Name: Rosemary Vass

Address: "Valley View"
79 Newell Hwy
PO Box 386
Coonabarabran 2357

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Attn: Executive Director, Resource Assessments
Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

This is a submission to the Narrabri Gas EIS.

I object to this project and believe it should be rejected.

"It's the health of the many versus the wealth of a few."

-Professor Anthony Ingraffea

I am a retired educator, mother and grandmother living near Coonabarabran NSW and within the Santos Petroleum Exploration Licence 450. My property is situated on the southern edge of the Pilliga Forest and approximately 70 kms south of the proposed Santos gasfield. My family is totally reliant on bore water for all our needs and to remain living in our home. I have a lifelong association with the Pilliga Forest having been born and raised in the area of Baradine.

There are a great many reasons to object to this EIS and the Narrabri CSG project and it is almost impossible for an ordinary community member to respond adequately to it. Perhaps one of my greatest objections is to the fact that ordinary community people need to do this at all. It is the role of government agencies, who are after all the servants of the community and paid by them, to be the protectors of our health, the social, human and economic capital of our communities, the quality of our water, air and land, and above all the very environment of the planet we all share. Therefore I implore all those considering these matters to do so with their responsibility to the community foremost in their minds.

This submission will touch briefly on a broad range of problems posed by the EIS and the Narrabri project and then give detailed objections to three major problems – **well integrity, fugitive emissions and the impact of methane leakage on global warming and climate change.**

Economic Impact – Net Loss not Gain

Much is made of the "jobs for regions" that the project would provide but **over the 25 year lifetime of the project,** it would provide only 127 long term fulltime jobs for Narrabri LGA with the remaining total of approx. 380 jobs from wider region and beyond (ES9). It is well documented from the Queensland csg experience that the most likely outcome for communities is actually a net loss of local jobs as local agricultural and community workers take up low skill/high pay mine work. As the EIS outlines a large number of jobs will be done by FIFO workers accommodated in man camps. Studies of impacts in Queensland showed there is very little spill over to local business because these camps are mostly fully supplied outside of the area. *(Ref: TAI Mark Ogge, "Be careful what you wish for" 2015 with data from Fleming & Measham, GISERA; ABS, and Bureau of Resource & Energy 2013)* The EIS uses "weasel words" such as "utilising local businesses and suppliers where possible" (ES10) which are utterly meaningless and no guarantee that they will use any local contractors .... because Santos might deem it "not possible". The Ogge report referred to above showed that Queensland communities had net losses to their human and social capital and experienced all the adverse results of the boom and bust cycle with disastrous results for the social fabric of local towns in the long term. A few people made a lot of money for a short time and most people went backwards.

"The health of the many versus the wealth of a few".

Agriculture and Landowners

CSG projects such as Narrabri pose particular issues for safe, secure agricultural production and financial security for landowners generally. Insurance cannot be obtained against the risk of contamination of land, water, crops and stock caused by the industry. Land values can be reduced and there has already been an example of csg production on land being used as a reason not to provide a bank loan due to the inherent risk. Landowners remain liable for problems that may arise (such as water contamination to neighbours) long after the industry has left. Even if a landowner does not give access for drilling they may be hugely inconvenienced by adjoining a project or neighbours who do give access by noise, light and air pollution

from infrastructure and interference with farming practices due to pipelines and traffic. There is no reference to these risks in the EIS except for water contamination where Santos talks of "making good". This is totally inadequate as once water in a bore or aquifer is contaminated there is little to be done to "make it good". Monetary compensation does not bring back water. Reference is made to agreements/money paid to those few landowners who give access but no warning as to the problems outlined here for all the agricultural community.

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Waste Water

CSG extraction produces more water than it uses. This is called "produced water" which is ancient water previously locked up in the coal beds. It contains a toxic mixture of heavy metals, radioactive substances and aromatic hydrocarbon compounds and these will be concentrated and released from "treated water". Produced water and treated water must be stored prior to and after treatment. The EIS does not provide adequate provision for disposal that will give a nil effect on the environment. It will remain a risk to surface water and important catchment areas. One proposed disposal is via Bohena Creek when flows are at 100 megalitres per day however the flow gauge is not to be sited at outflow but 2kms downstream at point after other streams enter the creek. Flow rate of Bohena Creek at release site may be well below the recommended rate when showing 100 megalitres at the gauge due to flow from contributing streams downstream of outflow site. Risks include contamination and erosion. Storage dams will be needed for extended periods of time and risks remain for liner leakage, (already the cause of contamination of aquifer by Santos at this exploration site), dam wall breaches (occurred in Qld and already at the Pilliga site) and dam spill over caused by significant rain events which are more likely to be severe with climate change. We have evidence of at least 2 such spill sites in the Pilliga that after 10+ years have not responded to rehabilitation. We must consider the cumulative effect of 850 wells and the risks this amount of produced water will pose. Santos provides no pictures in the EIS of the spill sites and their failure to rehabilitate these sites currently in the Pilliga Forest. I include a recent photo of one of the sites to indicate the damage done and the failure of any rehabilitation efforts by Santos. It indicates the risk of longterm damage possible to forest and agricultural land from this project. Santos has already been unable to ensure

"nil effect position" on surface water or soils when spills such as the picture at Bohena 3 site demonstrates.

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Salt (Toxic Waste) Disposal

Produced water contains large amounts of dissolved salts – these are *not* table salt but would be better described as toxic or hazardous waste including carcinogenic substances. This salt/hazardous waste will be produced via the Leewood reverse osmosis plant at a rate "averaging approximately 47 tonnes per day with a peak of 115 tonnes per day in years 2-4 of production" (EIS Overview). Santos are classifying this as "general waste" which is highly inappropriate, and intending to transport it for disposal at a facility licenced to take such waste. Where and what facility will this be? What safeguards to the environment will be in place for this mountain of toxic hazardous waste? The risk from this waste is extremely high. Transparent, independent analysis of this produced waste should be made with a view to reclassifying it as hazardous waste and finding an

environmentally safe solution to this problem. This solution should be at a nil impact to the environment. Reverse osmosis is a highly energy intense process and Santos intend to use extracted gas to power this process. This is gas that Australians own and Santos should be required to pay for its use or at the very least pay the royalties on all gas used in the processing and the power plant.

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Fire Risks

The Pilliga Forest is a high risk fire area and the risk and severity of fire is increasing with climate change. In 2013 the adjoining shire experienced a catastrophic fire event with the loss of over 50 homes. The EIS provides scant assessment of the major risks of placing a gasfield and associated infrastructure containing highly flammable gas under high pressure in the middle of this fire prone forest. What is the cumulative risk if 850 wells are present? How will flares that are not shut down on catastrophic fire days pose new risks? Why would/should local RFS volunteers risk their lives fighting the highly dangerous fire hazard of a bushfire within a gasfield when Santos is taking no responsibility to provide personnel or money to assist. They have not provided any suitable fire plan nor consulted adequately about this.

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Groundwater and the Great Artesian Basin

There are 4000 bores used for domestic, stock, and irrigation water that are dependent on the Pilliga aquifer in the Namoi area. EIS states there will be draw down of 0.5 metres due to the project. What guarantee is there that this won't be more? Santos continuously makes statements about no connection between the coal seam and aquifers but if there is no connection and bores are unaffected why will there be draw down? Drilling will shatter rock and well integrity cannot be guaranteed so pathways will be possible. There are many "weasel words" re impact on aquifers from Santos in ES2, for example, that the seams will be "far below and isolated from the GAB and aquifers" but they cannot be "isolated" if they are drilling through them. The EIS claims that there is rock 250-400 metres thick that is "relatively impervious" separating the coal seam and the aquifers. There is no definition of "relatively" - either it is impervious or it isn't! This is like saying that someone is "relatively pregnant". Another statement in the EIS *"the*

project area is not located in a major recharge area for the GAB," and that the project is "*some distance*" from the Namoi recharge area. This is false, misleading and plainly incorrect. If the project area is not a "major" recharge area (which I dispute) then it must be a minor recharge area otherwise Santos would state that it is *not* a recharge area at all. It is misleading to not state the actual distance between the project and Namoi recharge. The Namoi River runs through Narrabri and as stated elsewhere in the EIS this is less than 20kms from the project. This landscape is connected from the Nandewar Ranges across the Pilliga to the Warrumbungle Mountains. The project absolutely sits above the Pilliga recharge of the GAB and as such poses a serious existential risk to it and other aquifers and all those thousands of people and agricultural producers who depend on it.

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Community Consultation and Social Licence

On the ES1 it states "The Narrabri Gas Project is identified as a Strategic Energy project in the NSW Gas Plan." Why then such a narrow definition of who the "stakeholders" are and the constant remarks from Santos

executives that any objections from outside of Narrabri could be discounted because those people weren't "locals". The impacts of this project, if approved, would be not only state wide but Australia wide, due to it's carbon footprint and negative contribution to climate change. I live less than 70 kms from the project but apart from advertising in local papers there has been no attempt to consult or inform me regarding the impacts. When an independent community economic forum was organised and the date changed to try and accommodate Santos attendance they refused to take part. There have been instances of attempts to cause division and pressure brought to bear via threats of withdrawal of sponsorships to community clubs if they rented out rooms for groups opposing the project. Survey work by volunteers across the North West area (now over 3+ million hectares) consistently give results of 90%+ opposition to the proposed project. International banking groups such as Credit Suisse and Deutche Bank recognised the strength of community opposition by including them in their reasons for writing down the economic value of the project. Claims in the EIS regarding consultation and support are misleading at best. The picture below was taken at Narrabri in November 2015. Each triangle represents a rural road/area in the surrounding district that has been surveyed and stands opposed to the csg project.

This project has no social licence to proceed.

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Health

Health issues are not addressed adequately in the EIS. Exposure to fugitive emissions and air pollution from the infrastructure and processing in a gasfield poses major health risks for people and animals of all types in the vicinity. While studies in the Australian context are only beginning to be done there is now a building body of research from the USA that provides the evidence of the dangers to health from csg extraction. Children and the elderly are most vunerable with exposure causing respiratory problems, nose bleeds, rashes and irritations to eyes and throat. These symptoms were experienced in the gasfields in Qld but were discounted because of the small population. However the recent huge methane leak from a storage facility near Porter Ranch in California exposed very large numbers of people in this urban environment and the symptoms were replicated in large numbers.

"Human exposure to toxic chemicals and other pollutants associated with UGD can occur throughout the life cycle of UGD. These include surface leaks, spills, releases from holding tanks, venting, well-casing failure and accidents during transportation of fluids.[7] Air pollutants such as volatile organic compounds, aromatic hydrocarbons, diesel particulate matter and tropospheric ozone can come into contact with human populations from atmospheric dispersion of UGD air emissions. As with air, risks to water quality can occur over the full life cycle of UGD."

(*Unconventional natural gas development and human health: thoughts from the United States. Finkel, Hays, & Law. MJA 203 (7) 5 October 2015*)

There are ample references on health risks posed that the EIS could have explored but did not. At no point did the EIS address the increased health service that would be needed to service the number of men in a man camp or likelihood of increased industrial accidents due to the project. A full independent expert review of health risks needs to be provided. The EIS could have started here:

http://www.rrh.org.au/articles/subviewnew.asp?ArticleID=3825

Health Dangers of Fracking Revealed in Johns Hopkins Study - EcoWatch

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Natural Areas and Value of Forest

On ES2 it states that the project will cover 95,000 hectares but only 1% of the area will be impacted. However this is a ludicrous statement when the project will have roads, well pads, pipelines, treatment plants, compression stations, flares, well heads, man camps and traffic operating in some cases 24/7. This type of csg development is "spatially intense" with a heavy industrial impact through intensified air, water, light, sound and dust pollution as it spreads across a landscape. There will be significant disturbance to the natural environment both plant and animal. The Pilliga is a significant habitat for important threatened species including the Pilliga mouse, regent honeyeaters, koalas, five clawed worm skink and the unusual stygofauna. The EIS does not address the significant disturbance to this ecosystem nor how to adequately protect the Pilliga's natural, Aboriginal cultural and heritage value. The impact for the public will be 100% of the area because if the project becomes operational then the public facility of the forest will be closed to their access.

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Light Pollution and Siding Spring Observatory

As a member of the Coonabarabran community I am particularly concerned with the possible longterm impact of light and dust pollution from the Narrabri project on the functioning of our world class science facility of Siding Spring Observatory. Light pollution from other extractive industries in the area is already noticeable and threatens our dark sky. If the project expands beyond the forest as is proposed by Santos to the six other planned gasfields including Toorawenah then the work of the Observatory will be severely affected. Light from unprotected flares and infrastructure will be a major increasing problem for the observatory. Siding Spring is of considerable economic importance to the region through both jobs and tourism. This area was recently declared a Dark Sky Park the only such designation in Australia. How would Santos protect this status for our area?

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Well Integrity

Dr John Williams, Adjunct professor at ANU, states that one of the biggest challenges for coal seam gas development is managing the longterm legacy

of 1000s of gas wells and the risk they pose to water. Longterm well integrity and the risks associated with methane leakage remains my major concern with the Narrabri project. The EIS contains limited reference to these problems. There is now extensive research by Prof. Ingraffea and others from the US and Canada regarding the rate of well leakage and the likelihood of contamination. This research shows:-

- whenever you punch holes in a rock barrier it is likely to leak
- the closer a well/water bore was to a gasfield the higher the rate of contamination.
- Gas/methane can leak from anywhere around the well and in many different ways
- The geology provides different pathways for the gas to migrate
- Good evidence that both onshore and offshore drilling wells fail at an increasing rate over time

Well failure rate was found to be similar across a range of studies:-

- About 5% of wells failed in first year of drilling
- More wells fail with age
- Most wells fail with maturity (approx.60% by 30 years)

At a webinar for industry in 2013 the following information was presented:-

- worldwide industry will drill more wells in the next decade (2013-2023) than have been drilled in the last 100years
- the global well population is +/-1.8 million, of which +/- 35% are leaking
- life cycle extension of aging assets is becoming a pre-requisite of legislators
  (Society of Petroleum Engineers – Webinar on Wellbore Integrity Paul Hopman, March 27, 2013)

Collected information across a range of studies shows that the geology/location of wells will dictate the rate of failure, that integrity of wells is not improving as failure rates remain similar in newer gasfields, and if these are not leaking into water then gas must be going into the atmosphere.

The EIS claims that well construction will meet requirements of the Code of Practice for CSG – Well Integrity (the Code DTORIS 2012) and so wells will be safe and environmentally sound. However cement and geology do not obey our rules and are blind to codes and regulations. It doesn't matter how strict

you make the code of construction evidence from around the world shows that wells still fail.

"Leaking wells is a chronic, ubiquitous well understood problem. It is unresponsive to "tough regulation". It is causing lose of private water wells at an increasing rate. " Professor Anthony Ingraffea Cornell Uni.

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Fugitive Emissions, Air Quality and Climate Change

Fugitive emissions of methane and other gases can leak into water air and soil and migrate through rock from any part of the wells, infrastructure or pipelines at any point in the production process and storage and distribution. Baseline data in the Pilliga indicates that NO CH4 (methane) is naturally occurring. It will therefore be important to adequately monitor air quality and measure any changes to the baseline data and test for methane levels. Aside from methane other compounds dangerous to health will also be present in gas extracted and these will also need to be very carefully monitored as well.

Methane has been promoted as a "cleaner fossil fuel" and useful as a "transition fuel" or bridge to renewable energy however this is now highly questionable as recent research shows methane to be a highly potent green house gas. It is in fact a more potent GHG than CO2 :-

- methane is up to 34 times more potent over 100 years
- and up to 86 times more potent over 20 years

(IPCC AR5, Oct 2013)

This means even small leakage rates are very important.

"Over a 20 year period each 1% lifetime production leakage produces nearly the same climate impact as burning the methane twice."

(Howarth, Ingraffea, NATURE, 477,2011)

The global warming potential of methane is very high and studies in 2012 and 2013 to measure leakage rates from production fields and in urban environments from transmission lines is showing that leakage/fugitive emissions has been underestimated by a significant factor.

http://www.climate-energy-college.net/review-current-and-future-methane-emissions-australian-unconventional-oil-and-gas-production

The impact of csg production on global warming and hence climate change is much more significant than previously understood. This brings into question its cost to the environment and the long term problems/costs of independently monitoring well integrity and methane emissions into the future. It must certainly go well beyond the 20-25 year lifetime of this project mentioned in the EIS and provision must be made by Santos to cover the costs of maintenance and not leave this as a liability for communities and landowners. Failure to pay attention to the threat methane poses to climate change may mean Santos would be culpable for future damage and economic loss to the community and the wider environment beyond. These factors may well make this project economically unviable as a price on carbon emissions or equivalent would seem inevitable in the near future.

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Recommedations

1. Buy back the exploration licences covering the North West of NSW and do not grant a production licence for this project as it cannot proceed without major negative impacts and is an unacceptable risk on many levels.
2. Encourage Santos to move out of this economically unviable project that has no social licence in this area and reinvest instead in renewable energy projects in our region. Renewable energy projects can co-exist with agriculture, provide "clean" jobs that are sustainable into the future.

I urge the Government to reject this EIS and its proposed gas project for the many reasons outlined in this submission. The Narrabri Gas project as proposed in this EIS will overtime be an unacceptable risk to the well being of this community and the wider Australian environment on many levels. This project poses an existential threat to the Great Artesian Basin and groundwater aquifers on which the region's people and agricultural production depends. It could compound problems with climate change and threaten the health of our people, and the life of our natural environment.

Signed,

Rosemary Vass

Rosemary Vass (B.A. Masters Educat.Studies)