HANCOCK PROSPECTING PTY LTD

ABN 69 008 676 417

HPPL House
28-42 Ventnor Avenue
West Perth WA 6005
PO Locked Bag No 2
West Perth WA 6872

Telephone: (08) 9429 8222
International: +618 9429 8222
mail@hancockprospecting.com.au

1 May 2024

Committee Secretary
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600

By email: ec.sen@aph.gov.au

Dear Madam or Sir,

Submission to the Senate Standing Committee on Environment and Communications (*Committee*)
The Implications of Glencore's Proposed Carbon Capture & Storage Project (*Project*)

The Committee is investigating the implications of the Project in the Great Artesian Basin proposed by Glencore's subsidiary, Carbon Transport and Storage Corporation Pty Ltd.

Hancock notes the scope of the investigation of the Committee into the proposed Project, and we respectfully request that the Commission considers the matters addressed below, which are set out under the referenced headings of the Committee's investigation.

Executive Summary

This Submission **against** the Project is made by Hancock Agriculture, a division of Hancock Prospecting Pty Ltd (***Hancock***), which owns a total of twelve properties across the Great Artesian Basin in southern Queensland, five of which are in the area covered by the Precipice Sandstone Aquifer (see ***map attached***).

Hancock is currently actively pursuing the expansion of its interests in the western Surat area, which we have identified as key to:

- Alleviating drought risk in other parts of Hancock Agriculture's portfolio, which requires the use of ground water that is fit for animal consumption; and

- Growing crops as part of a portfolio approach to supply our regional feedlot assets, which requires the use of groundwater for irrigation purposes.

In February 2023, responding to the request by the Queensland Department of Environment and Science for submissions on the draft Environmental Impact Assessment (***EIS***) for the Project,

Hancock commissioned at its own expense a report entitled *Technical Groundwater Review of the Surat Basin Carbon Capture and Storage Project Draft EIS* prepared by an expert Queensland-based hydrologist, Daniel Barclay, of hydrogeologist.com.au (***Report***) and submitted it as formal feedback.

That Report, which is ***attached*** to this submission, identified a number of key concerns with the EIS, concerns which we submit have not been dealt with by Glencore in any subsequent revisions. These include:

- Uncertainty in the geology/hydrogeology within the region
- Limited groundwater sampling which was been too distant from the injection site
- Lack of compliance with the regulations and uploading of data to Queensland Globe for groundwater bores
- The assumption of high fluoride levels in the groundwater, which is incorrectly stated as impacting upon water usage for animal consumption
- Water within the aquifer is brackish, rather than saline as erroneously stated on numerous occasions in the draft EIS. The Precipice Sandstone Aquifer in fact yields usable water on a local and regional basis
- Lack of acknowledgement of and engagement with existing water extraction licensees within the aquifer zone
- That the six-monthly groundwater monitoring will not comply with Queensland government guidelines, and that the number of monitoring bores proposed is insufficient.

Hancock is broadly supportive of the use of carbon capture and storage where appropriate as a potentially valuable technology for the alleviation of the effects of carbon dioxide release into the atmosphere.

However, the concerns raised in the Report specific to the Project, and the inadequacies identified in the EIS, mean we are opposed to the Project being pursued in this location or indeed in any location that would affect the Precipice Aquifer or the Great Artesian Basin given their regional significance and value. The risks of Glencore's proposal to agriculture – not just our own operations, but more broadly, including long-term water supplies and feedlot security, are unacceptable given the matters summarised above, and the limitations of Glencore's modelling work on the effect on the aquifer.

Responses to the Committee's Specific Areas of Investigation

(a) The environmental impact assessment process and the adequacy of the project's approval by federal and state regulatory bodies, including the decision not to classify the project as a controlled action under national environment law

The importance of the Great Artesian Basin (**GAB**), within which the Precipice Aquifer sits, is underscored by the fact that there are only four Basins in the country that have a specific Strategic Management Plan, with that for the GAB having a history stretching back over two decades[1].

[1] https://www.dcceew.gov.au/water/policy/national/great-artesian-basin/strategic-management-plan

The GAB is the largest groundwater system in Australia and is the world's largest potable water source, covering 1.7 million square kilometres and is estimated to carry 65 gigalitres of water. It is nevertheless a finite resource which is slow to replenish yet of enormous significance to agricultural productivity in times of extended dry periods. The economic value of the resource is estimated at $13 billion per annum[2].

It seems to us inexplicable that in assessing the initial application, the Federal Department of Environment did not determine the application to be a matter of National Environmental Significance, and therefore not a Controlled Action under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (***EPBC Act***). We submit that this is a flawed conclusion and in direct contradiction to the intentions expressed in the GAB Strategic Management Plan. We note that Glencore did not supply its EIS or technical water reports to the Department, and the Department did not request them for consideration before making its decision. Had they done so, the inadequacies of those documents, some of which are identified by Hancock's own Report, may have contributed to a different decision being taken.

(b) The potential risks and impacts of the project on the groundwater quality within the Great Artesian Basin, especially concerning the findings related to the dification (*sic*) **of groundwater and mobilisation of heavy metals such as lead and arsenic**

In seeking approval for the Project, Glencore states that it wishes to inject 110,000 tonnes of hypercritical CO2 each year into the Precipice Aquifer of the GAB near Moonie in the western Darling Downs area of the Surat Basin.

Glencore cannot meet the current Queensland environment regulations applicable to this Project, and is applying to the Queensland Government to change the relevant environmental regulations which would potentially allow liquid CO2 to be injected into any aquifer in the State.

Despite this, Glencore has stated "Our [EIS] details a range of comprehensive monitoring and verification management measures to ensure the injected, food-grade carbon dioxide does not impact any existing or potential GAB water users".

Whilst Glencore has attempted to play down the risk by labelling the CO2 they will inject as 'food grade' and commenting that it is the same as that used in carbonated drinks[2], **any** CO2 when transported in bulk is labelled as a hazardous liquid, with inhalation risk through leaks or ruptures of pipelines or transportation vessels as the main identified hazard.

Glencore's modelling predicts the 'plume area' created by the CO2 injection to a depth of 2.3km would reach roughly 1.6km in diameter over a century. Water from the plume area would be unsuitable for livestock to drink.

They have made a number of telling admissions, including in their technical report, where they state that no one should be permitted to draw water in proximity to their injection site nor within the zone surrounding it. The also admit that the injection of CO2 will lead to the degradation of the environmental values of the ground water into which the CO2 is received, with a significant lowering of the pH level from a relatively neutral 8.4 to a highly acidic pH of 4.

[2] https://www.abc.net.au/news/rural/2023-11-23/great-artesian-basin-carbon-capture-project-opposition/103080402

This is consistent with the views of noted hydrologist Mr Ned Hamer who has stated that, once injected, the CO2 would have a corrosive effect which would quickly cause a 10,000-fold increase in groundwater acidity, which would dissolve the aquifer rock and result in the mobilisation of heavy metals towards other existing water users.

He is quoted as saying: "Those metals include arsenic and lead and other heavy metals that make the water unsuitable for any use, particularly those uses that are occurring at the moment, such as for livestock"[2].

Mr Hamer labelled Glencore's modelling as 'highly confusing', stating "Typically there is a lot more work done that hasn't been done to make the modelling more accurate"[3].

(c) The scientific basis and transparency of the data supporting the project's safety claims, including the robustness of fieldwork, data, and analysis presented by CTSCo and critiques by independent hydrogeologists and aqueous geochemists

Glencore's EIS submission points to a number of technical reports. Section 8 – Geology, at section 8.2.7 on page 29 highlights that the Project is designed to test "the storage component of CCS in Queensland" as "[it] is not well established". The same paragraph goes on to note that the reason why this test is proposed is that earlier projects in Queensland were abandoned due to unsuitable geology.

Mr Hamer also stated his concerns about Glencore's modelling and assumptions.

"There's a lack of clarity in the model inputs and, secondly, models are only as good as the data that's collected from the field," he said. "Typically, pumping tests would be undertaken on the Precipice Sandstone aquifer over an extended period to test the aquifer at an appropriate scale, similar to the scale they are proposing during the project"[2].

Hancock's Report (at page 7) refers to the similarities drawn between this Project and the underground coal gasification (***UCG***) projects which were approved by the Queensland government in the 2000s. The Linc Energy UCG trial was located nearby Lagoon Gully power station in the Surat Basin, the Cougar Energy UCG trial was located near the Tarong power station in the Tarong Basin and the Carbon Energy UCG trial was located near Bloodwood Creek (Dalby) near the Braemar power station[4]. These trials were approved at the time by the Queensland government as emerging technologies and strategically located to benefit from what was considered to be suitable geological conditions and existing infrastructure.

However, the Report goes on to note that these projects were poorly informed on the technology and the suitability of the local environment and geological conditions. Though the UCG trials were approved, they are widely considered to have been unsuccessful and have or are likely to have

[3] https://www.theguardian.com/australia-news/2023/dec/09/carbon-capture-in-the-great-artesian-basin-risks-greatest-environmental-asset-farmers-say
[4] https://www.qld.gov.au/environment/land/management/abandoned-mines/remediation-projects/bloodwood-creek

resulted in local contamination of groundwater resources[5] [6]. The UCG sites remain in the hands of the Queensland government as legacy sites that will demand significant resources and public expense to rehabilitate - if that is actually possible.

(d) The potential socioeconomic impacts on agriculture and regional communities, relying on the Great Artesian Basin for water, including an assessment of the project's impact on existing and future water use rights

We refer to the Report, which clearly identifies that the decision on the location of the West Moonie-1 Injection Well was based on the assumption that the Precipice Aquifer is saline. It can be demonstrated that this assumption is incorrect, and that the EIS incorrectly assesses the environmental values of the Precipice sandstone. The aquifer is suitable for livestock watering and farming purposes.

As noted under heading (b), Glencore has itself said the Project will lead to deterioration of environmental values of the receiving ground water.

The figure of the GAB contributing to an economic value of $13 billion annually is if anything an understatement, given that the data that led to that value is now almost eight years out-of-date.

As mentioned previously, Hancock owns a total of twelve properties across the GAB with five in the area covered by the Precipice Aquifer that is set to be directly affected by the Project. Like many other agricultural users – and regional communities and industry – we are dependent on this water source for at least part of our water requirement, and its importance is increasingly critical as weather patterns become more uncertain.

(e) The consultation processes undertaken with stakeholders, including farmers, Indigenous landholders, environmental groups, and the broader public, and the adequacy of these processes in addressing stakeholder concerns

Hancock has serious concerns regarding the adequacy of the consultation process for the Project undertaken by Glencore.

The main result of feedback on the draft EIS to which Hancock contributed the Report seems, based on our review, to have been that Glencore removed sections of its EIS that had been criticised.

There have been no significant amendments that address concerns raised in our Report or in some of the other materials and commentary mentioned in previous paragraphs of this Submission.

Our own Queensland staff advise us that there was little publicity given via effective media to those on the ground to the proposed Project or the submissions to the Queensland or Federal environmental departments as the Project approvals processes proceeded.

We have also become aware that other key stakeholders including the Great Artesian Basin Stakeholder Advisory Committee (***GABSAC***) were not properly consulted, with no meetings taking

[5] https://statements.qld.gov.au/statements/77713

[6] https://www.couriermail.com.au/news/queensland/cougar-energy-fined-75000-for-releasing-cancer-causing-chemical-into-groundwater-at-coal-seam-gas-trial-at-kingaroy/news-story/7b5bd2ec9979a5c284e2874a89f532d7

place between 2019 and 2022, and then only after the EPBC Act approval had been given. Failure to consult with the GABSAC is particularly surprising, given its remit specifically references that it will:

1) present the views of the industries, communities and stakeholders.

2) provide a sounding board for the implementation of the Great Artesian Basin Strategic Management Plan [to] ensure the delivery of the plan and projects in the GAB is well informed, and that the best possible economic, environmental, cultural and social outcomes are obtained for the Basin and its users. [GABSAC] will provide advice to governments and ministers on a wide range of relevant issues, including:

   - the sustainability of the artesian and sub-artesian water resources
   - the environmental, economic, social and cultural significance of the water
   - whole-of-Basin policies and initiatives being applied and developed by Basin governments.[7]

The fact that Glencore's consultation was manifestly inadequate was a major opportunity lost for stakeholders to provide effective and meaningful input into the Project's proposals.

(f) The potential precedent set by allowing CCS projects within the Great Artesian Basin and its implications for future projects, considering Australia's strategic interests in preserving its largest groundwater system

This question has largely been covered off in our comments under the preceding paragraphs. It is our view that the risks inherent in this Project, including previous the previous UCG failures referred to under heading (c) that have had significant environmental consequences and left the taxpayer footing the remediation bill, mean that it is an unsuitable location for the application of CCS technology. It would be an extremely undesirable precedent to allow experimentation with the precious water resource in the GAB for what would at most be a very limited return. As noted previously, there are prior local examples which have a legacy of failure and possibly irreversible effects on groundwater.

The vast majority of CCS projects that are being undertaken around the world are in depleted hydrocarbon reservoirs whose characteristics are well known to the project proponents after long production life. Depleted reservoirs are stable geological structures with known 'seals', which is why the hydrocarbons were trapped there in the first place. Injecting CO2 into those depleted reservoirs is a known proposition with very limited risk of adverse environmental consequences.

This is in distinct contrast to the aim of the Glencore Project to inject liquefied CO2 into an active and crucially important water resource – a major aquifer of regional and national significance and value.

[7] https://www.dcceew.gov.au/water/policy/national/great-artesian-basin/great-artesian-basin-stakeholder-advisory-committee

(g) The role of CCS technology in Australia's broader climate change mitigation strategy, including an evaluation of its efficacy, risks and alternatives

Hancock believes that CO2 sequestration at scale into depleted hydrocarbon reservoirs can be an appropriate and safe technology to mitigate the release of CO2 into the atmosphere.

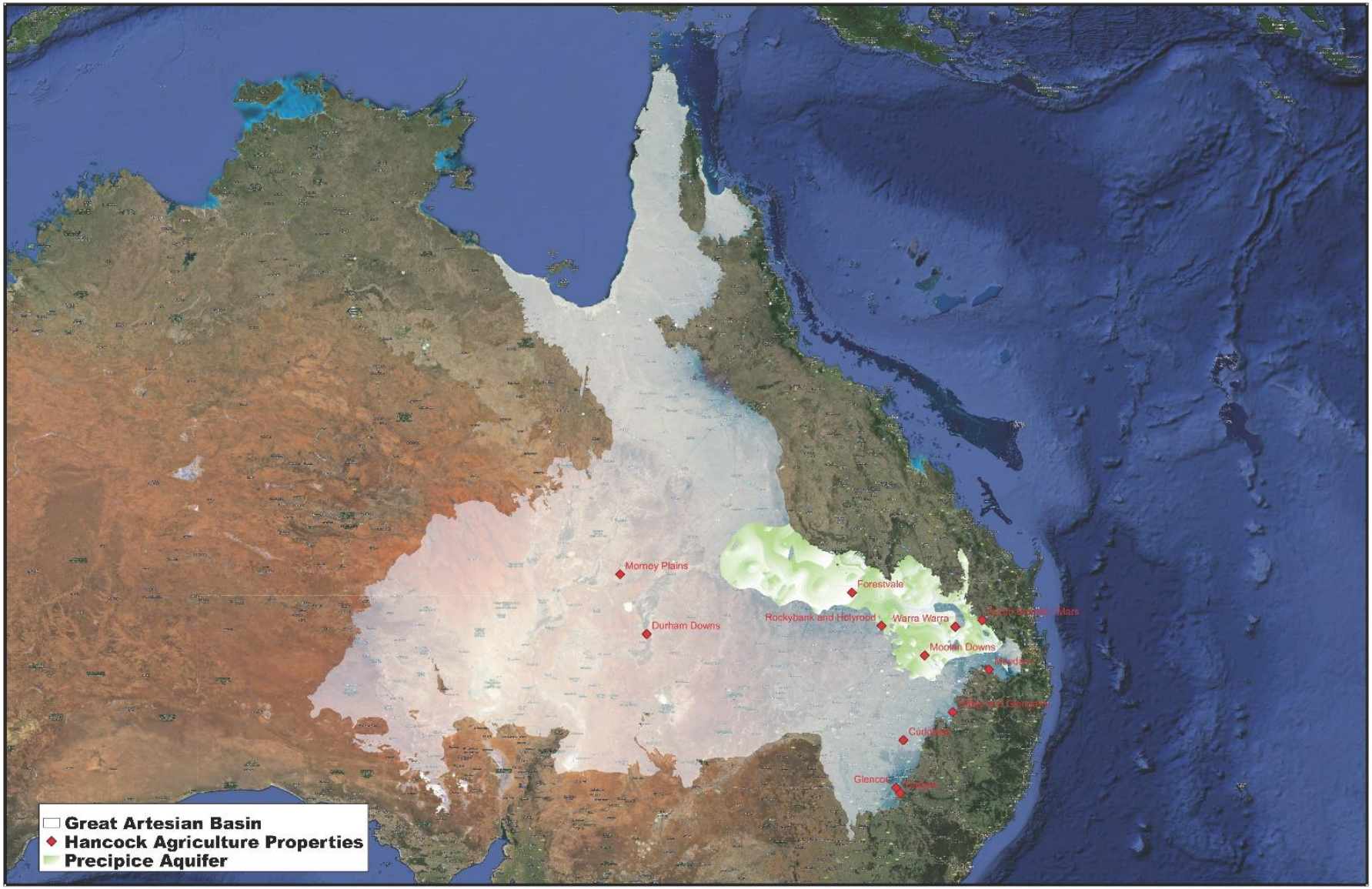
Numerous scientific studies and assessments, such as those by the International Energy Agency (IEA) and the Intergovernmental Panel on Climate Change (IPCC) provide evidence of the technical feasibility, environmental safety, and potential scalability of CCS technologies for reducing CO2 emissions.

CCS enables the continued use of fossil fuels, such as natural gas, while minimizing their environmental impact. This can help enhance energy security by diversifying energy sources and reducing dependence on imported fuels.

Whilst deployment of CCS at commercial scale in Australia has been limited to date, additional to the Gorgon CCS project there are a number of projects in advanced stages of development such as Santos' Moomba CCS project and a number of demonstration projects that could further prove the commercial viability of this technology. Although not currently investing in CCS directly, Hancock supports these efforts.

Yours faithfully,
For and on behalf of Hancock Prospecting Pty Ltd

Adam Giles
Chief Executive Officer – Agriculture, Food & Fibre



Great Artesian Basin and Precipice Aquifer Map

Technical Groundwater Review of the
Surat Basin Carbon Capture and Storage Project Draft EIS

Prepared for

Hancock Prospecting Pty Ltd

1. Introduction

hydrogeologist.com.au has been engaged by Hancock Prospecting Pty Ltd (Hancock) to undertake a technical groundwater review of the Surat Basin Carbon Capture and Storage (CCS) Project Environmental Impact Statement (EIS). The draft EIS has been submitted by Carbon Transport and Storage Corporation (CTSCo) Pty Limited.

The project is seeking to conduct greenhouse gas (GHG) (predominantly carbon dioxide [CO_2]) storage injection testing and would be located approximately 44 kilometres (km) south-west of Moonie, Queensland. The project covers a disturbance area of approximately 13.6 hectares (ha) of 1,079 ha of operational lands within GHG exploration tenement EPQ10.

The project will involve injection testing of up to 110,000 tonnes of GHG stream (CO_2) per year for up to three (3) years, totalling 330,000 tonnes. The project will include transport of the GHG stream by truck along 260 km of existing local and State controlled roads from Millmerran Power Station to the site, approximately 640 m of road improvements to Harts Road, a Transportation Facility, 9.5 km of flowline, an injection well and associated monitoring infrastructure. The project's expected life is seven (7) years, including construction, operation, monitoring, and rehabilitation.

The technical groundwater review has been carried out by Daniel Barclay. Daniel has a Bachelor of Applied Science (Hons) in Geology from the Queensland University of Technology. Daniel has over 25 years' experience as a hydrogeologist within the consulting, government and mining sectors. He has carried out numerous groundwater impact assessments in Queensland, New South Wales, South Australia and Victoria; and has provided third party technical reviews on a number of large mining projects.

Since 1999, Daniel has been involved with groundwater studies in the Great Artesian Basin (GAB) and has been involved with numerous drilling programs, conceptualisation assessments and the numerical modelling of groundwater flow within the various aquifers of the GAB. He has an intimate knowledge of the GAB, has worked on specific projects involving the Precipice Sandstone, and is appropriately qualified and experienced to undertake this technical groundwater review of the draft EIS.

2. Data review

The draft EIS submission is available to view and download from the CTSCo website[1]. This technical review considered the following chapters/appendices from the draft EIS:

- 00 Executive Summary;
- 08 Geology;
- 09 Groundwater;
- 20 Cumulative Impacts;
- Appendix 8 – Well completion reports; and
- Appendix 9 – Groundwater Impact Assessment Technical Report.

In addition to the draft EIS documentation, the following publicly available reports were also considered:

- Hoffman et al., 2020. Hydrogeology of the Southern Surat Basin. Final report for the Australian National Low Emissions Coal Research & Development (ANLEC) Report for the project 7-C316[2].

3. Review

3.1. Geology and hydrogeology

The draft EIS is supported by the following site bores:

- West Moonie-1 Injection Well;
- West Moonie-2 Monitoring Well;
- West Moonie Shallow Monitoring Bore, and
- Gubberamunda Monitoring Bore.

Page 21 states that these have been *designed, drilled, constructed and equipped by or on behalf of CTSCo comply with the relevant Australian Standards, code and guidelines, including the "Code of Practice for the construction and abandonment of petroleum wells andassociated bores in Queensland" (DNRME, 2019).* However, according to Queensland Globe the above bores are not registeredfacilities and it is unclear whether these groundwater monitoring bores were supervised by a Class 3 water bore driller as required under the Water Act 2000. Only details of the West Moonie-1 Injection Well and West Moonie-2 Monitoring Well are provided in Appendix 8 (Well Completion Reports). Full details of the monitoring bores should be provided anduploaded to Queensland Globe for public access.

Page 23 of the executive summary states that *the 3D seismic program is scheduled to be undertaken in Quarter 1 (Q1) 2023, depending upon weather and ground conditions.* From this it is understood that no 3D seismic testing has been completed to date, and therefore with the exception of the well (point) data and an initial 2D seismic survey, there is no detailed understanding of the geology and structural geology on the project site. It is not unreasonable to suggest that this data acquisition should be available to inform the draft EIS prior to approval of the project.

Hoffman et al., (2020) states that the Precipice Sandstone is *assumed or inferred to have lower quality groundwater and the potential for CO_2 enhanced water recovery as has been investigated elsewhere (e.g., Garnett et al., 2019; Harfoush et al., 2019; La Croix et al., 2019; Pearce et al., 2019a). However, uncertainties remain around the central southern Surat Basin hydrogeology such as flow paths and the connection to the Clarence-Moreton Basin in the east, connectivity of faults (e.g., between the Precipice and Hutton sandstones around the Burunga-Leichardt / Moonie-Goondiwindi fault) and water chemistry/hydrochemistry distribution.*

[1] https://www.ctsco.com.au/about#eis

[2] https://anlecrd.com.au/projects/regional-hydrogeology-of-the-southern-surat-basin/

The information presented on a local and regional scale highlights significant uncertainty associated with the Precipice Sandstone geology and its horizontal and vertical hydraulic relationships on a local, sub-regional and regional basis.

The draft EIS often shows a differing extent of mapped Precipice Sandstone in the region. For example, the extents shown in Figure 9-19 and Figure 9-26 (Chapter 9) are different. It is unclear why this difference would occur, and this brings into question which datasets have been used and the reliability and comparability between the various assessments.

Hoffman et al., (2020) goes on further to state *salinity is low to moderate and slightly higher in the Precipice Sandstone with electrical conductivity (EC) values ranging from 775 to 6350 µS/cm (median 2000 µS/cm) in the Hutton Sandstone, 656 to 7750 µS/cm (median 1800 µS/cm) in the Evergreen Formation and 193 to 8301 µS/cm (median 2468 µS/cm) in the Precipice Sandstone.*

The EC, as a proxy for the total dissolved solids (TDS), increases with depth in all formations. A gradual increase in salinity occurs fromthe northern edges of the Surat Basin towards the central north and central south Surat Basin. A further increase occurs with flow directions to the east across the Cecil Plains into the Clarence-Moreton Basin. The highest salinity samples (EC 6769 – 8301 µS/cm) from the Precipice Sandstone are in the Chinchilla and Condabri regions east of the Burunga-Leichardt fault zone, which are at a medium depth. They are closer to the eastern margin of the basin and the subcrop areas of the Hutton and Precipice sandstones. Potential leakage from shallow, higher salinity waters may be the cause of the higher salinities. This is consistent with previous work focussed on the northern Surat Basin (Raiber and Suckow, 2017; Suckow et al., 2018). The two lowest salinity samples of the Precipice Sandstone in this study were sampled from bores near Cecil Plains.

Local differences deviating from the general north-south trend were observed, for example, groundwater bores in the Precipice Sandstone around the Moonie Oil Field have much lower TDS values than other parts of the Precipice Sandstone. Heterogeneities in permeability and dual porosity effects are potential reasons, where higher groundwater fluxes occur in higher permeability units and macro pores, leading to generally higher exchange rates of water volumes. Groundwater in finer, low permeability units on the other hand often has higher TDS due to low flow or stagnant conditions. The Moonie Oil Field has been pumped for decades and groundwater is most likely drawn from higher permeability units, producing the lower salinities.

Further to our above statement, the information presented highlights significant uncertainty associated with the Precipice Sandstone flow paths on a local, sub-regional and regional basis. This uncertainty needs to be addressed prior to project approval.

3.2. Groundwater quality

Page 14 of the executive summary states *CTSCo previously held EPQ7 in the northern Surat Basin. At an identified development site16 km west of Wandoan township, CTSCo conducted extensive studies of the feasibility of GHG injection testing between 2009 and 2019, including the drilling of the West Wandoan-1 well to a depth of 1,293 m below surface into the Moolayember Formation, the acquisition of detailed geological and hydrogeological data from the Glenhaven 3D Seismic Survey, studies into existing CO_2 atmospheric dynamics,and various baseline studies of surface water quality, groundwater quality, air quality and the atmosphere. The characteristics of the siteincluded:*

- *a freshwater source for existing community and shared bores that draw water from the Precipice Sandstone aquifer for agriculture and community use, including the drinking water supply of Wandoan township;*
- *water quality that meets various water quality objectives including for aquatic ecology, town water supply, and irrigation, stock and domestic use; and*
- *potential for community opposition to GHG storage injection testing at this location due to the community's existing use of thewater drawn from the Precipice Sandstone aquifer.*

Given the potential impacts associated with water quality within the predicted plume, and community concerns from users of water from the Precipice Sandstone aquifer, in close consultation with Department of Resources, CTSCo made the decision to cease activities in EPQ7, with EPQ7 fully relinquished in 2019.

The decision to investigate EPQ10 and locate the West Moonie-1 Injection Well in its current location was that the

*Precipice Sandstone aquifer is **saline**, and the closest entity that accesses the aquifer is for the purposes of oil and gas production.*

The basis for the development of the project at its proposed location is the assumption that the Precipice Sandstone is saline, and the closest user is oil and gas production at Moonie. Hoffman et al. (2020) broadly describes the existing salinitydata (total dissolved solids - TDS) for the Precipice Sandstone in the range of 210 to 5700 mg/L with a median of2120 mg/L and a mean of 2344 mg/L. Hoffman et al. (2020) goes on to state that t*he highest salinities occur around the Burunga-Leichardt Fault and the salinity at the EPQ10 site is 2849 µS/cm (TDS of 1823 mg/L).*

Chapter 9 of the draft EIS states that *the TDS content from West Moonie-1 Injection Well sample is about 1,850 mg/L, which is very close to the TDS in the 2018 samples ranging from 887 to 1,550 mg/L, indicating fresher groundwater*. In fact, the TDS of groundwater from the West Moonie-1 Injection Well is fresher than the median TDS concentration of 2120 mg/L and mean TDS concentration of 2344 mg/L identified from the larger Surat Basin assessment (Hoffman et al., 2020).

Table 9-19 of the draft EIS states that there are only three representative groundwater quality samples available from West Moonie 1 with which to characterise local Precipice Sandstone groundwaters in the project area. This number of groundwater samples is considered insufficient to characterise baseline conditions and on which to base an impact assessment for a GHG CCS project. Furthermore, the spatial and temporal extent of the project dataset (three sample points taken on the same day in 16/7/2021 at one bore) is insufficient on which to base an impact assessment for a GHG CCS project. The closest datapoint in excess of 20 km away from the injection site.

Brackish water is typically regarded[3] as water with TDS between 1500 mg/L and 5000 mg/L. The information provided in the draft EIS strongly indicates that the local and regional groundwaters of the Precipice Sandstone are indeed brackish and not saline as the draft EIS would suggest.

Further to the comment above, Appendix 9 (Section 4.5.5) of the draft EIS goes on to describe the Precipice Sandstone aquifer has yielding brackish groundwater which conflicts with the premise or assumption outlined in the executive summary (Section 9.5.2) of the draft EIS. If the Precipice Sandstone aquifer is not saline, surely this should impact the high level decision to investigate EPQ10 and locate the injection trial in its current location.

In regards to fluoride concentrations, page 89 of Hoffman et al. (2020) states *F concentrations are high in some of the groundwaters with values for the whole dataset ranging from 0.01 to 9.32 mg/l. Highest F concentrations occur in the Precipice Sandstone (min=0.03, max=9.32, median=0.85 mg/l), the Evergreen Formation (min=0.10, max=6.70, median=0.7 mg/l) and the HuttonSandstone (min=0.02, max=8.60, median=1.3 mg/l). The F levels (range from 0.01 to 9.3 mg/l) in some groundwater bores exceed the World Health Organisation (WHO) drinking water limits of 1.5 mg/l and exceed the levels that can cause severe health hazards of3 mg/l. Concentrations increase with depth and distance in these units and the highest concentrations occur in the central northern and central southern Surat Basin around the Burunga-Leichardt Fault, the Moonie-Goondiwindi Fault and the EPQ10 site (Appendix).*

High fluoride is well known in the GAB and there are certain regions such as the Flinders that are well known to have high fluoride values. The high fluoride in these regions does not restrict the use of the GAB groundwaters for stock watering purposes.

3.3. Environmental values

Page 50 of the executive summary states *the existing water quality of the Precipice Sandstone aquifer is characterised as having lowwater quality that is saline, high in iron (long-term), high in fluoride, and high in total dissolved solids, and is unsuitable for aquatic ecosystems, and unsuitable for irrigation water, stock water, and drinking water.*

As discussed above, page 35 of Hoffman et al. (2020) describes the groundwater quality of the Precipice Sandstone as follows *a broad analysis of the existing data for the Precipice Sandstone classifies the water to be Na-HCO3 to Na-Cl type with TDS inthe range of 210 to 5700 mg/L with a median of 2120 mg/L and a mean of 2344 mg/L.*

There is consistent misinterpretation presented in the draft EIS that the Precipice Sandstone is saline. This assessment is incorrect and the Precipice Sandstone yields brackish, usable water on a local and regional basis.

Chapter 9 of the draft EIS (Page 42) states u*nder the EPP, groundwater within the Precipice Sandstone aquifer in the Project Area ischaracterised as belonging to the Basal Great Artesian Basin Zone, in the Eastern Central Area, with the applicable EVs presented in Table 9-21. A comparison of the groundwater quality sampled from the Precipice Sandstone aquifer via West Moonie-1 Injection Well, with the WQOs for the listed EVs is discussed below. Generally, the water quality at West Moonie-1 Injection Well indicates that the aquifer is naturally not consistent with the WQOs for the identified EVs. Additionally, the depth to the aquifer would be a limiting factor for most users. Shallower aquifers with better water quality would be used instead as a source of water.*

It is not clear what the term "the aquifer is naturally not consistent with the WQOs for the identified EVs" means. This statement is illogical. We would also argue that the depth of the aquifer or bore is irrelevant when considering all but aquatic ecosystems. If suitable water quality is available at a certain depth, the issue of drilling depth and bore construction costs becomes an economic consideration rather than relevant to the assessment of environmental values.

Chapter 9 of the draft EIS (page 52) summarises the Precipice Sandstone as *a regional sandstone aquifer, representing the deepestand oldest unit of the Surat Basin. Regional groundwater levels suggest a flow divide just south of the Great Dividing Range. This separates the aquifer into a shallow northern flow system with many EVs and a more saline southern zone located at depth with limited to no EVs.*

Once again there is misinterpretation presented in the draft EIS that the Precipice Sandstone is saline, and this has influenced the assessment of EVs. The Precipice Sandstone yields fresh to brackish water and is suitable for livestock watering purposes over much of the GAB. Irrigation and farm use/supply EVs are both relevant to the Precipice Sandstone and it can be argued that Precipice Sandstone groundwaters are used extensively for farm use / supply in the GAB. Furthermore groundwaters of the Precipice Sandstone may be blended with surface waters where available to provide further flexibility in its environmental value.

Chapter 9 of the draft EIS (page 43) states *this EV aims to ensure that water provided to livestock is of sufficient quality to prevent any deterioration in the health or condition of watered livestock. The natural occurring fluoride concentrations from the samples may be hazardous to livestock health (particularly young livestock). This is likely to render the in situ groundwater from the Precipice Sandstoneaquifer in the location of West Moonie-1 Injection Well unsuitable for livestock consumption (Table 9-24).*

The groundwater is unsuitable for livestock consumption and would present a risk to stock based on the fluoride concentration. In addition, as discussed in section 9.3.6.1.2, the water is likely to be corrosive and foul equipment used to pump water to troughs for drinking. Overall, on this basis, the water is unlikely to be suitable for the purposes of stock water.

As stated above, other areas and aquifers of the GAB have high fluoride concentrations and are successfully used for livestock watering purposes.

[3] https://vfa.vic.gov.au/recreational-fishing/fishing-locations/inland-angling-guide/special-articles/water-salinity

3.4. Groundwater users

Chapter 9 of the draft EIS (page 46) states *there are no registered bores associated with the three licences allocated to the Precipice Sandstone, indicating that the Precipice Sandstone licences are currently not being utilised.*

Chapter 20 of the draft EIS (page 7) states *a search of the Queensland database for water entitlements (DMRDW 2022) was undertaken to identify sub-surface water licences within 50 km of the West Moonie-1 Injection Well. This search identified three water licences for the Precipice Sandstone as shown in Figure 20-3. These licences have a combined allocation of 515 ML/y. No registered bores are associated with these water licences, indicating that no bores have been drilled, and that the Precipice Sandstone water licences are currently not utilised. For two of the properties, water licences and registered bores have been drilled and are operating, both accessing the Gubberamunda Sandstone aquifer.*

Further, Chapter 20 of the draft EIS (page 9) states *CTSCo will continue to check whether registered bores are drilled within the identified lot on plans under the water licences, and where appropriate, engage directly with the holders of the water licences.*

It is our understanding of the water licence application process that water licences are generally only issued once it can be demonstrated that the aquifer is present, and the supply can be extracted from a constructed bore. This is typically carried out with a pumping test carried out on a suitably constructed bore. We find it difficult to believe that the government would issue a licence without a development application and proven ability to take the groundwater.

The proponent should be engaging now with the holders of these water licences and the government to confirm the presence of groundwater bores. Regardless, the holders of these water licences are entitled to take water from the Precipice Sandstone and the proponent should assess impacts against these properties.

3.5. Monitoring and mitigation

As part of the monitoring and mitigation measures proposed by the proponent, six monthly groundwater monitoring is proposed for the EA conditions. We are of the opinion that six monthly monitoring is vastly inadequate for establishing a baseline data set and assessing compliance for a project with a three year injection schedule.

The Queensland guidelines [4] should be followed for assessing trigger levels and contaminant limits and they define a statistically relevant dataset for baseline characterisation. Six monthly groundwater monitoring will not allow compliance against the guidelines.

Table 9-30 provides a 5000 µS/cm trigger value for electrical conductivity (EC). The application of this trigger will allow for a 270% increase (deterioration) in EC before an investigation is triggered. This method of defining trigger levels is based on an inadequate baseline dataset, is flawed and does not allow for the protection of groundwater quality and EVs in a regionally significant aquifer of the GAB.

We are also concerned about the lack of proposed groundwater monitoring in the Hutton Sandstone. The Hutton Sandstone is present between the Gubberamunda Sandstone and the Precipice Sandstone and would be considered at higherrisk of impact than the Gubberamunda Sandstone. The monitoring strategy for the project should include monitoring within the Hutton Sandstone.

[4] https://www.publications.qld.gov.au/dataset/groundwater-quality-assessment-guideline/resource/472cc88a-000a-4bb8-a60d-204cfe7e0238

The groundwater impact assessment is currently based on the approach that one monitoring bore in the Precipice Sandstone (180 m from the injection well) will be sufficient to confirm predictions and the success of the injection trial. We would strongly recommend that the monitoring network within the Precipice Sandstone be improved substantially to better understand the baseline conditions and the spatial and temporal changes within the Precipice Sandstone. The current assessment assumes radial flow and homogenous conditions within the project area. There is sufficient uncertainty in the impact assessment to warrant additional monitoring bores in the Precipice Sandstone. Monthly monitoring from a ring ofsix monitoring bores at 500 m from the injection well would confirm baseline conditions and would allow for spatial variation to be assessed. These bores could then be used to verify the modelled extent of the CCS plume.

4. Closure

We are of the opinion the CCS is a valuable technology and appropriate for tackling the current issues of climate change. However, we are opposed to the location of the CCS trial within the GAB and the targeting of a major aquifer with regional significance and value. The inference of the Precipice Sandstone as saline with no environmental value is incorrect and the conclusions of the draft EIS have been influenced by this presumption.

The primary purpose of the project is to demonstrate the viability of geological storage of CO_2 in the Surat Basin to allow the later assessment of the region for potential future large-scale CO_2 storage. Similarities are drawn between this project and the underground coal gasification (UCG) projects which were approved by the Queensland government in the 2000s. The Linc Energy UCG trial was located nearby Lagoon Gully power station in the Surat Basin, the Cougar Energy UCG trial was located near the Tarong power station in the Tarong Basin and the Carbon Energy UCG trial[5] was located near Bloodwood Creek (Dalby) near the Braemar power station. These trials were approved at the time by the Queensland government as emerging technologies and strategically located to benefit from what was considered to be suitable geological conditions and existing infrastructure.

However, history informs us that these projects were poorly informed on the technology and the suitability of the local environment and geological conditions. The UCG trials were approved yet are widely considered unsuccessful and have or are likely to have resulted in local contamination of groundwater resources[6][7]. The UCG sites remain in the hands of the Queensland government as legacy sites that will cost significant resources and cost to rehabilitate (if at all possible).

The draft EIS states quite clearly that the decision to investigate EPQ10 and locate the West Moonie-1 Injection Well in its current location was based on the assumption that the Precipice Sandstone aquifer is saline. It can be demonstrated that this inference and assumption is incorrect.

Further the draft EIS incorrectly assesses the environmental values of the Precipice Sandstone. The Precipice Sandstone is suitable for livestock watering and farm use purposes and this needs to be recognised by the Queensland government prior to approval of this project.

There is sufficient uncertainty identified within the various studies to recommend that additional work is carried out prior to approval. This uncertainty relates to the understanding of baseline conditions within the Precipice Sandstone and the overlying stratigraphy. There is also uncertainty relating to the groundwater users of the Precipice Sandstone, and the spatial variation on a project site scale. Additional monitoring and data is required to inform the EIS process.

We thank you for the opportunity to provide this technical review of the draft EIS.

If you have any queries, please do not hesitate to call on mobile:

Yours faithfully,

Daniel Barclay
Principal Hydrogeologist
hydrogeologist.com.au

[5] https://www.qld.gov.au/environment/land/management/abandoned-mines/remediation-projects/bloodwood-creek

[6] https://statements.qld.gov.au/statements/77713

[7] https://www.couriermail.com.au/news/queensland/cougar-energy-fined-75000-for-releasing-cancer-causing-chemical-into-groundwater-at-coal-seam-gas-trial-at-kingaroy/news-story/7b5bd2ec9979a5c284e2874a89f532d7