

## Environmental Defenders Office - Suggested Questions for Government Agencies and Santos

### Questions for Department of Planning, Industry and Environment

1. Did the Department conduct an assessment of the project against the principles of ecologically sustainable development? There doesn't seem to be any mention of this requirement in the Assessment Report.
2. The assessment report refers to the *Brigalow Belt Nandewar Community Conservation Area Act 2005 (BNCCA Act)*, and the fact that much of the project area is within Zone 4 of that Act, which is, in the words of the Assessment Report "expressly zoned for forestry, recreation and mineral extraction" (page xv). The assessment report contends that "there is greater strategic support for the use of this land for the project than there is for its permanent protection for conservation."

However, the Assessment Report does not refer to the *Brigalow and Nandewar Community Conservation Area Agreement 2009*, so it's not clear if that agreement informed the Department's assessment. This Agreement is created under the *BNCCA Act* to provide a coordinated framework to manage lands including public land subject to this project proposal.

Did the Department conduct any sort of assessment of the project against the high level strategic aims in section 8.1 of the *Brigalow and Nandewar Community Conservation Area Agreement 2009*, the first of which is that all zones are to be managed "for social, economic and environmental sustainability, based on the principle of intergenerational equity"? There are other relevant provisions of that agreement about ecologically sustainable development, connection to country, Aboriginal access to land for cultural use and biodiversity management that is responsive to the changing climate. Has this agreement been taken into the Department's consideration?

3. The Assessment Report says that that the project will add gas supply and "put downward pressure on gas prices" (Exec Summary pages xvii and xix, main report paragraphs 74, 94 and 606). Can you tell us what analysis and information was provided about this project that led you to this conclusion?
4. Narrabri Shire Council's support for the project appears to be conditional on the inclusion of consent conditions that apply a three-layered policy of security deposits, enhanced insurance coverage, and an environmental rehabilitation fund or an alternative to the satisfaction of the NSW Chief Scientist & Engineer. Can you tell us why such conditions have not been included in the conditions of consent drafted by the Department?
5. The Water Expert Panel stated that it would be prudent to fully document methane occurrences in groundwater and determine their likely source, "prior to major CSG developments in the area" and "to document known occurrences of methane and the surface or in wells or water bodies in the Narrabri region prior to commencement." Why has this not been done prior to determination?

6. Are you aware that there are seismic data indicating the presence of faults and volcanic intrusions extending from the base of the Gunnedah Basin, upwards into the base of the Pilliga Sandstone in the area<sup>1</sup>?

This seismic data was collected by Santos' former coal seam gas partner Eastern Star Gas and identified that "A north-south seismic section along the axis of the [Wilga Park] anticline maps faults that cut into the Pilliga Sandstone and a volcanic plug that extends from the regional basement and passes upwards through the Maules Creek Formation and Hoskissons coal seam into the base of the Pilliga sandstone."<sup>2</sup>

The Water Expert Panel said that the presence of geological faults could create "an impact on groundwater flow that would not be evident in the model."

The Water Expert Panel recommended "detailed geological mapping and seismic investigation be conducted prior to selecting final well locations" Is this captured by the "topographic baseline survey" required as part of the Groundwater Management Plan in Condition B38 (d) (iv)? Do you anticipate that this survey would be undertaken across the entire project area? Why was it not deemed important to detect faults and incorporate them into the model as part of the determination process?

7. The Department's Assessment Report asserts that "the Department accepts that there is adequate depth in the market for all affected water sources to accommodate the relatively small water take associated with the project" (paragraph 309). This seems contrary to the DPIE Water agency's advice that "the acquisition by Santos of licences in some groundwater sources is not guaranteed, as some sources are fully allocated with high competition for groundwater entitlement" (DPIE Advice on Conditions 9 October 2019) and to remarks by the Water Expert Panel about the limited historical trading in the productive groundwater sources that will be affected by the project. Can you account for this difference?
8. There seems to be a serious discrepancy between the discharge rate from the Pilliga Sandstone to the Lower Namoi Alluvium in the water model used by the Government to manage that water source and the discharge rate used by Santos in its groundwater model.

In a discussion about this discrepancy and the drawdown likely to be caused by the gasfield in the Lower Namoi Alluvium the Water Expert Panel observes that "it would be risky for the project to assume whatever [water] the [Narrabri Gas Project] requires will be available" (223 of PDF) because while not large in comparison to current usage, it is "likely to be large in comparison to the historic trading patterns." Has the Department's assessment considered what environmental and social risks there might be from the proponent not being able to secure entitlements for this water? Is it true to say that once dewatering and gas production begins, this flow-on effect on overlying aquifers though it may take some time to occur, will not be able to be stopped?

9. Advice from DPIE Water and the EPA both made comments on the inadequacy of Santos' proposed monitoring network and trigger thresholds, remarking in its submission that data presented in the Water Baseline Report was not sufficient to adequately determine

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<sup>1</sup> From Iverach et al., 2020: "The Wilga Park Anticline located 5 km to the south of Narrabri runs north-south, through our study area (Supplementary Fig. 1). A north-south seismic section along the axis of the anticline maps faults that cut into the Pilliga Sandstone and a volcanic plug that extends from the regional basement and passes upwards through the Maules Creek Formation and Hoskissons coal seam into the base of the Pilliga sandstone. The faults and plug contact zones are potential pathways for groundwater and gas to migrate."

<sup>2</sup> Iverach et al. (2020). <https://www.sciencedirect.com/science/article/pii/S0048969719349198#m0010>

thresholds to identify change in the condition of the water resources, especially for Gunnedah-Oxley Basin aquifers where there is very limited existing information available.

The Groundwater impact assessment made mention of fifteen bores that access deep aquifers of the Gunnedah Oxley Basin to the east of the project (Groundwater Impact Assessment Part 1 4-39-40). Has there been any assessment conducted that identifies the scale of impact landholders relying on these bores are likely to experience?

10. DPIE Water's final advice requests that "management response triggers" be imposed on the gas field in accordance with its earlier advice which is Attachment B to document OUT18/6607 dated October 2018. The action responses requested in that document for several groundwater formations state that if re-assessment is triggered and shows impacts on greater than the Level 1 minimal impact considerations in the Aquifer Interference Policy "the proponent consult with DP&E as to the requirement to re-apply for project approval." Do you understand this to mean that the water agency is proposing that the development consent be halted or revoked if these triggers are reached? Is there a mechanism in the draft consent conditions that would allow a re-application of this kind?
11. The "very low presence of sulphate in the target aquifers," (paragraph 348) is cited in the Assessment Report as a reason to not be concerned about the risk of sulphate-reducing bacteria. But the target aquifers are not the only formations that will be drilled and drilling fluid will introduce sulphate to the system. The *Drilling Fluid Risk Evaluation* conducted for Santos for its Dewhurst pilot (the consent for which is proposed to be rolled into this consent) stated that "Due to the naturally elevated background levels of sodium and sulphate within the shallow groundwater system (Narrabri sediments) the dissolution of sodium and sulphate from drilling muds is not anticipated to have a measureable impact on groundwater quality." (*Dewhurst Gas Exploration Pilot Expansion Response to Submissions* Appendix 3). At that stage, Santos was arguing that the presence of sulphate-reducing bacteria was a factor that would limit the spread of sulphate. The drilling fluids contain biocides designed to inhibit these microbes, but did the Department undertake any investigation into this issue and the effectiveness of Santos' strategy?
12. "Like for like land based offsets" (paragraph 467) for biodiversity impacts are proposed, but no actual offset areas specified. The property search conducted for the Biodiversity Offset Strategy in the Response to Submissions (Appendix F Response to Submissions) found a total of 11 suitable properties in the entire Brigalow Belt South IBRA Bioregion, which together host 6,796 hectares of native vegetation. The amount of native vegetation, of specific plant communities, estimated to be required to offset the impacts of the gas field in the Pilliga is 6,472 hectares. The Assessment Report mentions the 282,000 hectares of native vegetation on private property in the bioregion found in that draft Biodiversity Offset Strategy, but not the property assessment that indicated that Santos may need to buy every eligible private property in the bioregion to secure their offsets? Has the Department considered how this might affect the social impact considerations for the Project?

Does this information suggest that Santos may not be able to secure sufficient land based offsets to meet the specified offset credit requirement? Did the Department consider what that limited availability of suitable offset properties suggested about the relative importance of the habitat in the Pilliga in the context of the bioregion as a whole?

13. What is the purpose of proposed Condition A23, which gives the Planning Secretary the power to cut out other agencies and parties that would otherwise have involvement in management plans and how does this accord with the EPA's status as "lead regulator?"
14. Is it the Department's contention that field-based data and robust hydrogeological conceptualization will be incorporated into groundwater modelling after the approval for a project is given, and after partial commencement of construction of the project begins?
15. Will there be any avenue available to halt phase 2 of the development from proceeding if it is found, after the model is calibrated, that the scale and duration of impacts of the gasfield dewatering on other water users and on groundwater dependent ecosystems will be unacceptable?
16. Are you aware that peer-reviewed research with significant relevance to the question of inter-aquifer connectivity has been conducted by UNSW and ANSTO, using a range of geochemical, microbiological, and geophysical data from the project area (two papers by Iverach et al)? Are you aware that this research indicates potentially substantially greater levels of inter-aquifer connectivity between the deep layers of the Gunnedah Basin targeted by CSG extraction, and the overlying aquifers, including the important GAB and Namoi Alluvium water sources?
17. Is it feasible to remediate impacts – such as the enhanced leakage of methane into water bores, and enhanced leakage of water beyond that predicted, once gas drilling and extraction activity has commenced? If so, explain how these impacts can be remediated.
18. Is it possible that if inter-aquifer connectivity is greater than currently modelled, the extent of leakage of water from the Namoi Alluvium and Pilliga Sandstone would be greater than what is currently predicted in the modelling?

**Questions for DPIE – Environment, Energy and Science (EES) Group (biodiversity)**

1. "Like for like land based offsets" (paragraph 467 of the Department's report) for biodiversity impacts are proposed, but no actual offset areas specified. The property search conducted for the Biodiversity Offset Strategy in the Response to Submissions (Appendix F Response to Submissions) found a total of 11 suitable properties in the entire Brigalow Belt South IBRA Bioregion, which together host 6,796 hectares of native vegetation. The amount of native vegetation, of specific plant communities, estimated to be required to offset the impacts of the gas field in the Pilliga is 6,472 hectares. The Assessment Report mentions the 282,000 hectares of native vegetation on private property in the bioregion found in that draft Biodiversity Offset Strategy, but not the property assessment that indicated that Santos may need to buy *every* eligible private property in the bioregion to secure their offsets?

Does this information suggest that Santos may not be able to secure sufficient land-based offsets to meet the specified offset credit requirement? Did the EES consider what that limited availability suitable offset properties suggested about the relative importance of the habitat in the Pilliga in the context of the bioregion as a whole?

What would the Biodiversity Conservation Division suggest that Santos do in the event there are not offsets available to compensate for clearing in the Pilliga?

## Questions for the EPA

1. What information was provided to the EPA between their “Final advice” dated 12 February which indicated insufficient information was available to you about fugitive emissions and air toxics and the “Final advice on fugitive emissions” dated 23 March when you expressed satisfaction?
2. You have previously stated that Santos should provide an assessment of landfill facilities with the capacity to take the volumes of salt waste the project will create, but this has not been provided. Is the EPA confident that a suitable landfill facility will be found that will be willing to take waste produced by this project?
3. The Water Expert Panel stated that it would be prudent to fully document methane occurrences in groundwater and determine their likely source, “prior to major CSG developments in the area” and “to document known occurrences of methane and the surface or in wells or water bodies in the Narrabri region prior to commencement.” What is the EPA’s view on this matter?
4. One of the performance measures proposed in the conditions of consent is “Negligible change to baseline methane levels in groundwater user bores” In your view, can this performance measure be tested without comprehensive baseline methane occurrences being established?
5. The EPA’s policy on *Safeguarding future environmental liabilities from Coal Seam Gas Activities in NSW*, released in February, states that the agency will require CSG operators to hold insurance, or “prove to the EPA the existence of sufficient potential clean up funds.” How will the EPA determine what size of clean up funds are potentially needed? Has an assessment been done of the potential cost of contamination, including commercial losses by other parties?
6. Your policy on *Safeguarding future environmental liabilities from Coal Seam Gas Activities in NSW* remarks that “access to adequate insurance for gas operations is not straightforward in the Australian insurance market with the types of activities and risks that insurance companies will cover.” Can you expand on what this means and what bearing this observation might have for Santos’ project and any nearby landholders that are concerned about lost or contaminated water resources?
7. The EPA is the lead regulator for gas in NSW. This means your agency will be responsible for enforcement not just of an Environment Protection Licence for this project but also its development consent and petroleum production licence conditions. For this reason, the EPA specifically recommended in its Final Advice in February 2020 that vague phrases like “all reasonable and feasible measures,” “as soon as practicable” “to the greatest extent practicable” and “as soon as reasonably practicable” be replaced with measurable and quantifiable measures or methods. This doesn’t appear to have occurred. Are you satisfied that the consent conditions as drafted are enforceable? What has been the EPA’s experience of enforcing environmental conditions that are imprecise in their drafting?

## Questions for DPIE Water

1. You have previously advised that Santos' groundwater model "is not able to provide output at the scale and accuracy to assess the project's impacts against the minimal impact considerations of the Aquifer Interference Policy without intensive data collection and refinement of the model within the first five years of the project" (DPI Water submission 2017). How does that advice accord with the Department of Planning's statement in its Assessment Report that "Predicted drawdown can be compared against the 'minimal harm considerations' in the AIP" (para 297) and that drawdown "complies within the minimal impact considerations in the AIP" (para 301)?
2. Advice from DPIE Water and the EPA both made comments on the inadequacy of Santos' proposed monitoring network and trigger thresholds, remarking in its submission that data presented in the Water Baseline Report was not sufficient to adequately determine thresholds to identify change in the condition of the water resources, especially for Gunnedah-Oxley Basin aquifers where there is very limited existing information available.
3. The Water Expert Panel raises what appear to be serious discrepancies about the impact of the project on the Lower Namoi Alluvium, indicating Santos has underestimated the scale of take from that water source and the impact of that take on other water users. What is your view of this issue? Is the scale of take from the Lower Namoi alluvium predicted accurately by the EIS?
4. The final "Advice on conditions" from DPIE Water, dated October 2019, includes specific requests not included by the Department in its draft conditions of consent particularly around the timing of data collection ahead of production. The Department seems to have ignored your advice that there be "*at least three years of monitoring data collected prior to Phase 2*" which is full production of the gasfield. What do you see as the risks of a failure to collect three years of monitoring data prior to Phase 2?
5. The Department of Planning's Assessment Report says the Narrabri gas project is not in a significant recharge area for the Great Artesian Basin. Can you describe for us the function of **diffuse recharge** as described in the *Southern and Eastern Recharge Groundwater Sources Literature Review and Recommended Recharge Rates* (February 2020) prepared for your agency and the overall volume that diffuse recharge contributes to GAB recharge in NSW? Would you say that the Narrabi gasfield is in a diffuse recharge area?
6. The Department's Assessment Report asserts that "the Department accepts that there is adequate depth in the market for all affected water sources to accommodate the relatively small water take associated with the project." This seems contrary to your agency's advice that "the acquisition by Santos of licences in some groundwater sources is not guaranteed, as some sources are fully allocated with high competition for groundwater entitlement" and to remarks by the Water Expert Panel about the limited historical trading in the productive groundwater sources that will be affected by the project. Can you account for this difference?
7. In August 2019 your agency advised that, "The proposed groundwater monitoring triggers need to be improved as they do not provide enough early warning to allow for appropriate management measures to be implemented." Do you still hold this view? Why haven't these triggers been agreed in advance of consent being determined?
8. Your final advice requests that "management response triggers" be imposed on the gasfield accordance with its earlier advice which is Attachment B to document OUT18/6607 dated October 2018. The action responses requested in that document for several groundwater formations state that if re-assessment is triggered and shows impacts on greater than the

Level 1 minimal impact considerations in the Aquifer Interference Policy “the proponent consult with DP&E as to the requirement to re-apply for project approval.” Can you describe what mechanism is being proposed here? Are you proposing that the development consent be halted or revoked if these triggers are reached? As these triggers and action responses were proposed by your agency nearly two years ago, and your most recent advice reiterates them, why haven’t they been agreed to and included in the documents before the Commission?

9. Do you consider that the full range of potential groundwater quality and quantity impacts to water users and GDEs has been presented in the EIS, RTS and other relevant materials (based on the current modelling and impact prediction)?

If not, what impacts have not been presented?

10. Would you say that the hydrogeological model used by Santos in this assessment is able to make reasonable and accurate predictions of the impacts on groundwater from a project such as this? Including impacts on groundwater used by landholders near the project and on groundwater dependent ecosystems in the project area?

11. Does a rigorous hydrogeological conceptual model usually require extensive, high-quality field data to determine key variables such as geological unit thicknesses, the presence of any geological structures important for groundwater flow, and detailed geochemical and pumping test data to assess groundwater recharge, flow patterns and inter-aquifer connectivity?

12. What risks and problems would you say are created by the groundwater model for this project being developed *without* substantial field-based studies of inter-aquifer connectivity, groundwater recharge and discharge, groundwater flow paths (and their timescales), and groundwater dependent ecosystems within the project area?

(If you believe such field-based studies of these issues have been conducted, please indicate where these are presented in the EIS or subsequent project documentation. Note: the IESC believe the field-based surveys of GDEs, faulting and other key groundwater-related issues were inadequate in the EIS)

13. What would be the implications if faults, volcanic intrusions and/or other geological structures provide pathways for the movement of gas (e.g. methane) and groundwater for:
- A. The risk of cross contamination (e.g. methane contamination of water bores)
  - B. Water quantity impacts – e.g., leakage of water from important shallow aquifers into underlying layers in response to depressurization?

14. What are the possible risks of not incorporating such data and information into modelling and impact prediction prior to the commencement of a project of this kind?

15. Is it feasible to remediate impacts – such as the enhanced leakage of methane into water bores, and enhanced leakage of water beyond that predicted, once gas drilling and extraction activity has commenced? If so, explain how these impacts can be remediated.

16. Is it possible that if inter-aquifer connectivity is greater than currently modelled, the extent of leakage of water from the Namoi Alluvium and Pilliga Sandstone would be greater than what is currently predicted in the modelling?
17. Do you believe under current modelling predictions, that sufficient water entitlements will be able to be secured, to compensate for the take of water that is projected to occur from the relevant aquifers (including GAB and Namoi Alluvium?)
18. If the volumes of water that leak from these aquifers in response to gas extraction are higher than currently predicted – e.g., if inter-aquifer connectivity is greater than currently modelled (as the UNSW research suggests), do you believe the proponent will be able to secure sufficient water entitlements to account for this additional take of water under current groundwater management rules?
19. Do you believe that the additional take of water that may occur as a result of the project (based on the above) is sustainable, in the context of the current rates of water usage and availability within the Namoi region, and considering the recent climatic conditions?

### **Questions for Santos**

- 1) Please provide any detailed analysis demonstrating that the Project is likely to put downward pressure on gas prices.
- 2) Will Santos provide a commitment to implement a three-layered policy of security deposits, enhanced insurance coverage, and an environmental rehabilitation fund or an alternative to the satisfaction of the NSW Chief Scientist & Engineer as requested by Narrabri Shire Council?
- 3) Please provide a detailed account of the likely jobs that will be suitable and available for local residents (within 1 hours drive of the project) - including job type, level of skill required, number of positions likely to be available.
- 4) “Like for like land based offsets” for biodiversity impacts are proposed, but no actual offset areas specified. What work has Santos undertaken to determine whether it will be possible to obtain the necessary offsets? Has Santos reviewed their social impact assessment in light of the fact that the scale of the offsets required may mean Santos will need to buy every eligible private property in the bioregion to secure their offsets?
- 5) What impact does seismic data indicating the presence of faults and volcanic intrusions extending from the base of the Gunnedah Basin, upwards into the base of the Pilliga Sandstone in the area<sup>1</sup> have on the existing predictions of groundwater impacts arising from the Project? Specifically, what would be the implications if faults, volcanic intrusions and/or other geological structures provide pathways for the movement of gas (e.g. methane) and groundwater for:
  - a. The risk of cross contamination (e.g. methane contamination of water bores)
  - b. Water quantity impacts – e.g., leakage of water from important shallow aquifers into underlying layers in response to depressurization?

<sup>1</sup> From Iverach et al., 2020: “The Wilga Park Anticline located 5 km to the south of Narrabri runs north-south, through our study area (Supplementary Fig. 1). A north-south seismic section along the axis of the anticline maps faults that cut into the Pilliga Sandstone and a volcanic plug that extends from the regional basement and passes upwards through the Maules Creek Formation and Hoskissons coal seam into the base of the Pilliga sandstone. The faults and plug contact zones are potential pathways for groundwater and gas to migrate.”



- 6) Is Santos aware that peer-reviewed research with significant relevance to the question of inter-aquifer connectivity has been conducted by UNSW and ANSTO, using a range of geochemical, microbiological, and geophysical data from the project area (two papers by Iverach et al)? Is Santos aware that this research indicates potentially substantially greater levels of inter-aquifer connectivity between the deep layers of the Gunnedah Basin targeted by CSG extraction, and the overlying aquifers, including the important GAB and Namoi Alluvium water sources?
- 7) Is it possible that if inter-aquifer connectivity is greater than currently modelled, the extent of leakage of water from the Namoi Alluvium and Pilliga Sandstone would be greater than what is currently predicted in the modelling? What work has been done to consider this information in the environmental assessment for the Project?
- 8) Does a rigorous hydrogeological conceptual model usually require extensive, high-quality field data to determine key variables such as geological unit thicknesses, the presence of any geological structures important for groundwater flow, and detailed geochemical and pumping test data to assess groundwater recharge, flow patterns and inter-aquifer connectivity? What are the possible risks of not incorporating such data and information into modelling and impact prediction prior to the commencement of a project of this kind?
- 9) What risks and problems would you say are created by the groundwater model for this project being developed without substantial field-based studies of inter-aquifer connectivity, groundwater recharge and discharge, groundwater flow paths (and their timescales), and groundwater dependent ecosystems within the project area? If you believe such field-based studies of these issues have been conducted, please indicate where these are presented in the EIS or subsequent project documentation.
- 10) There seems to be a serious discrepancy between the discharge rate from the Pilliga Sandstone to the Lower Namoi Alluvium in the water model used by the Government to manage that water source and the discharge rate used by Santos in its groundwater model.

In a discussion about this discrepancy and the drawdown likely to be caused by the gasfield in the Lower Namoi Alluvium the Water Expert Panel observes that “it would be risky for the project to assume whatever [water] the [Narrabri Gas Project] requires will be available” (223 of PDF) because while not large in comparison to current usage, it is “likely to be large in comparison to the historic trading patterns.” What environmental and social risks might arise from the Santos not being able to secure entitlements for this water? Is it true to say that once dewatering and gas production begins, this flow-on effect on overlying aquifers though it may take some time to occur, will not be able to be stopped?

- 11) Do you believe under current modelling predictions, that sufficient water entitlements will be able to be secured, to compensate for the take of water that is projected to occur from the relevant aquifers (including GAB and Namoi Alluvium?)
- 12) If the volumes of water that leak from these aquifers in response to gas extraction are higher than currently predicted – e.g., if inter-aquifer connectivity is greater than currently modelled (as the UNSW research suggests), do you believe Santos will be able to secure sufficient water entitlements to account for this additional take of water under current groundwater management rules?
- 13) Advice from DPIE Water and the EPA both made comments on the inadequacy of Santos’ proposed monitoring network and trigger thresholds, remarking in its submission that data presented in the Water Baseline Report was not sufficient to adequately determine thresholds to identify change in the condition of the water resources, especially for Gunnedah-Oxley Basin aquifers where there is very limited existing information available.

The Groundwater impact assessment made mention of fifteen bores that access deep aquifers of the Gunnedah Oxley Basin to the east of the project (Groundwater Impact Assessment Part 1 4-39-40). Has there been any assessment conducted that identifies the scale of impact landholders relying on these bores are likely to experience? Has Santos committed to any further monitoring to respond to this concern?

- 14) The “very low presence of sulphate in the target aquifers,” (paragraph 348) is cited in the Department’s Assessment Report as a reason to not be concerned about the risk of sulphate-reducing bacteria. But the target aquifers are not the only formations that will be drilled and drilling fluid will introduce sulphate to the system. The Drilling Fluid Risk Evaluation conducted for Santos for its Dewhurst pilot (the consent for which is proposed to be rolled into this consent) stated that “Due to the naturally elevated background levels of sodium and sulphate within the shallow groundwater system (Narrabri sediments) the dissolution of sodium and sulphate from drilling muds is not anticipated to have a measureable impact on groundwater quality.” (Dewhurst Gas Exploration Pilot Expansion Response to Submissions Appendix 3). At that stage, Santos was arguing that the presence of sulphate-reducing bacteria was a factor that would limit the spread of sulphate. The drilling fluids contain biocides designed to inhibit these microbes. Did Santos undertake any further investigation into this issue?
- 15) The Water Expert Panel stated that it would be prudent to fully document methane occurrences in groundwater and determine their likely source, “prior to major CSG developments in the area” and “to document known occurrences of methane and the surface or in wells or water bodies in the Narrabri region prior to commencement.” What work has Santos conducted in this regard?
- 16) One of the performance measures proposed in the conditions of consent is “Negligible change to baseline methane levels in groundwater user bores” In your view, can this performance measure be tested without comprehensive baseline methane occurrences being established?
- 17) Please provide annual numbers/estimates for CO<sub>2</sub> emissions (T CO<sub>2</sub>/yr shown separately for every year of operation) and for methane emissions (T methane/yr shown separately for every year of operation) and provide a detailed explanatory basis for these estimates.
- 18) Please provide a detailed list (equipment items listed and approximate location coordinates) of all the planned CO<sub>2</sub> venting / release points and all the planned methane venting / release points.
- 19) Is it feasible to remediate impacts – such as the enhanced leakage of methane into water bores, and enhanced leakage of water beyond that predicted - once gas drilling and extraction activity has commenced? If so, explain how these impacts can be remediated.
- 20) Has Santos conducted an assessment of landfill facilities with the capacity to take the volumes of salt waste the project will create?