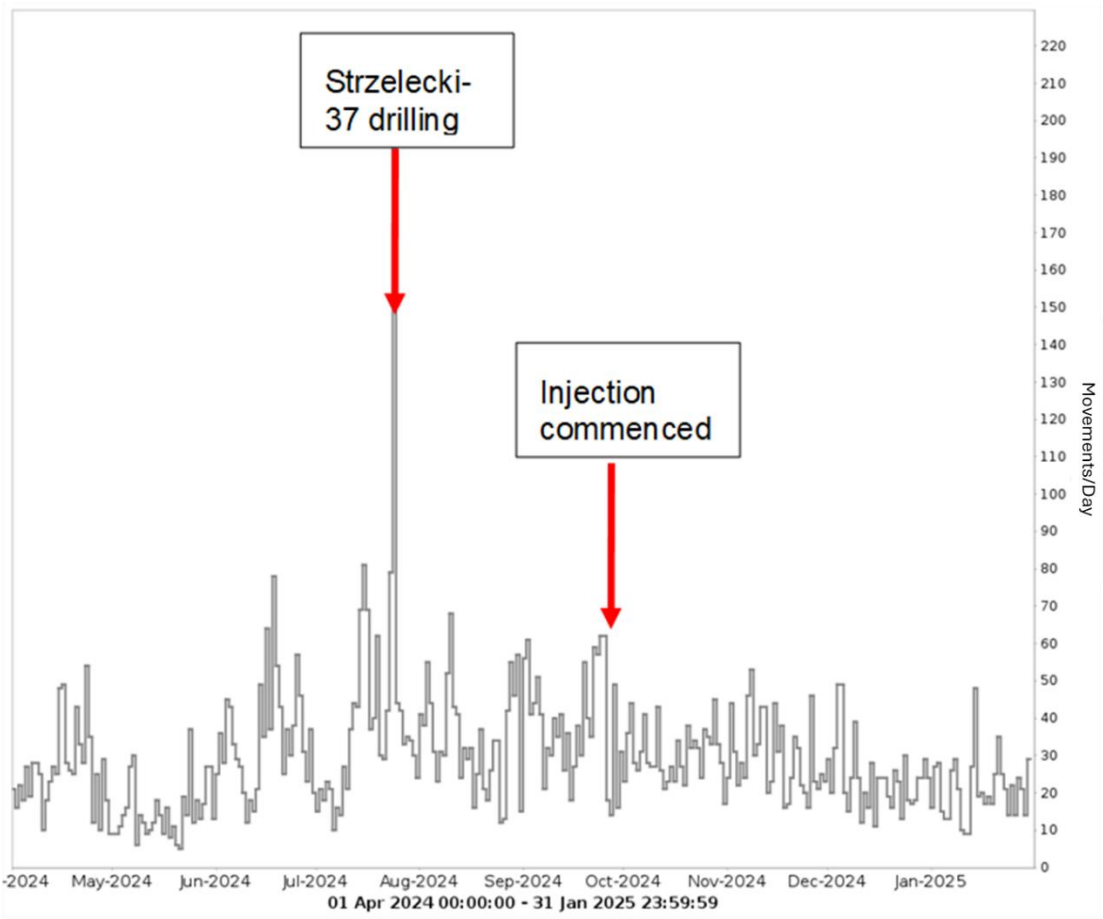

Figure 11 Frequency of ground movements recorded by the monitoring array

All processed and validated ground movements are analysed, and seismic events of interest are geo-located to establish if they originated within the storage complex.

Since the commencement of injection, there have been no seismic events within the storage complex that exceed the detection limit threshold (Mw 1.0, M&V plan). Within the reporting period and prior to CO2 injection, a seismic event was recorded on 14 August 2024, associated with the perforation of the Strzelecki 37 injection well. This event was detected by the monitoring array with a moment magnitude of 1.2 and geo-located to within approximately 200m. Prior to the reporting period, a natural seismic event originating within the storage complex was detected on 2 January 2023 and geo-located to a mapped lineament within the basement. The locations of these events are shown in Figure 12 and give confidence that the seismic array is working as designed.

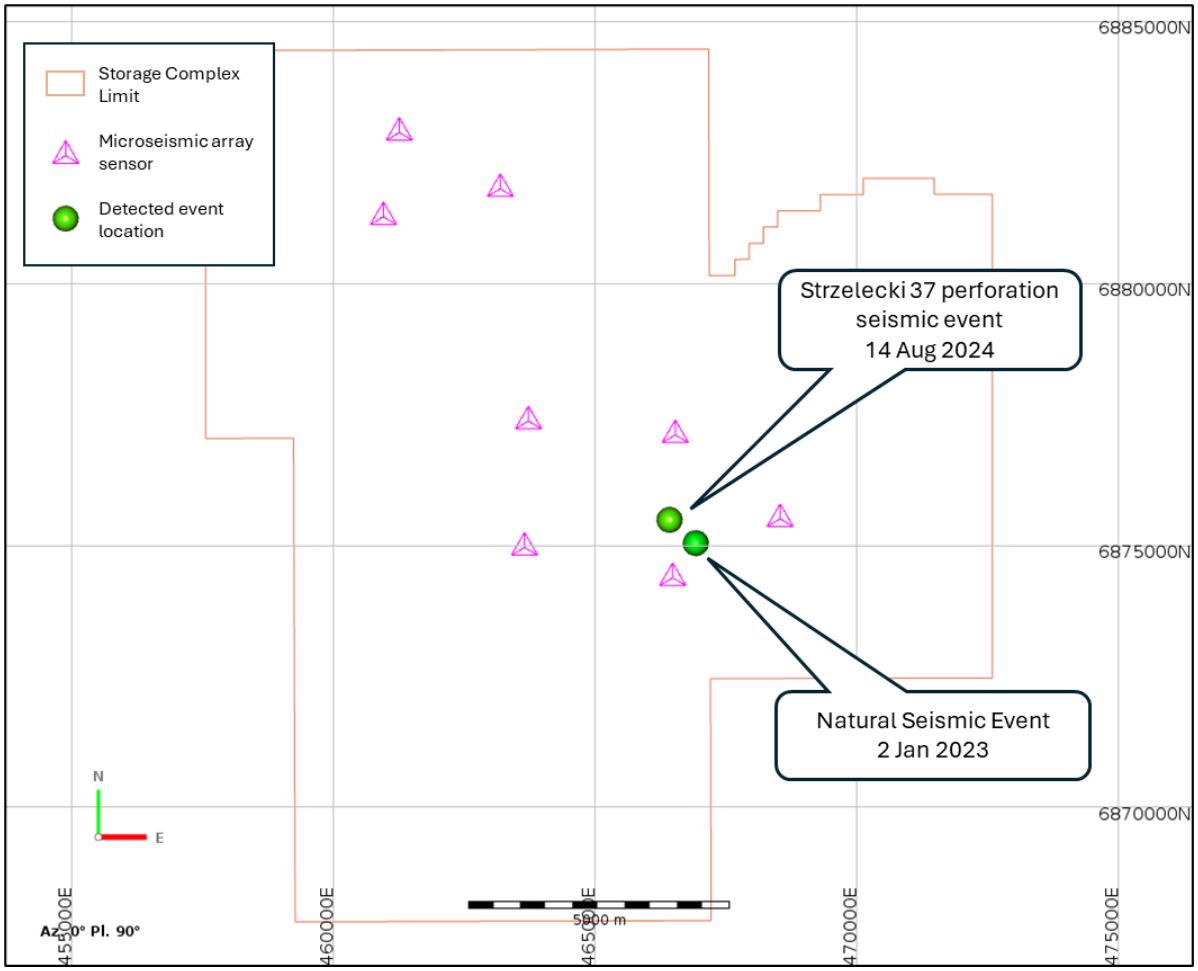

Figure 12 Detected events originating within the storage complex since recording commenced

Since the commencement of CO2 injection, seven seismic events not associated with the Moomba CCS project have been detected by the array exceeding the defined threshold for a significant event (Mw 2.5, M&V plan). Comparison of the CCS array with the Geoscience Australia passive seismic array shows a match for these seismic events. The location of two of these events (NW of Lindon Event, Strzelecki Dunefield Event) is displayed relative to the project area in Figure 13. The other five events were from more distant locations including: NSW, Central South Australia, Indonesia, PNG and an event from El Salvador which passed through the Earth's core.

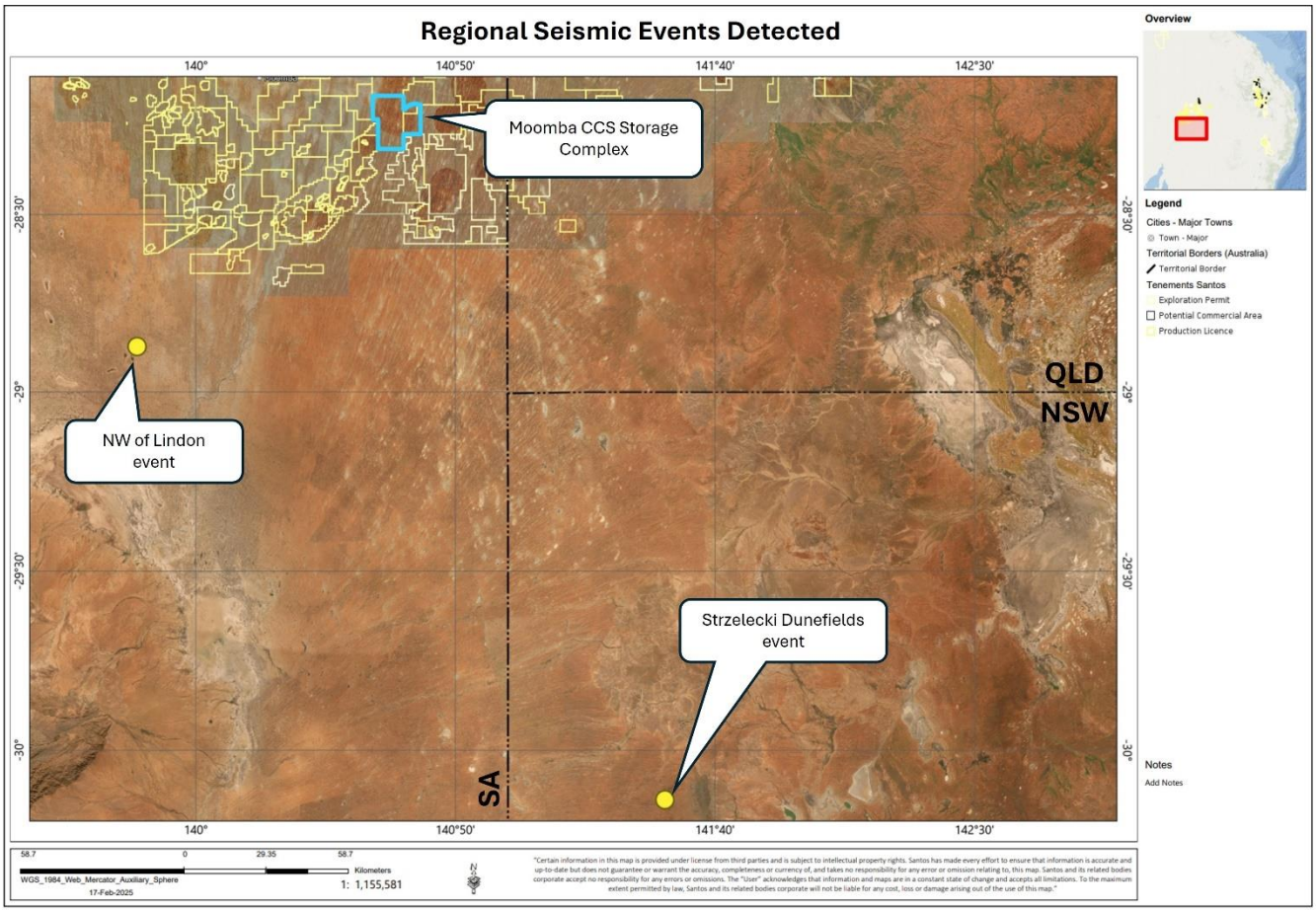

Figure 13 Location of seismic events not associated with Moomba CCS project

Given the information recorded to date, Santos is confident the array is performing to expectations and can detect any significant events within the storage complex which may result from injection activities.

5.2.5. Pulsed Neutron Logs

Two campaigns of cased hole pulsed neutron logging (PNL) were conducted across eight wells in Strzelecki and Marabooka area to establish baseline fluid saturation prior to CO2 injection, in line with the M&V plan activities schedule. Logging was performed across both the target injection reservoir (Toolachee Formation) and the overlying formation (Hutton Sandstone). Log data quality control was performed by service providers and Santos.

Campaign one utilised the Schlumberger pulsed neutron logging tool (PNX). Logging was undertaken in Marabooka 5, Marabooka 6, Nanima 2, Strzelecki 10 and Wanara 1 wells. Outputs from the PNX tool include SIGM-TPHI-FNXS and spectroscopy data. PNX data is of good quality and can be used as a baseline dataset for saturation monitoring during the CO2 injection operational phase. The PNX derived mineralogy, formation porosity and fluid saturation are broadly in line with OH evaluation.

Campaign two was conducted across Strzelecki 10, Marana 2, Strzelecki 33 and Marabooka 4 using the Baker Hughes RPM tool. Outputs from the RPM tool include SIGM-RPOR-RIN13-RATO13. Full quality control of data was undertaken and all logged data found to be of good quality enabling post-processing and data analysis. The Baker Hughes RPM tool utilises the GasView analysis technique to perform saturation analysis for CH4, CO2. GasView is a ratio-based gas saturation technique using RIN13 and RATO13 detector logs sensitive to liquid vs gas saturations. The RIN13 provides a salinity-independent gas saturation which is critical in this field. This analysis

has been undertaken and forms the baseline dataset for saturation monitoring during the following CO2 injection phase.

To enable comparison between the output logs from the two service providers Strzelecki 10 well was logged using both the SLB PNX and Baker Hughes RPM tool. Comparison of the results show a good agreement between the two tools.

Table 11 List of wells with pulsed neutron logs and target formation

Well Name	Logging Date	Logging Tool	Toolachee	Hutton
Marabooka 5	15 September2023	PNX	Logged	
Nanima 2	27 August 2023	PNX	Logged	
Wanara 1	3 September 2023	PNX	Logged	
Strzelecki 10	13 September 2023	PNX	Logged	Logged
Strzelecki 10	17 September 2024	RPM	Logged	Logged
Marana 2	20 September 2024	RPM	Logged	
Strzelecki 33	15 September 2024	RPM	Logged	Logged
Marabooka 4	22 September 2024	RPM	Logged	

5.2.6. Downhole Gauges (DHG)

Reservoir pressure surveillance is a key part of the M&V plan and downhole gauges have been installed at selected monitoring wells in Strzelecki and Marabooka to continuously monitor the Toolachee reservoir pressure. These data will be used to monitor the extent of the CO2 plume within the storage reservoir and to update the reservoir model. A further gauge has been installed at Nanima to monitor for lateral containment of CO2.

All gauges were installed prior to the commencement of injection to obtain a reliable baseline data set. Based on the data acquired to date, the gauges are responding to injected CO2 in line with expectation and consistent with full containment of CO2 within the Toolachee storage reservoir. Lateral containment remains at 'green' level.

A summary of the downhole gauges is provided in Table 12 below and gauge data is presented in the following figures.

Table 12 List of wells with downhole gauge and Toolachee target monitoring zone

Well Name	DHG online date	Online prior to start of injection (Days)	Monitoring Zone	Comments
Marabooka 5	12/05/2024	141	Toolachee	
Strzelecki 24	22/04/2024	161	Toolachee	Overbalance Rig workover, pressure gradually equalised
Nanima 2	3/07/2024	89	Toolachee	

Figure 14 shows the measured Toolachee reservoir pressure at Marabooka 5 from the time the downhole gauge was installed until the end of the reporting period. The period of baseline pressure data prior to the start of CO2

injection shows a small but clear trend of reservoir pressure increase. This increase is an indication of reservoir recharge due to broader field pressure support since the field was shut-in in 2024, and cross flow between Toolachee sands of varying pressure. In December, an additional small change in the rate of pressure increase can be seen, approximately 8 weeks after the commencement of injection. This later pressure increase is the observed pressure response to CO2 injection into the adjacent injection well, Marabooka 19, and the pressure response is in line with expectation and the reservoir model.

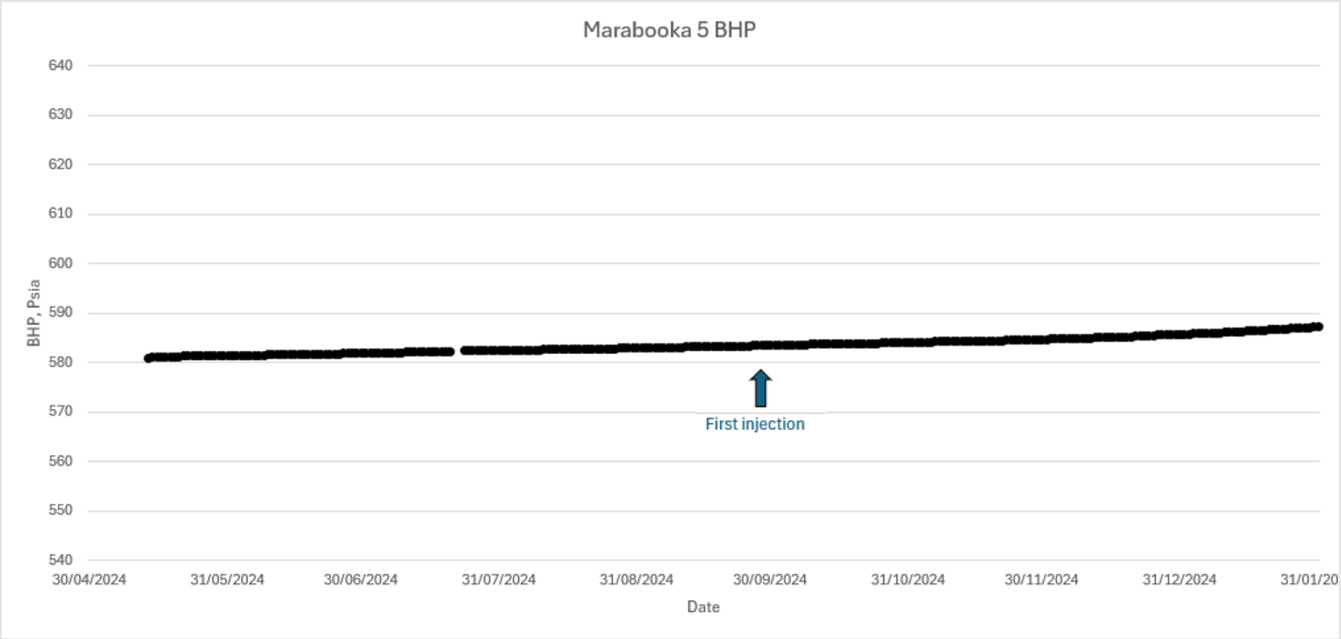

Figure 14 Marabooka 5 monitoring well, DHG showing Toolachee pressure

Like Marabooka 5, a small level of reservoir recharge is evident in the baseline bottomhole pressure data at Strzelecki 24 prior to CO2 injection (Figure 15). There has been no indication of Toolachee pressure increase due to CO2 injection at the Strzelecki injector wells. This is consistent with expectations since Strzelecki 24 is some distance from the injectors, with a fault mapped between the well and the main part of the field. The history-matched reservoir model predicts the well will see a pressure response later in the life of the project.

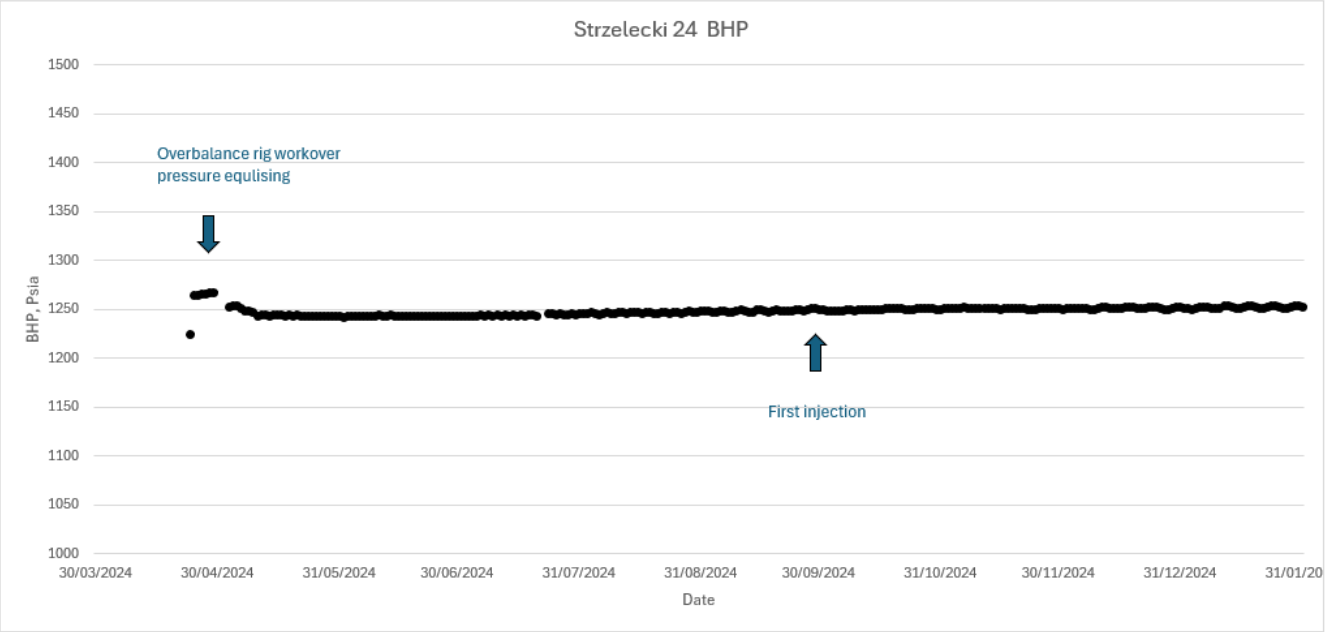

Figure 15 Strzelecki 24 monitoring well, DHG showing Toolachee pressure

Nanima 2 is a key monitoring well located in a small structural high on the migration pathway out of the main Strzelecki structure, and outside the estimated maximum extent of the CO2 plume. If CO2 were to spill laterally out of closure, it would be expected to accumulate at this location.

Consistent with the other monitoring wells, a small level of reservoir recharge is evident in the baseline pressure data (Figure 16). There has been no change in pressure at Nanima 2 due to CO2 injection, which is evidence of lateral containment within the target storage reservoir.

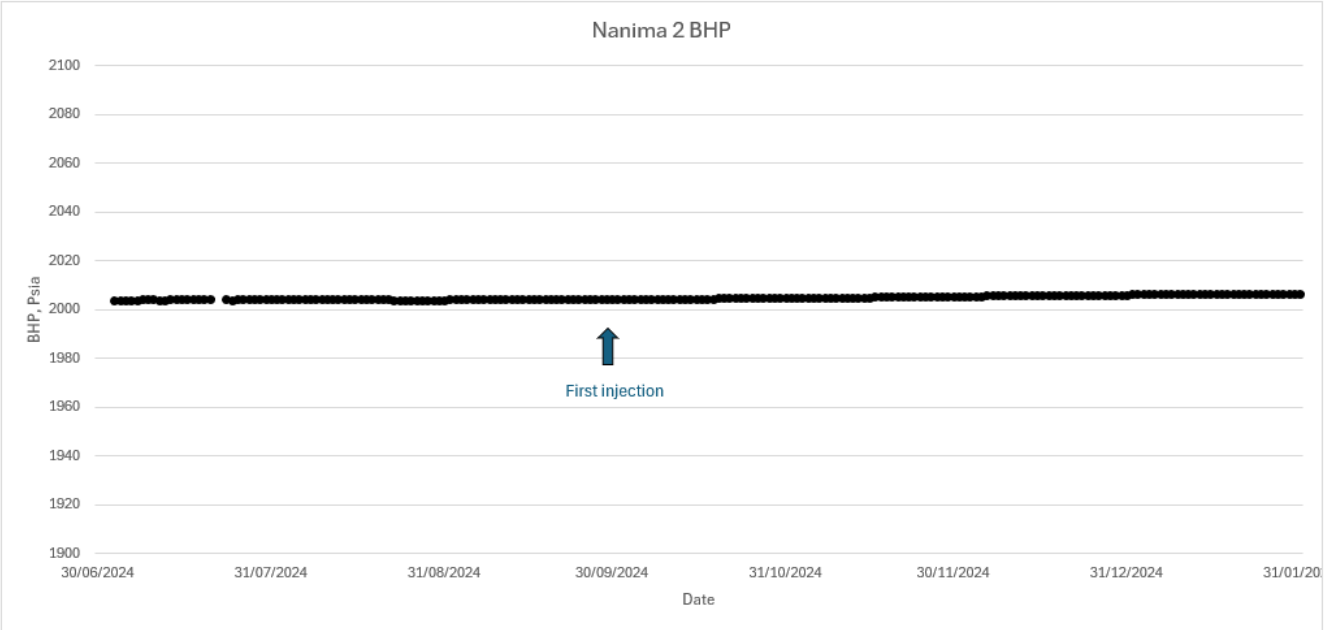

Figure 16 Nanima 2 monitoring well, DHG showing Toolachee pressure

5.2.7. Static Gradient Survey (SGS)

Reservoir pressure surveillance is conducted at other designated monitoring wells using slickline-conveyed static gradient surveys (SGS), and baseline data have been successfully acquired at the following wells in accordance with the M&V plan; Marabooka 4, Strzelecki 10, Strzelecki Northeast 1, Wanara1 and Marana 2.

The Marabooka 4 measured pressure correlates well with FMT data recently acquired at Marabooka 19 in equivalent sands, Marana 2 pressure is consistent expectation, and Strzelecki 10 pressure at 1,192 psi indicates a level of reservoir recharge in that part of the field, consistent with other monitoring well observations. Wanara 1 provides a baseline Toolachee pressure at the Wanara structure, outside the estimated maximum extent of the CO2 plume.

Table 13 List of wells with baseline SGS surveys in Toolachee

Well	Date SGS Run	Max BHP (psi)	Top Toolachee Pressure (psi)	Comments
Marabooka 4	10/09/2024	1,902	1,666	Baseline data
Strzelecki 10	18/05/2023	1,217	1,192	Baseline data
Wanara 1	18/07/2023	2,395	2,228	Baseline data
Marana 2	20/07/2024	940	830	Baseline data

A SGS acquired at Strzelecki Northeast 1 provides a baseline Patchawarra pressure in the northeast of the Strzelecki field (Table 14).

Table 14 List of wells with baseline SGS surveys in Patchawarra

Well	Date SGS Run	Max BHP (psi)	Top Patchawarra Pressure (psi)	Comments
Strzelecki Northeast 1	22/07/2024	1,888	1,824	Baseline data

5.2.8. Casing and Tubing Monitoring

The risk of casing or tubing degradation due to corrosion from exposure to carbon dioxide and water is expected to be low. Downhole plugs have been used to protect legacy wells with carbon steel tubing and the injection wells utilised corrosion resistant casing and tubing. However, as per the M&V plan, it is considered prudent to monitor a sample of wells before and during injection period.

Baseline corrosion logs were acquired at Strzelecki 10 (2-3/8" J55 tubing) and Strzelecki 33 (2-7/8" Cr monobore), against which future logs can be compared to determine the extent of any deterioration over the life of the project. The analysis of the tubing and casing logs has found the wells to be in good condition and any baseline wall loss along the length of pipe is recorded.

Table 15 Casing and tubing integrity log summary

Casing/Tubing	Strzelecki 33	Strzelecki 10
Logging Date	30 July 2024	18 September 2024
Logging Tool	Baker _ MVERT	Baker _ EDM
9-5/8"	NA	The 9-5/8" casing was found to be in good condition with only minor corrosion detected. The maximum metal loss recorded from the 9-5/8" casing was 4% at 405 ft.
7"	NA	The 7" casing was found to be predominantly in good condition with only minor corrosion detected. The maximum metal loss recorded from the 7" casing was 9% at 6,130 ft
2-7/8"	Base line data shows casing is in good condition, with maximum localised wall loss of 32% on the OD of joint 7 at 218 ft.	NA
2-3/8"	NA	The 2-3/8" tubing was found to be predominantly in good condition with only minor corrosion detected. The maximum metal loss recorded from the 2-3/8" tubing was 9% at 6,143 ft

5.2.9. Cement Bond Logs

A diligent cement evaluation interpretation has been conducted for all wells in the storage complex. Where new baseline cement evaluation logs were required, these were completed as part of the 2023 legacy well integrity program. As per the M&V plan, ongoing repeat cement evaluation will be acquired at key wells, the scope and frequency of which will be determined based on each individual well integrity management plan and any observed changes. Characterising any change in cement quality over time will help to manage the risk of cement degradation.

Strzelecki 33 and Strzelecki Northeast 1 have been identified as key monitoring wells close to injection wells for the monitoring of cement degradation. Existing baseline cement evaluation logs at Strzelecki 33 (2-7/8" Cr monobore) and Strzelecki Northeast 1 (2-7/8" Cr monobore) were deemed to be of good quality and acceptable as part of well integrity review. These baseline data will be compared against future cement evaluation logs to be acquired over the life of the project to evaluate any change in cement quality.

Table 16 Baseline cement quality across key indicator wells

Cement Quality across formation	Strzelecki 33	Strzelecki Northeast 1
Logging Date	11 May 2019	8 January 2011
Birkhead	Good Cement	Good Cement

Cement Quality across formation	Strzelecki 33	Strzelecki Northeast 1
Hutton	Good Cement	Good Cement
Nappamerri	Good Cement	Good Cement
Toolachee	Good Cement	Good Cement
Murteree	Good Cement	NA
Patchawarra	Good Cement	NA
Pre-Permian	NA	Good Cement

5.2.10. Well Integrity and Annulus Monitoring

Well annulus monitoring has been completed at all non-P&A wells within the storage complex for the report period in accordance with the M&V plan and well integrity management plans.

Annulus monitoring includes:

- Continuous remote monitoring of the production and surface casing annulus pressure for all injection wells;
- Continuous remote monitoring of the surface casing annulus pressure for specified monitoring wells;
- At least one manual survey of annulus pressure every six months for all non-P&A wells that are not continuously monitored within the storage complex; and
- Well integrity visual inspections will be undertaken at least once every year as per Onshore Well Integrity Management Procedure (OWIMP). Inspections cover the general condition of the wellhead, surface casing and cellar.

Since the start of injection, all annulus pressure changes have been within the expectations of ambient or wellbore thermal effects.

Table 17 List of wells with continuous annulus monitoring

Permit	Well Name	Details
GSL 2	MARABOOKA 19	Injection well – Continuous monitoring of surface and production casing pressures
GSL 2	STRZELECKI 34	Injection well – Continuous monitoring of surface and production casing pressures
GSL 2	STRZELECKI 35	Injection well – Continuous monitoring of surface and production casing pressures
GSL 2	STRZELECKI 36	Injection well – Continuous monitoring of surface and production casing pressures
GSL 2	STRZELECKI 37	Injection well – Continuous monitoring of surface and production casing pressures
GSL 2	MARABOOKA 5	Monitoring well – Continuous monitoring of surface casing pressure

Permit	Well Name	Details
GSL 2	NANIMA 2	Monitoring well – Continuous monitoring of surface casing pressure
GSL 2	STRZELECKI 12	Monitoring well – Continuous monitoring of surface casing pressure
GSL 2	STRZELECKI 24	Monitoring well – Continuous monitoring of surface casing pressure

5.2.11. InSAR

Santos has engaged TRE ALTAMIRA to provide ground displacement monitoring services using satellite based interferometric synthetic aperture radar (InSAR) technology.

Baseline data has been acquired from the Sentinel-1 (SNT) satellite over an area of interest (AOI) including the Moomba CCS project storage complex (Strzelecki and Marabooka fields) with a total extent of 1,717 km2. The data was processed and analysed using TRE ALTAMIRA's proprietary SqueeSAR algorithm and the results include Line of Sight (LOS) datasets covering the full baseline period from December 2016 until October 2022 (Figure 17). The baseline analysis has benchmarked ground displacement over the entire AOI including fields adjacent to the storage complex and other features of interest such as wells and infrastructure. The analysis also quantifies natural noise levels in areas of natural movement.

As required by the M&V plan, repeat InSAR surveys and analysis will be completed over the life of the project and the baseline survey used as reference point from which any ground displacement (heave) may be identified.

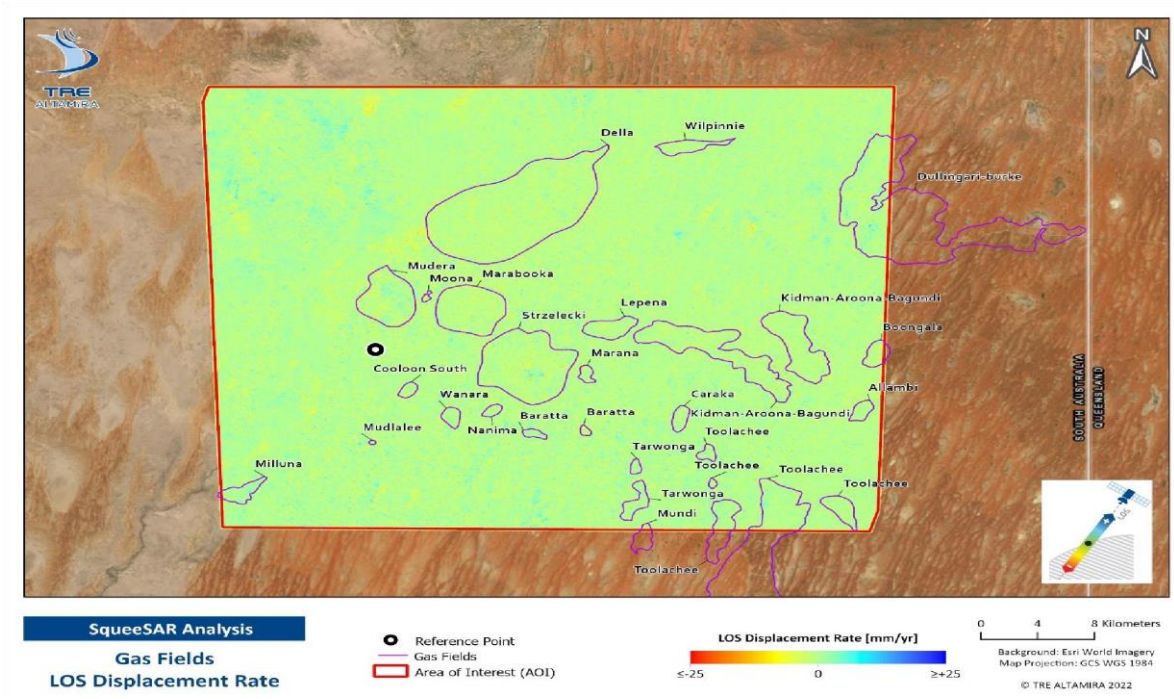

Figure 17 Gas field annual displacement rate (December 2016 – October 2022)

5.3. M&V Environmental Assurance Monitoring

As required by the M&V plan, an Annual Report must contain:

"Summary and interpretation of M&V activities"

Environmental assurance monitoring is required to demonstrate containment within the storage complex has been achieved.

Environmental assurance monitoring comprises the following elements:

- Groundwater quality monitoring – in response to other monitoring data that indicates a subsurface loss of containment may have occurred; and
- Monitoring of the overlying geological formations – gathering data to confirm that CO2 has not migrated into formations above the target storage reservoir.

All environmental assurance monitoring activities have been completed during the reporting period, in line with the M&V plan schedule.

5.3.1. Groundwater Quality Monitoring

As part of pre-injection phase activities described in the M&V plan, baseline groundwater samples were collected between April 2023 and September 2024 from bores/wells screened in geologic formations above the target reservoirs. These data sets have been statistically and geochemically analysed, in accordance with Appendix B of the M&V plan, to assess their sufficiency for development of environmental thresholds. Findings from the statistical analysis and of the geochemical results are summarised below and can also be found within the *Baseline Groundwater Quality Report, Moomba Carbon Capture and Storage Project (June 2025)*.

Baseline groundwater quality data have been analysed from two groundwater formations: the Hutton Sandstone, and the Shallow Aquifer. These groundwater formations are located in the vicinity of planned CO2 injection associated with the Moomba CCS Project. Based on this analysis, geochemically relevant and statistically robust environmental thresholds have been developed for the Hutton Sandstone and individual wells in the Shallow Aquifer. Three to four parameters were identified that are highly suitable for statistical threshold development in each Shallow Aquifer well location or the Hutton Sandstone. These parameters were selected based on detection frequency in samples, data distribution, statistical power, and consistency across monitored wells. Proposed environmental thresholds would be triggered by a change of approximately 1.1 to 5 times in concentrations of key inorganic parameters in groundwater including calcium, magnesium, strontium, potassium, and reactive silica (depending on location).

Based on the geochemical evaluation and statistical assessment completed in accordance with Appendix B of the M&V plan, the environmental thresholds developed are sufficiently sensitive to detect a material change to groundwater chemistry if a release of CO2 into groundwater at the monitored locations occurs. Additional sampling is not required to improve the statistical power of the baseline dataset. However, the statistical assessment and environmental thresholds will be reviewed in consideration of any additional data available as part of any investigation to a material change to groundwater in response to environmental assurance monitoring detecting a red level migration indicator as per section 5.8 of the M&V plan.

The M&V plan included a commitment to continue ongoing annual monitoring of the Shallow Aquifer bores throughout the injection period. The first annual monitoring event is scheduled for Q3 2025, and will be reported in the relevant operational reporting period.

5.3.2. Downhole Gauge (DHG)

A downhole gauge has been installed in Strzelecki 12 to monitor the pressure at the top of the Hutton Sandstone, the first permeable formation above the target storage reservoir. Accumulation of CO2 at the crest of the Hutton would produce a pressure increase in combination with a wellbore pressure gradient that would be an early indicator of CO2 leakage from the storage reservoir into the Hutton.

Table 18 List of wells with downhole gauge with Hutton target monitoring zone

Well Name	DHG online date	Online prior to start of injection (Days)	Monitoring Zone	Comments
Strzelecki 12	23/04/2024	160	Hutton	DHG failed on 14/10/2024, was replaced and back online 12/12/2024

The gauge was installed prior to the commencement of injection to obtain a reliable baseline data set. Overall, during the injection period the trend has remained steady and there is no indication of pressure increase. This supports full containment of CO2 within the Toolachee storage reservoir and vertical containment threshold remains at 'green' level for the reporting period.

The downhole gauge failed two weeks after the start of injection and a new replacement gauge was promptly mobilised and installed in December 2024. There is a small step change in bottom hole pressure after the gauge replacement that is a function of a slight change in setting depth for the new downhole gauge and completion fluid density used to maintain well control while replacing the downhole gauge.

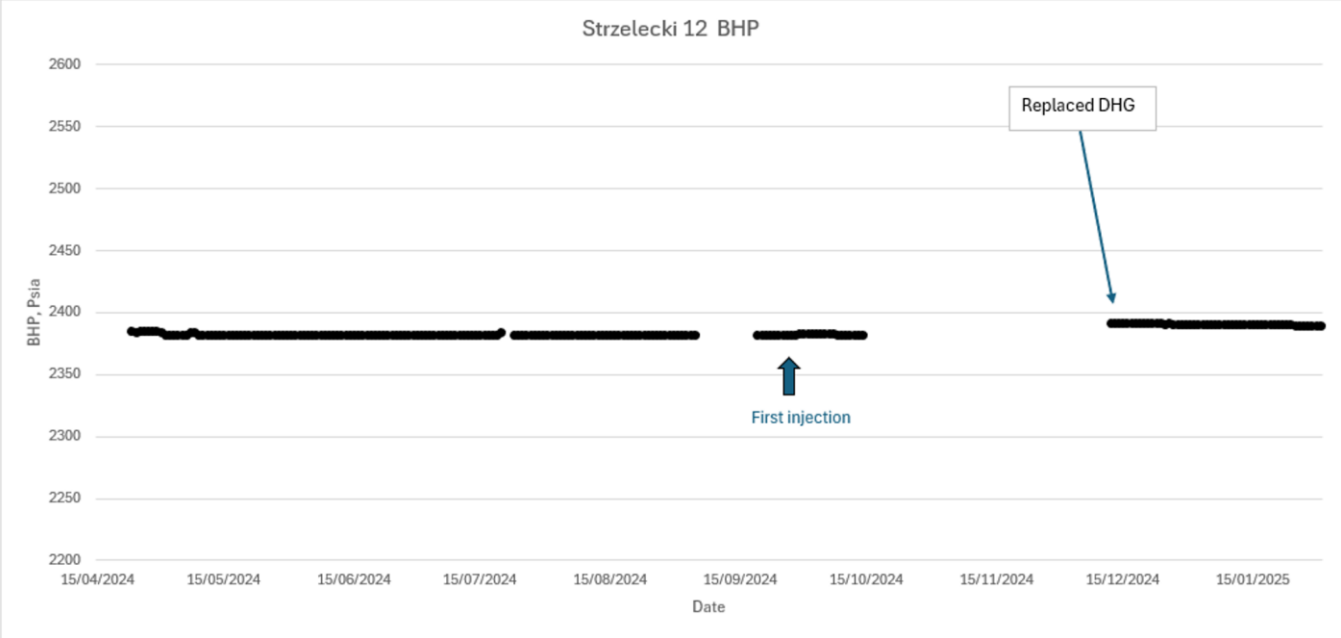

Figure 18 Strzelecki 12 monitoring well, DHG showing Hutton pressure

5.3.3. Static Gradient Survey (SGS)

Nanima 1 is located southwest of the Strzelecki storage reservoir and near the crest of Poolowanna Formation. The well was selected to monitor Poolowanna pressure for any change over the life of the project which could indicate CO2 migration outside the target storage reservoir. Baseline pressure was successfully acquired.

Table 19 Nanima 1 SGS survey, Poolowanna pressure

Well	Date SGS Run	Max BHP (psi)	Poolowanna Pressure (psi)	Comments
Nanima 1	15/10/2024	2,504	2,444	Baseline data

5.3.4. Pulsed Neutron Logging (PNL)

PNL surveys enable the detection of a gas column in the formation adjacent to well, through the well casing and cement. It does not require a well to be completed and open to the target formation for monitoring. The following locations will be monitored using PNL surveys to detect whether a gas column has accumulated in the Hutton Sandstone:

- Strzelecki 33, located near the crest of the Strzelecki Hutton Sandstone structure; and
- Marabooka 6, located near the crest of the Marabooka Hutton Sandstone structure.

Baseline PNL data has been acquired, the data is of good quality and can be used for comparison against future PNL operational logging to evaluate migration of CO2 if required.

Table 20 List of wells with pulsed neutron logs and target formation

Well Name	Logging Date	Logging Tool	Hutton
Marabooka 6	22/08/2023	PNX	Logged
Strzelecki 33	15/09/2024	RPM	Logged

5.4. Containment Risk Assessment

This section summarises the risks associated with containment of CO2 within the target storage reservoir. Further details are outlined in the M&V plan.

Operational and environmental assurance monitoring activities have been completed in line with the M&V plan schedule and all observations support full containment and storage of CO2 within the target storage reservoir. Since monitoring activities conform to the plan and there has been no deviation from expected reservoir performance at this early stage of the project, there will be no change to the project containment risk assessment. Containment residual risks ratings are set out in Table 21 below.

Table 21 Containment residual risk ratings

Number	Risk name	Rating	Category
1	Poor cement – old well	Low	Well integrity
2	Poor cement – new well	Low	
3	Degradation of cement – old well	Low	
4	Degradation of cement – new well	Low	
5	Casing corrosion – old well	Low	
6	Casing corrosion – new well	Low	
7	Tubing / packer failure – old well	Low	
8	Tubing / packer failure – new well	Low	
9	Wellhead seal failure – old well	Very Low	
10	Wellhead seal failure – new well	Very Low	
11	Capillary failure of primary seal	Very Low	Geological
12	Fault reactivation	Low	
13	Induced fracture through primary seal	Low	
14	Natural seismicity	Very Low	
15	Natural fracture through primary seal	Very Low	
16	Degradation of primary seal from exposure to CO2	Low	
17	Stratigraphic pathway through primary seal	Very Low	
18	Lateral migration	Low	
19	Third party interference	Very Low	Other

5.5. Independent Expert Review

The Moomba CCS project M&V plan must be reviewed regularly to ensure it remains fit for purpose.

As set out in this report, M&V plan KPIs have been met, the storage complex is behaving as expected at this early stage of the project, and injected CO2 is fully contained within the target storage reservoir. Containment risks have been reviewed against the new project data and have not changed, and the containment risk assessment is still valid.

A review of the M&V plan was completed by Santos during the reporting period and found the plan remains fit for purpose, there will be no revision to the plan at this time.

An independent third-party expert review was completed by CO2Tech, a world-leading CCS technical advisory and consultancy services company with a particular expertise in monitoring and verification of CCS projects, arising from more than 20 years of operational experience in CCS Injection and Monitoring Demonstration Projects at the Otway International Test Centre (OITC) demonstration site in Victoria, via their parent company CO2CRC.

The independent expert reviewed the M&V Plan and operational data and has determined that there has been no loss of containment and that the M&V plan remains fit for purpose at this time.

6. Future Work Program

The following regulated activities are proposed for the ensuing year:

- Civil works where required (road, track, borrow pit and well lease construction, road and access track maintenance);
- Well repair activities where required, for example in the case of gauge failure;
- Well rigless monitoring and surveillance activities, including logging activities and well integrity activities;
- Seismicity monitoring;
- Ongoing operation and maintenance of the wells and associated infrastructure;
- Ongoing operation of the CCS facility; and
- Monitoring of CO2 injection and reservoir surveillance activities in accordance with the M&V plan.

In addition, desktop appraisal and future CCS project definition will continue over the broader licence area.

7. Forecasted Storage Volumes

1.6 million tonnes of CO2 (1.7 million tonnes of CO2-equivalent) are forecasted to be stored in the ensuing reporting period, subject to maintenance activities, reliability and CO2 availability.

APPENDIX 1 – Summary of compliance with the Strzelecki and Marabooka Toolachee Monitoring and Verification Plan (July 2024)

Obligation	Measurement Criteria	Compliance Status	Performance
Injection telemetry monitoring	Continuous measurement of CO2 injection parameters.	Achieved	To continuously monitor injection rate and reservoir pressure across the Moomba CCS project as reservoir pressures rise following the injection of CO2, several gauges have been installed. These gauges have been allocated to different wells across several structures and targets to create a comprehensive monitoring and verification network to depict the change in reservoir pressure over the project life cycle. All gauges were installed prior to injection to provide a historical baseline. Sections 4 and 5 of this report address this obligation.
Reservoir surveillance	Regular pressure and saturation measurements.	Achieved	Cased hole pulsed neutron logging (PNL) was conducted across 8 wells in Strzelecki and Marabooka area to establish baseline fluid saturation prior to CCS injection operations. Logging was performed across both the interval of injection (Toolachee Formation) and the overlying Hutton Sandstone. Section 5 provides further detail on how this obligation was achieved.
Well integrity monitoring and management	Conduct casing/tubing evaluations, cement bond logs.	Achieved	A diligent cement evaluation interpretation has been conducted for all wells in the storage complex. Where new baseline cement evaluation logs were required, these were completed as part of the 2023 legacy well integrity program. Well annulus monitoring will continue for all non-P&A wells in accordance with well integrity management plans. Section 5 provides further detail on how this obligation was achieved.
Environmental assurance monitoring	Monitor groundwater chemistry and CO2 migration indicators.	Not yet triggered.	Based on geochemical evaluation and statistical assessment completed in accordance with Appendix B of the M&V plan, the environmental thresholds developed are sufficiently sensitive to detect a material change to groundwater chemistry if a release of CO2 into groundwater at the monitored locations occurs. Groundwater monitoring is scheduled to be undertaken in Q3 2025 to fulfill the annual Shallow Aquifer monitoring obligation and will be reported in the relevant operational reporting period.
Compliance with operational monitoring schedule	Minimum 90% adherence to planned activity schedule.	Achieved	All baseline data as per M&V plan has been acquired and captured. Section 5 provides further detail on how this obligation was achieved.

Obligation	Measurement Criteria	Compliance Status	Performance
Annual reporting to DEM	Submission of project status report detailing major activities, incident reports, and containment assessment.	Achieved	This report addresses this compliance obligation to provide DEM with an Annual Report detailing major activities, incident reports, and containment assessment.
Incident reporting	Report serious and reportable incidents in accordance with Carbon Storage SEO.	Achieved	There were no loss of containment incidents during the reporting period. The storage complex is behaving as expected and injected CO2 is fully contained within the target storage reservoir.
Closure monitoring activities	Continued monitoring of downhole gauges, pressure analysis, and CO2 migration verification.	Not yet triggered	No closure activities have been undertaken for this project. Monitoring programs will be established for decommissioned CCS assets as they arise.
Operating envelope compliance	Maintain CO2 injection parameters within approved limits.	Achieved	Section 4, injection well performance, demonstrates that pressure, temperature and injected CO2 concentration conforms to the operating envelope.
Compliance with Carbon Credit Methodology	Adhere to Clean Energy Regulator (CER) requirements for ACCUs.	Achieved	Santos has a robust method for quantifying and reporting emissions, including fugitive emissions, which adheres to the requirements of the National Greenhouse and Energy Reporting (NGER) Scheme. This established process will form the basis of the methodology for Santos measuring, generating and reporting ACCUs. The M&V plan meets the requirements of the CER guidelines with focus on safe long-term containment of stored CO2. It sets out all measurement and surveillance activities necessary to ensure geological storage. Other emissions caused by project activity and calculations of net abatement are not part of the M&V plan.
Groundwater monitoring for CO2 migration	Conduct baseline and periodic groundwater sampling.	Achieved	Based on geochemical evaluation and statistical assessment completed in accordance with Appendix B of the M&V plan, the environmental thresholds developed are sufficiently sensitive to detect a material change to groundwater chemistry if a release of CO2 into groundwater at the monitored locations occurs. Groundwater monitoring is scheduled to be undertaken in Q3 2025 to fulfill the annual Shallow Aquifer monitoring obligation and will be reported in the relevant operational reporting period.
Environmental response plan activation	Implement remedial actions upon detecting containment loss indicators.	Achieved	Santos maintains the Emergency response Plan – Moomba Plant (0005-210-ERP-0001) for its Moomba Plant and CCS activities. No containment loss indicators requiring remedial actions were triggered during the reporting period.

APPENDIX 2 – Activity approval: carbon dioxide injection – Strzelecki and Marabooka (July 2024)

Approval Condition	Compliance Status	Performance
Providing the Department for Energy and Mining (DEM) 24-hour notice prior to the commencement of these activities, this notice can be provided directly to DEM by email at DEM.Engineering@sa.gov.au.	Achieved	Email notification was sent to DEM on 27 September 2024 informing DEM of the anticipated first injection dates of Sunday, 29 September 2024 or Monday, 30 September 2024.
Complying with the *Strzelecki and Marabooka Toolachee monitoring and verification plan*, including any updates to the plan that are submitted by Santos and accepted by DEM.	Achieved	This Annual Monitoring and Verification Report confirms compliance with the *Strzelecki and Marabooka Toolachee monitoring and verification (M&V) plan.* There has been no changes or updates of the M&V plan during this reporting period.
Finalising, submitting and adhering to the *Santos draft internal Environmental Approval – Moomba CCS Injection (April 2024).*	Achieved	Finalised *Moomba CCS Injection – Internal Environmental Approval* was submitted to DEM on 9 August 2024.
Including a preliminary baseline groundwater quality report with the first summary report submission (6 months after first injection) demonstrating that appropriate exploratory data analysis has been conducted in accordance with Appendix B of the *Strzelecki and Marabooka Toolachee monitoring and verification plan* to verify whether the baseline data set is sufficient to detect a material change, and define a schedule for collecting additional baseline data if required.	Achieved	Baseline groundwater monitoring was completed between April 2023 and September 2024. Based on geochemical evaluation and statistical assessment completed in accordance with Appendix B of the M&V plan, the environmental thresholds developed are sufficiently sensitive to detect a material change to groundwater chemistry if a release of CO2 into groundwater at the monitored locations occurs. The *Baseline Groundwater Quality Report, Moomba Carbon Capture and Storage Project (June, 2025)* will be sent to DEM with this Annual Report. Groundwater monitoring is scheduled to be undertaken in Q3 2025 to fulfill the annual Shallow Aquifer monitoring obligation and will be reported in the relevant operational reporting period.
Provision, once available, of: Copies of the suite for As-Built P&IDS for the CCS facility and injection skids, as an update to the IFC P&IDs previously provided. Copies of the suite of CCS related Bowtie risk assessments to complement DEM's copies covering the Moomba Plant and Upstream Productions. A copy of the Santos signed and approved initial Operational Acceptance (OA) certificate for the CCS project (excluding HRSG).	Achieved	As built P&IDs for the CCS facility and Injection Skids were submitted to DEM on 14 November 2024. Copies of the suite of CCS related Bowtie risk assessments were submitted to DEM on 23 October 2024. A copy of the Santos signed and approved initial Operational Acceptance (OA) certificate for the CCS project was submitted to DEM on 18 November 2024.

Approval Condition	Compliance Status	Performance
Submitting injection reports in accordance with Regulation 45 of the *Energy Resources Regulations 2013*.	Partial non-compliance, since rectified with corrective action	Monthly injection reports were submitted to DEM for the months of September through December 2024 inclusive, on 26 February 2025. Refer section 5.3. Corrective Action: Future Monthly Injection volumes will be included within Monthly Well Production reporting.