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

19 May 2017

To Whom it May Concern

Re: Submission regarding Santos' Narrabri Gas Project Environmental Impact Statement

Thank you for the opportunity to make a submission in relation to Santos' Narrabri Gas Project Environmental Impact Statement.

I, Sarah Ciesiolka, OBJECT to this Project and believe it should be rejected.

Failure to do otherwise in the face of the overwhelming evidence of the large-scale risks and impacts, and community opposition, both locally and from further afield, is not only culpable but potentially liable.

Santos' Environmental Impact Statement for the Narrabri Gas Project is long on motherhood statements and alarmingly short where it matters – on the critical details, including the placement of field infrastructure and Management Plans, that the community and NSW Government should reasonably expect for a project of this size and scale.

"We cannot afford to make a mistake; the potential risks are too great. In fact, they are not even fully known."

- Andrew Cuomo

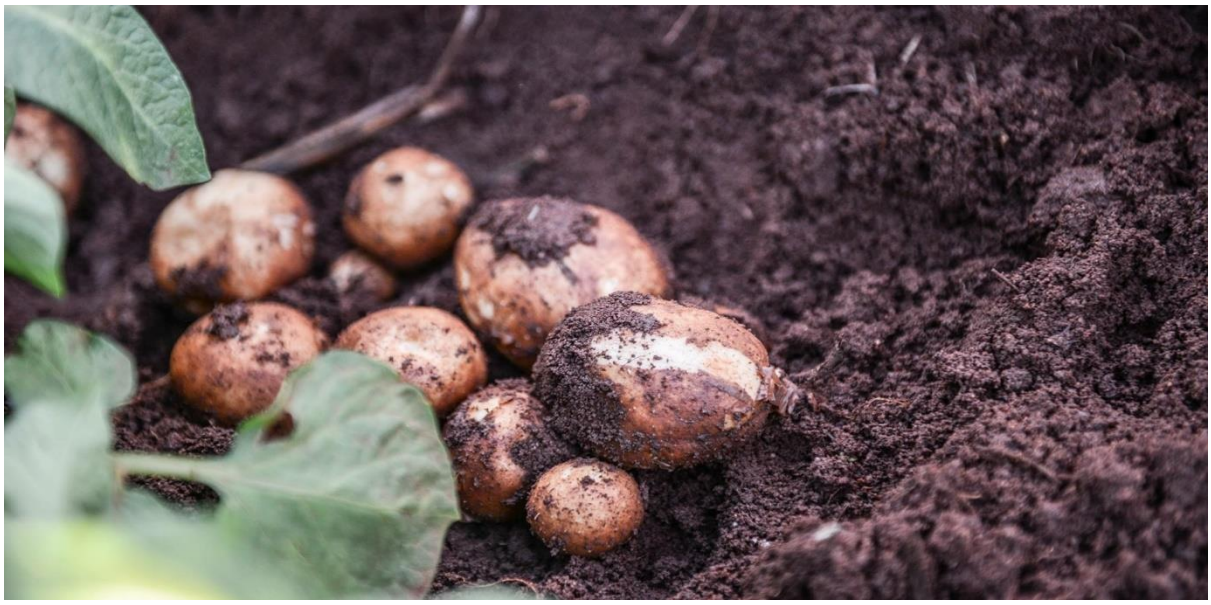
Santos' Environmental Impact Statement for the Narrabri Gas Project claims that "the Project can proceed safely with minimal and manageable risk to the environment". The evidence, however, paints a very different picture and Santos' Narrabri Gas Project Environmental Impact Statement is largely dismissive of the significant environmental, social, and economic risks and impacts. My submission hopes to bring to your attention many of the deficiencies, inaccuracies, omissions, misleading statements, and unsubstantiated assertions, as well as provide additional information, regarding Santos' Environmental Impact Statement for the Narrabri Gas Project. It is not intended to be an exhaustive list of concerns.

It is clear that there is rapidly mounting evidence from the US over a longer period, and from Queensland more recently, which Santos has conveniently failed to reference, that CSG developments, the likes of which Santos are proposing near Narrabri, have resulted in people's health being compromised, productive farmland eroded being away and precious aquifers permanently damaged.

Currently, our local community can have no faith that our health, our environment, and our water supplies will be safe. It is unthinkable that "one off" extraction of CSG would even be considered whilst putting at risk water, air, soil and public health, and risking thousands of hectares across Australia vulnerable to a position that is unviable for life and agriculture. Once our surface and groundwater resources, our air, our soil, and/or our health is contaminated or destroyed, there is no turning back, there is no "make good".

Family Background

My name is Sarah Ciesiolka. I am a mother of three young children and I care deeply about the future of agriculture and our precious land and water resources. I am also a 5th generation farmer living and farming less than 6km to the north, and downstream, from Santos' proposed Stage 1 Narrabri Gas Project. We farm potatoes, peanuts, and grains that supply NSW, Australian, and global consumers. To put that into some perspective, each year, year in, year out, our 945-hectare farm produces approximately 50 million potatoes, 1 million kilograms of peanuts and wheat for 3.3 million loaves of bread. The end-point value of this product is in excess of $50 million annually. We also employ up to 20 permanent and seasonal staff. We rely entirely on underground water to irrigate our crops, and for drinking and everyday household use. We have no other reliable source of water.



Environmental Impact Statement lacks key details

Critically, Santos' Environmental Impact Statement for the Narrabri Gas Project lacks key details.

There are no maps indicating where these 850 wells, or 425 well pads, and the lines and infrastructure that run between and around them, will go. Santos is seeking carte blanche for this gasfield on the promise that it will decide where the wells will go at a time of their choosing using a "Field Development Protocol." This is completely unacceptable to the local community, and local landholders, who stand to be directly impacted by this Project.

No project has ever been assessed this way before in NSW and the constraints Santos propose are weak and subject to change later on. This is not an appropriate way to assess the largest development project ever undertaken under the Environmental Planning and Assessment Act, and a sanctioned State Significant Development. Further, under procedural fairness, the NSW Government must insist that Santos provide an opportunity for the community to review, assess and comment on the impact of the placement of individual wells, pipelines, and other infrastructure prior to Project determination.

The Environmental Impact Statement mainly refers to 850 gas wells, as do all previous Santos statements. The Department of Planning & Environment refers to "up to 850 gas wells" in its notice of the development accompanying submission requests, both printed and on its web site. However, in Table 1-1 of Appendix R the statement is made that the proponent proposes the **"**conversion or upgrade of existing exploration and appraisal wells to production **in addition to** the 850 new wells". Given that more than 50 wells have been constructed or approved already (see Chapter 2), it now appears that the project will consist of more than 900 wells in total. This figure has never been disclosed previously, and demonstrates once again Santos' attempts to hoodwink the NSW Government and the community.

There are no detailed Management Plans in the Environmental Impact Statement. Until such times as Santos can provide Management Plans for the scenarios listed below for community input and public scrutiny, this Project should be rejected. It is not enough to say that they will be developed - the Plans themselves need to be included in the Environmental Impact Statement.

- Waste Management Plan
- Air Quality Management Plan
- Field Development Protocol
- Erosion and Sediment Control Plan
- Soil Management Plan
- Biodiversity Management Plan
- Feral Animal Control Strategy
- Noise Management Plan
- Traffic Management Plan
- Bushfire Management Plan
- Santos' Climate Change Policy (which is a non-climate change policy)
- Environment, Health, and Safety Management System
- Historic Heritage Management Plan
- Aboriginal Engagement Policy
- Produced Water Management Plan (including an Irrigation Management Plan and a Managed Release Protocol)
- Decommissioning Management Plan
- Rehabilitation Strategy.

No economic justification

This Project will inflict significant harm on the social, environmental, and economic values of the Narrabri LGA, and NSW more broadly, which needs to be weighed against the economic justification for the Project. However, it has been widely established that the so called economic justification for the Narrabri Gas Project, a gas supply shortage in NSW, has, and continues to be, underpinned by false economic assumptions.

Santos misleadingly asserts that 1 million NSW family homes and 33,000 businesses rely upon an affordable supply of gas. These are simply figures plucked out the air and in any event the reason for increases in domestic gas prices is because companies like Santos are so keen to export their gas at the much higher international price, plundering supplies previously available to local manufacturers, businesses, power stations and residential customers.

According to a new report, the predicted shortage of gas for electricity generation in Australia from 2018 will not eventuate, and the recent surge in domestic prices will not be mitigated by opening up new coal seam gas fields.
http://www.smh.com.au/environment/higher-energy-prices-have-little-to-do-with-gas-shortages-researchers-say-20170517-gw6tg2.html
https://www.theguardian.com/australia-news/2017/may/18/australias-2018-gas-shortage-will-not-eventuate-report-shows
(http://www.smh.com.au/comment/phoney-energy-crisis-merely-a-ploy-to-access-offlimits-gas-20170315-guz8pb.html)
http://www.smh.com.au/business/comment-and-analysis/east-coast-gas-market-has-all-the-hallmarks-of-a-cartel-20151011-gk6b4i.html
https://www.thesaturdaypaper.com.au/news/resources/2017/03/25/the-gas-industrys-power-play/14903604004401

In addition, AGL, Australia's oldest gas company, says that the transition to a low carbon economy will largely bypass "baseload" gas, and instead shift straight to large-scale wind and solar.
(http://reneweconomy.com.au/agl-kills-idea-of-gas-as-transition-fuel-wind-solar-storage-cheaper-63013/)

Santos has no social licence – farmers reject the Narrabri Gas Project

Despite what Santos would have you believe, there is widespread, local, and ongoing community rejection of the CSG industry in North West NSW, and Santos' Narrabri Gas Project in particular. Comprehensive community-run door-to-door surveys have been undertaken by over 100 communities completely surrounding the Pilliga Forest, spanning an area of over 3.28 million hectares to date. These communities have declared their districts Gasfield Free, with an average of 96% of their residents rejecting plans for gasfields in North West NSW. Many of these communities include large tracts of privately owned, highly productive and highly valuable agricultural land, where landholders have conclusively demonstrated that Santos has no social licence.

(http://www.northerndailyleader.com.au/story/3512931/96-communities-say-no-to-coal-seam-gas/)
(http://www.theland.com.au/news/agriculture/general/news/protest-sky-high-at-gunnedah/2726549.aspx)

On 19 April 2015, locals lined the Newell Highway from Dubbo to the Queensland border (a distance of some 500km) to show their opposition to CSG in our region. This became Australia's longest demonstration. The attached video captures voices along a 200 km section of the highway over 4 hours, right through the heart of Santos' proposed Stage 1 Narrabri Gas Project. This video shows the resolution with which local communities oppose Santos', and the NSW Government's, plans to turn our region into a gasfield. This is just one example of the many actions of its type, led by conservative local farmers, that have been undertaken to date.
(https://www.youtube.com/watch?v=MtvkaWm__fA)

Furthermore, a number of international investment analysts have either downgraded or written off Santos' Narrabri Gas Project as worthless due, in a large part, to widespread community opposition. (http://www.abc.net.au/news/2014-07-23/report-devalues-santos-pilliga-assets/5618830)

Santos themselves have now also written down their initial and subsequent investment in the Narrabri Gas Project to zero, reflecting a project that is not only plagued by community opposition, is environmental risky, but unviable and financially worthless as well. According to the Australian Financial Review, "that decision reflects the obvious fact that Santos would not fund the development even if its balance sheet could afford it."

(http://www.afr.com/business/energy/santos-chairman-peter-coates-looks-on-the-bright-side-20160219-gmyquv).

In addition, Santos have downgraded their reserves from a 2P (proven and probable) classification to a 2C (contingent) classification, highlighting that the Narrabri Gas Project is no longer considered a bankable project. And, as of December 2016, Santos has relegated the Narrabri Gas Project to a "non-core asset".
(http://www.smh.com.au/environment/santos-signals-possible-nsw-csg-exit-raising-doubts-about-government-gas-plan-20161208-gt6ruy.html)

A rapidly growing sector of the local, regional, and national community now believes the current NSW and Federal Governments have rural and regional communities positioned as secondary in their deliberations and actions, particularly with regard to the pursuit of the rapid establishment of unsustainable industries, such as CSG mining, to the mutual exclusion and sublimation of sustainable industries such as agriculture, which have nurtured the North-West region for more than 150 years.

Land Use Conflict – Agriculture and CSG cannot co-exist

We are just one farm in the highly productive and highly valuable agricultural area immediately surrounding Santos' Narrabri Gas Project. If you were to extrapolate out what we turn off our farm each year, you will gain some understanding of the value of the vital agricultural produce that is at risk from the establishment of the CSG industry in our region.

According to The World Bank and United Nations (2016) **"there won't be enough food to feed to global population by 2050"**, a mere 30 years from now. Consequently, the critical importance to the State and the nation of our food producing areas cannot be overstated, not just in terms of food security, but also in terms of ongoing, long-term, and sustainable employment, investment, and productivity.

Australia is the driest inhabited continent on the entire planet and we have only a finite amount of arable agricultural land. At Narrabri and in the broader North West region, we are fortunate to have the trifecta – pristine, potable water, fertile soils, and an ideal climate. This means farmers can achieve productivity levels equal to, or in many cases, better than, anywhere in Australia, sustaining billions of dollars of agricultural production annually.

Quite simply, to put all of this at risk for the short-term and unsustainable CSG industry is madness. CSG extraction and production water is entirely incompatible with agricultural production; the two **cannot** co-exist. Coexistence is nothing but a myth perpetrated by those who hope to benefit personally from the establishment of this industry.

The future opportunities for growth and expansion in the agricultural sector in North West NSW are significant, and critical to the long term economic and social well-being of NSW. The take-up of these opportunities is currently being severely curtailed due to the threat of CSG mining over our farmland and water catchments, and our own experience reflects this. Farming in the shadow of the largest

proposed gasfield in NSW, with all of the documented risks that CSG entails, means we are currently unable to justify the very substantial investment decisions being requested by our supply chain partners, which would see a doubling of our production capacity. This represents a lost opportunity for Narrabri, and for NSW.

Landholders' do not have the right to say 'no' enshrined in legislation

In NSW, and indeed in other jurisdictions, landholders' currently do not have the right to refuse access enshrined in legislation for any and all activities associated with CSG exploration and production, including sub-surface activities. At present, landholders' are ultimately powerless to refuse access to a gas company.
(https://www.theguardian.com/commentisfree/2015/dec/04/i-live-daily-with-the-stress-that-farmers-are-powerless-to-refuse-access-to-coal-seam-gas)

Santos and AGL, together with the NSW Farmers, Cotton Australia and the NSW Irrigators Council, did sign an Agreed Principles of Land Access on 28 March 2014, however, this agreement only served to cover drilling activities, and not the extensive range of critical infrastructure such as powerlines, gas and water pipelines, quarries, borrow pits, gas processing and compressor stations, water treatment facilities, roads, accommodation support camps for staff, fuel storage areas, flare pits, ponds, fences, etc which are essential to gas extraction and supply. In addition, the "principles" contained within this document have never actually been tested and frankly, local farmers do not consider it worth the paper it is written on.

Even the former Prime Minister, Tony Abbott has said that no one should be forced to have a gas well on their land and the right to refuse access for all CSG activity has recently been supported by former Federal Nationals Leader, Warren Truss, Federal Nationals Deputy Leader, Fiona Nash, and former NSW Roads Minister, Duncan Gay. In fact, former NSW Deputy Premier Andrew Stoner said to the ABC in February 2013 about how CSG drilling is potentially dangerous, and how he wouldn't want a CSG well near his property. For landholders' to have no legal fall-back position enshrined in legislation – no right to say 'no' – creates an uneven and unbalanced playing field and is a testament that the current system is broken.

At present, nothing is off limits for agricultural land or drinking water catchments or productive aquifers. The much-lauded protection measure of a 2km buffer zone for CSG operations does not apply to all household dwellings and it does not provide any protection for rural farming families such as my own, who can have a CSG well drilled within 200m of their home, or 50m from their garden. Such a policy represents an admission of the negative impacts of CSG extraction on human health, so why is my family not protected? Are my children less important than others because, by necessity, we do not reside within a cluster of people? The 2km exclusion around urban areas and residential zones should be extended to also apply to **all** household dwellings.

Surface and groundwater

"If the wars of last century were fought over oil, the wars of this century will be fought over water – unless we change our approach to managing this precious and vital resource"

- Ismail Serageldin, former World Bank Vice-President

Santos asserts that their water modelling is "state of the art", yet nothing could be further from the truth. The Narrabri Gas Project risks depleting and/or contaminating our two most vital and precious water resources – the Great Artesian Basin and the Murray Darling Basin.

Santos' Environmental Impact Statement claims that they will not interfere with the vital Southern Recharge Zone of the Great Artesian Basin. This is misleading and not supported by evidence. Government hydrogeological mapping of the Great Artesian Basin shows the Project will overlay the most important inflow zone into the Great Artesian Basin in NSW (Hydrogeological Atlas of the Great Artesian Basin (2016) Department of Water Resources (NSW) Hydrogeological Series Sheet SH 55-12; NSW Department of Water & Energy April 2009 PN00799 WR2008-089).

Not only is the Great Artesian Basin the largest, deepest Artesian Basin in the world, it is Australia's largest underground water resource. Sitting beneath 22% of Australia, the Great Artesian Basin underpins the lives and livelihoods of inland eastern Australia. A 2016 Government report found that the Basin sustains $12 billion worth of industry annually.
(http://www.agriculture.gov.au/water/national/great-artesian-basin/economic-output-groundwater-dependent-sectors-great-artesian-basin)
(http://www.abc.net.au/news/rural/2016-08-25/gab-economic-report/7784084)

A scientific review by soil scientist Robert Banks outlined the severe risk to the Great Artesian Basin (and all that depends on it) from CSG drilling in the Pilliga State Forest. The most serious risk is to the pressure exerted in the "recharge" area of the Pilliga, the site of Santos' proposed drilling for CSG, which keeps the bores of the GAB flowing from "Cape York to Coober Pedy". The report states "removal of this pressure through water abstraction associated particularly with CSG risks removing the driving force of many of the free-flowing artesian bores and springs."
(http://www.gabpg.org.au/wp-content/uploads/2014/11/GAB-Report-Second-Edition_Final10032015.pdf)

The Project will extract over 35 billion litres of salt laden groundwater, much of it in the first five years. The coal seam needs to be dewatered to release the gas, but critically this aquifer lies beneath the Pilliga Sandstone, part of the Great Artesian Basin Recharge Zone. Santos' Environmental Impact Statement admits that the Project will result in a loss of water from the Great Artesian Basin recharge aquifer over time. In Queensland, CSG operations have already resulted in draw down of aquifers, despite assurances by the proponents to the contrary.

It is unthinkable that any government would allow this to happen and make thousands of communities and millions of hectares across Australian entirely unviable for life and agriculture. The recharge area of the Pilliga must be protected at all costs. On this point alone, allowing the Narrabri Gas Project to proceed, putting at risk the productivity of the agricultural lands that surround the Pilliga Forest and the health and well-being of its residents, would be a catastrophically short-sighted decision. Once our water resources are destroyed, there is no turning back.

The Environmental Impact Statement fails to correctly risk assess the groundwater impacts of the Narrabri Gas Project on stock, domestic and irrigation users, and groundwater dependent ecosystems. This could have disastrous consequences as there are over 4,000 bores within just 30 km of Leewood, including the Narrabri town water supply, not to mention the Artesian bores the length and breadth of the Basin.

The Environmental Impact Statement claims that depressurisation of good quality shallower aquifers will be less than 0.5m due to the assumption that there are "relatively impervious rock layers" between the target coal seams and the aquifer. These modelled drawdown impacts on groundwater in the Environmental Impact Statement are not credible given the absence of supporting data. There is absolutely no evidence in the Environmental Impact Statement that demonstrates there is no connectivity between aquifer strata, other than Santos' own highly subjective risk assessment. Santos' claims that there is a "relatively impervious rock layer" is misleading at best, a complete falsehood at worst, and is tantamount to an admission that Santos know their CSG operations can and will have an impact on groundwater quality and quantity in adjacent or overlying aquifers.

The hydrology model completely fails to consider the complexities of the underground strata. Its assumptions need to be critically and independently reviewed since the Consultant has used their own values for the key hydraulic parameters. They have assumed very low permeability of rock strata above the coal seams which are to be de-watered. Both the model and the hydraulic conductivity values could be totally wrong (or faulting in the rock strata could render the entire model meaningless), with calamitous ramifications for the groundwater resources that the region relies upon.

Regardless, even a drop of 0.5m could have significant impacts on the permanence of some waterholes and shallow water tables associated with alluvial areas. Similar claims related to depressurisation made by the proponents of major CSG projects in Queensland have been found to have significantly underestimated the impact.

The calculated subsidence (done by Eco logical) from de-watering is assumed to be no more than 20cm, which cannot be verified. Regardless, even a drop of 20cm could have significant impacts on agricultural production.

The risk of gas leakage into shallow irrigation, domestic and stock bores has been subjectively assessed as low by Santos. Again, this is an unsubstantiated assertion. There is no data or measurements, and no reference to the Queensland CSG industry or international experience, which surely must be considered in light of the empirical evidence from Queensland of methane flux through soils of the

Condamine/ Tara/ Chinchilla area and the proven connectivity of the aquifer with the Walloon coal measure in the Condamine River (https://www.nature.com/articles/srep15996)

Santos did their own faulting study and concluded low risk. The faulting study carried out by Santos is not sufficiently detailed to rule out connectivity faulting in the rock strata under the Project area.

Santos' referral to the Commonwealth under the EPBC Act (2014, p65) indicated that "an assessment of the Project indicates that the duration and wider geographic extent of depressurisation of groundwater head within the coal seams and adjacent strata will cause a significant impact to the groundwater resources of the Gunnedah-Oxley Basin." The use of the word "will" is definitive - the dewatering of the targeted coal seams will at some point in the future have an impact on the water availability in another basin remote to the area known as the Narrabri Gas Project. Even those not living in or adjacent to a gasfield could potentially be impacted through water loss or pollution, and the changing of the entire region toward gasfield industrialisation.

The Bohena Creek catchment area comes directly from the Pilliga Forest and is a large, unregulated catchment with the capacity to provide substantial flows through the Narrabri Gas Project area. Santos' Leewood Waste Water Facility is located just 450m from the Bohena Creek, in the heart of the catchment area.

Santos plans to release treated water into Bohena Creek during high and moderate flows. Hydrological modelling on the impacts of treated water release into Bohena Creek relies on a principle of maximum dilution during periods of high flow but completely ignores the fact that surface water can be trapped in creek features and can rapidly sink into the shall aquifer which underlies the creek system. No assessment has been undertaken on the impact of polluted water within waterholes, which get recharged during periods of high flow.

Bohena Creek is also a very important local waterway, which feeds directly into the Namoi River, where it forms the lower Namoi "alluvial fan" that is relied upon by all downstream irrigators and all downstream communities. This underpins a substantial part of the Namoi Gross Regional Production from irrigation and depends on both quality and quantity of supply. The NSW Government must insist that no treated water is released into Bohena Creek.

The Environmental Impact Statement contradicts the Australian GDE Atlas by claiming that the only surface groundwater ecosystems in Bohena Creek are a few unidentified waterholes which are in poor condition. The Environmental Impact Statement completely ignores that Bohena Creek itself is a recognised surface groundwater ecosystem (Australian GDE Atlas), "moderately dependent upon surface expressions of groundwater". The 30 odd waterholes and the upstream springs are the surface expressions of this system.

Santos claims that Bohena Creek is generally in poor condition. This is simply untrue. Bohena Creek meets the criteria of being a "priority groundwater dependent ecosystem" and surveys have found that most parts of the Creek are in good condition, supporting old growth red gum, rough barked apple, woodlands, and many semi-permanent waterholes (refer above). These have a high biodiversity value and local significance to wildlife.

Bohena Creek

The stygofauna survey appears to have been conducted in a way so as to minimise the chances of obtaining results, with very poor coverage of 'control' areas. Independent surveys as recently as 2013 discovered new species and areas of high diversity. To claim that there will be no impact on stygofauna is an unsubstantiated given this lack of information and given questions relating to the modelled groundwater and treated water release.
(http://www.australiangeographic.com.au/news/2013/08/bizarre-new-species-stops-pilliga-mining)

Well Integrity

Despite claims of "world's best practice", Santos **cannot** guarantee well integrity and mother nature does not care much for it. No amount of regulation in the form of a Code of Practice for CSG Well Integrity will prevent the inevitable - as with all engineered structures, all well casings will fail in time. According to Professor Tony Ingraffea (who heads the Cornell Fracture Group and who has undertaken numerous research and development projects for both public and private institutions, including Schlumberger and the Gas Research Institute), data from the gas industry itself demonstrates that 7% of wells fail upon commissioning, 30% leak within 20 years, and 50% within 30 years.
(http://www.pnas.org/content/111/30/10955.full)
(https://www.youtube.com/watch?v=WJ0cBZxpghg&feature=youtu.be)

Leaky gas well casings, often hundreds of metres underground, provide a pathway for methane and other contaminants to pass laterally and vertically through fracture systems and into the water and the atmosphere.

Santos has no comprehensive strategy to ensure long-term well integrity. There will be a honeycomb-like structure of 850 crumbling, disintegrating, corroding time-bombs and associated infrastructure, including pipelines, leaking into the Great Artesian Basin and the shallower alluvial aquifers that rural communities across North West NSW rely upon, and no insurance mechanism is available to landholders to protect their assets and their livelihoods (see below).

Example of one of the many corroding, crumbling Santos CSG wells in the Pilliga Forest

Groundwater contamination and/or depletion

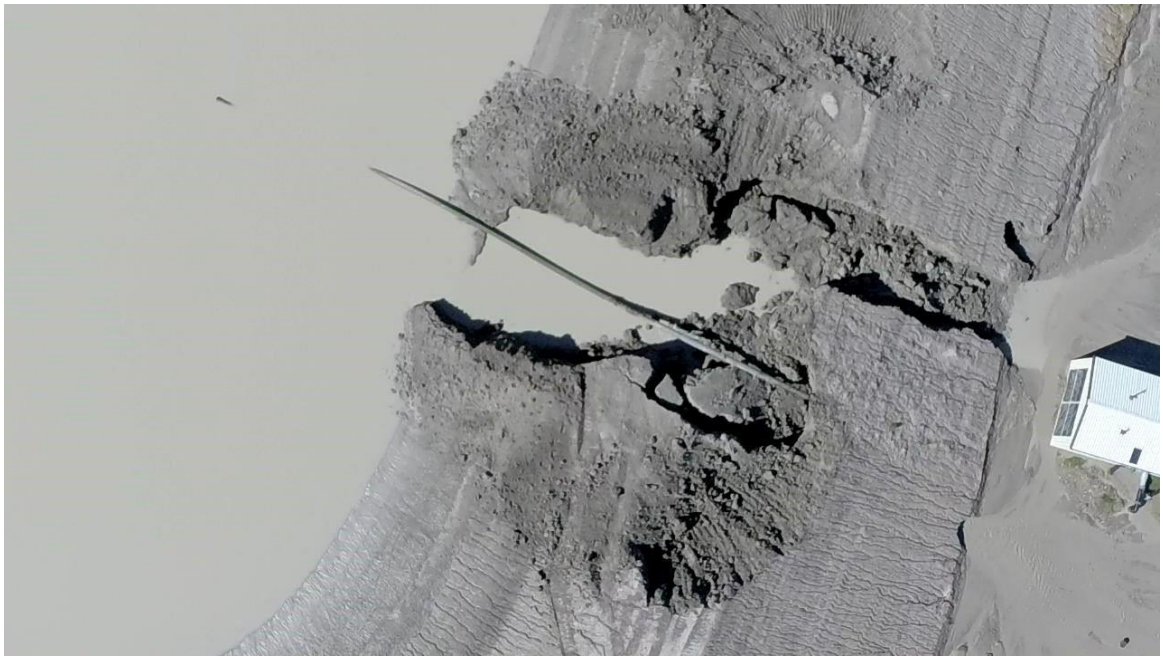
We are gravely concerned that our water supply could be contaminated (or depleted) by CSG operations in our region, leaving us high and dry. Contamination of our precious water resources, our air and our soils is a very real risk and does not respect property boundaries.

Potential contamination of aquifers needs to be taken seriously and is a real possibility. Santos and their predecessor, Eastern Star Gas (of which Santos was a major shareholder), have been unable to demonstrate to the community or to the NSW Government that it can undertake CSG extraction in our region safely, and that our precious surface and groundwater systems will be protected.

Santos' environmental management systems have routinely failed, with over 20 spills from all parts of their operations, from "holding ponds", pipelines, the waste water treatment facilities and at well sites in the Pilliga Forest. Santos has poorly handled multiple contamination events to waterways and aquifers. Major spill events have occurred, including a 10,000-litre spill of waste water that polluted

hectares of the Pilliga Forest, resulting in tree deaths and soil damage. Santos CSG operations have also involved the contamination of an aquifer with heavy metals, including uranium at levels 20 times higher than safe drinking water guidelines (http://www.smh.com.au/environment/santos-coal-seam-gas-project-contaminates-aquifer-20140307-34csb.html). Alarmingly, virtually every incident was discovered by community whistleblowers.

In Queensland, the potential for contamination was highlighted to devastating effect by the blow out of a CSG waste water dam wall near Miles in early May 2015, which led to huge volumes of waste water flowing onto a neighbouring property (photos courtesy of John Reid Carew attached).



In early May 2017, three spills of CSG wastewater totalling 237,000 litres were discovered from Santos' infrastructure in Queensland. These spills again underscore the risks to our land and our water from CSG operations (https://twitter.com/isobelroe/status/859864223806967808).

For us, the effect of CSG operations which negatively impact our single reliable source of water and our soil would be to critically damage our business, threaten the livelihoods of our employees and their families, and the multiple supply businesses who rely upon us.

This suggests that the value of rural properties surrounding the Narrabri Gas Project could be rendered virtually zero, should aquifer contamination and/or depletion occur. Recent experience, particularly in the Hunter Valley, suggests that posted bonds are insufficient to cover the cost of rehabilitation, if such a thing were even possible. To ensure that this experience is not repeated, **Santos should be**

required to post a bond equivalent to the value of properties (including irrigation, stock, and domestic water licences) which could be potentially affected, guaranteed for 100 years, with the proviso that it be included as a condition of approval (if approved) and that Santos raise the money and post the bond before further work is undertaken. If Santos' operations as part of the Narrabri Gas Project are as safe and low risk as they claim, they should be pleased of the opportunity to "put their money where their mouth is".

For example, if groundwater were rendered unusable over the Project area and an area extending five kilometres north and south and 50 kilometres to the west (the general direction of groundwater flow), this would affect about 400,000 hectares and about 300,000 megalitres of irrigation licences. The NSW Government must insist that Santos post a bond equivalent to the value of this land and water. Assuming a conservative land value of $1,000 per hectare (including the forest land) and $1,500 per megalitre, this would suggest a bond in excess of $850 million, guaranteed for 100 years.

For this valuation to be more accurately quantified, as it should, the extent of any possible pollution plume should be modelled and actual land values of the affected area should be applied, together with an amount to compensate for lost future earnings. This would allow the magnitude of the appropriate bond to be determined.

Insurance, or lack thereof

The risks associated with the CSG industry are so significant that they are considered "uninsurable". That is to say, significant adverse impacts are considered almost inevitable.

We approached our own insurance company to mitigate the risk of CSG operations in our locality and to safeguard our assets and livelihood but were advised that this would not be possible. This leaves us entirely on our own, and at the mercy of Santos, a company with multiple well-documented environmental breaches, in both Queensland and also in the exploration phase of the Narrabri Gas Project.

When landholders consider this in conjunction with advice obtained from Meat and Livestock Australia which states that "the landholder may still have primary liability in the event of contamination of the soil, pasture or groundwater, neighbouring properties, as well as livestock which, if then processed and consumed, could breach Australian food standards or importing country requirements for meat." (www.mla.com.au Coal Seam Gas Operations on Livestock Properties). This is particularly pertinent for landholders who sign a National Vendor Declaration or similar document for their produce because, when they sign such a document, they are providing the buyer with a guarantee relating to the food safety status of the animals or crops they are purchasing.

Being unable to obtain insurance leaves food producers like myself at serious risk, questioning what consequences there may be for food products sold into the future, and whether we may ultimately incur a legal or financial liability. Detection of contaminants would also mean that we would be immediately suspended from current and future market participation for our product. Our signed contracts for supply all include clauses related to contamination of the shipment and, as per the terms of those documents, we know that our supply chain partners would hold us liable for any product

contamination caused by CSG activities within our wider region, essentially leaving us to bear the ultimate burden in the event of contamination of the food chain.

To date, and despite repeated requests, Santos has refused to provide evidence of their insurance policies, including how and to what extent they have quantified the potential adverse liability arising from their activities in PEL238, citing "confidentiality provisions which preclude them from disclosing details to me or any other third party".

This is precisely why we sought to insure against such an eventuality, and for which there is no cover available. Neither Santos, their insurance company, nor a NSW Government Bank Guarantee to an undisclosed amount, can provide certainty of cover for or a remedy for the inability to obtain insurance privately.

This critical issue of insurance, or lack thereof, was highlighted in The Land newspaper (18 September 2015) and more recently (28 April 2017), evidence emerged that a Northern Territory pastoralist had been advised by his broker that he would be placing himself at serious risk if he agreed to CSG on his property, and that some of the risks involved were virtually uninsurable.
(www.theland.com.au/story/3365648/csg-too-risky-for-insurers/)
(http://www.lockthegate.org.au/broker_farm_insurance_wont_cover_fracking_risks)

Santos' Narrabri Gas Project Environmental Impact Statement includes no contingency plans such as Comprehensive Environmental Insurance to manage a range of risks, including Residual Risk, which was specifically referred to in the Secretaries Environmental Assessment Requirements. It is not sufficient to only carry Public Liability Insurance.

By not taking out Environmental Insurance cover, the proponent is effectively managing their Residual Risk by transferring that risk to the landholder and the environment. The NSW Government must require Santos to provide evidence of Comprehensive Environmental Liability for the current development consents and permits that they hold and Santos must be required to provide a Certificate of Currency of Comprehensive Environmental Insurance including policy terms and conditions, and parties noted on the policy, when seeking land access. It is unconscionable that landholders, who do not have a legislated right to refuse access for any and all activities associated with the CSG industry, have this Residual Risk transferred to them.

For the NSW Government to assert (via the IPART) that landholders', whose land, water, business and/or product has been negatively impacted as a result of a gas companies CSG activities, could take a case for damages or loss in common law is extremely naïve at best, and demonstrates a complete lack of understanding of the risks landholders', their neighbours, and downstream water users, amongst others, are exposed to.

Salt and by-products

Santos' Narrabri Gas Project will produce massive quantities of toxic waste requiring treatment and disposal. Santos' Environmental Impact Statement indicates that up to 115 tonnes of salt per day (equivalent to 3 B-Double trucks), or 500,000 tonnes over the life of the Project, will be generated, which Santos says will be disposed of at a yet to be disclosed appropriately licensed facility. However, there is currently no licensed facility in Australia for the concentrated solid salt-waste produced after the reserve osmosis of CSG brine. A toxic waste dump at an undisclosed location isn't a solution - it is a time bomb being set for future generations of NSW taxpayers to deal with. Until such times as Santos can demonstrate that they have a clear management plan to dispose of the salt and toxic brine safely, this Project must be rejected.

This toxic waste is currently being held in "holding ponds" (essentially evaporation ponds by another name, which are banned in NSW) at the Leewood facility, a risky venture in a known flood plain. What guarantees are there that this infrastructure will not fail in the event of a significant rain event or the liners degrade, puncture and leak over time, allowing their contents of either produced water or concentrated brine, to ultimately flow into our groundwater systems – the only source of water available to the local residents?

CSG Holding Ponds, Darling Downs, Queensland

It is important to note that waste from AGL's CSG operations at Gloucester was rejected from two separate facilities in the Hawkesbury region and in Newcastle after community concerns were raised about the transport of the waste and the potential public health risks. Santos has also been a long-term, large-scale operator in the Queensland CSG industry and, despite this, they still have no clear management plan for the salt and toxic chemicals they will bring to the surface as a result of their CSG extraction activities in the Pilliga.

For any approval to be given without that plan in place, especially given the history of contamination and mismanagement of waste water in the Pilliga, is utterly irresponsible and culpable and would potentially expose both Santos and the NSW Government to legal action on a scale never seen before in this country. Failing to plan, as the saying goes, is planning to fail.

Santos also plans to use the treated CSG water for irrigation, dust suppression and fire-fighting, so called "beneficial reuse", putting at risk soil, local water ways, air quality, human health and the many rare and threatened plants, birds and animals in the Pilliga Forest, the largest remaining temperate woodland in eastern Australia. Such plans represent nothing but a short-term and cheap option for disposing of waste water. Santos states that the "Reverse Osmosis (RO) permeate should contain no heavy metals or organic compounds". However, Reverse Osmosis (RO) alone will not remove BTEXs and BTEX may naturally occur in extracted CSG water. Santos' previous Reverse Osmosis treatment plant in the Pilliga failed, sending millions of litres of water with elevated ammonia levels into a local creek.

In April 2015, AGL was forced to end a trial using CSG waste water for irrigation in northern NSW after regulators found it left behind unacceptably high levels of salt and heavy metals. Peter Jamieson, an operations chief with the NSW Environment Protection Authority, said of the trial that is was "unlikely to be sustainable in the long term". AGL's irrigation program involved mixing the waste water with fresh water to irrigate crops; crops which fed animals ultimately destined for the dinner tables of NSW and Australian families. If this method of disposing of waste water has failed with only a few exploration wells, then how will Santos dispose of the toxic water from hundreds of production gas wells?"

Social and public health impacts

Santos' Social Impact Assessment is now three years old and entirely inadequate. Santos' Environmental Impact Statement claims that the "residual social and health impacts of the Project are low". Not only is this assertion unable to be substantiated but it contradicts the documented evidence of impacts from other CSG regions.

In Queensland, the impact of the CSG industry has been severe. It has created boom and bust towns, with documented large scale job losses, towns with hundreds of unsaleable and un-rentable houses, contractor insolvency, together with depleted community services and infrastructure. No amount of money compensates for water and air pollution, degradation of agricultural land, loss of amenity and landscape, loss of control over what happens on your property, mental stress and anguish, pain and suffering or your children and family being constantly ill.

A 2015 report compiled by The Australia Institute, http://www.tai.org.au/content/unconventional-gas-bad-news-business-and-jobs-report, based on gas industry funded research, highlights the impacts of gas development on local towns in Queensland and serves as an important warning for NSW. The report demonstrates that expectations of economic benefits for local towns in Queensland largely failed to eventuate and most other industries reported being worse off due to the CSG industry's push into their region. The report shows that the CSG industry has led to a reduction in community well-being and social cohesion; a deterioration in local skills and infrastructure; few

additional local job opportunities; and limited economic benefit to the wider economy. In Queensland, where this research was undertaken, Santos were one of the lead operators, so we know it won't be any different at Narrabri.

Santos' own modelling, for example, indicates that this gasfield development is anticipated to support just 145 long term jobs after construction is complete, with less than 10% of those based in the Narrabri LGA. One has to wonder though, at what cost? Research tells us that for every job created in the CSG industry, 1.8 jobs are lost in agriculture.
(http://onlinelibrary.wiley.com/doi/10.1111/1467-8489.12043/abstract)
(https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/coal-seam-gas/Socioeconomic-impacts-of-coal-seam-gas-in-Queensland.pdf)

In Narrabri, this Project will have negative impacts on cost-of-living, the labour and housing markets. The latter is cited in as a benefit of the Project but it will not benefit low-income renters, pensioners, and other vulnerable members of the community. The effect of the Project on cost-of-living in the Narrabri LGA needs to be modelled, assessed, and considered, and available for public scrutiny, as do the labour dynamics of the Project, prior to Project determination.

In December 2016, researchers from the University of Newcastle finalised an evidence-based research project entitled "Local Attitudes to Changing Land Use – Narrabri Shire", on how a particular rural community is affected and responds to land use change (http://www.newcastle.edu.au/research-and-innovation/centre/csrrf/publications/local-attitudes-to-changing-land-use-narrabri-shire).

The key findings that are discussed in the reports include:

- **Land use change does not occur in a vacuum** and local experiences and perceptions of land use change are framed by particular social, cultural, economic, political, and natural dynamics.
- **Conceptions of place are critical mediators of attitudes to changing land use.** In Narrabri, place is connected to notions of rurality, economic diversity, and harmony. Land use change that is seen to threaten such visions of place will cause tension, friction, and conflict.
- **Water and soil are the ultimate resources that must be protected**. Conceptions of place are closely intertwined with notions of water and soil. Water and soil are at the top of the resource hierarchy and land use that are believed to jeopardise these resources are seen as a threat to the social and economic vigour of Narrabri and a threat to individual well-being.
- **Attitudes to land use are shaped by three interconnected modes of proximity: spatial, moral, and socio-economic.** These three modes of proximity cannot be viewed in isolation and people's location in spatial, moral, and socio-economic terms is not static. Attitudes will be transformed in response to individual's movement within spatial, moral, and socio-economic landscapes.
- **Local communities become 'casualties of spatial proximity'**. Narrabri residents express a general consensus that the local community disproportionately carry the costs of extractive activities and are disadvantaged because they are at the centre of impact.
- **A cultural code of reciprocity shapes people's attitudes to land use change and, more specifically, various agents in the land use sphere.** The cultural code of reciprocity demands a fair and appropriate exchange of costs and benefits.

- **Knowledge and scientific 'truths' are contested**. Knowledge is politicised and there is subsequent uncertainty associated with technical science. This often leads people on their own fact-finding missions.
- **Witnessing and circulating stories hold a validating force and transform 'gut feelings' to 'truths'**. Personal experiences or testimonies from significant others represent tipping points in people's assessment of truth and, subsequently, their positioning on a particular land use issue.
- **The Sandstone Curtain is a service delivery and communication barrier that shields decision makers from the consequences of their decisions**. The urban-rural (policy) divide is symbolised by the Great Dividing Range or the 'Sandstone Curtain'. The notion of a curtain attains metaphorical force in that it represents both a physical separation between urban-based decision makers and the perception of governments 'pulling the curtain' and remaining oblivious to what is happening beyond the ranges.
- **Perceptions of preferential treatment are profuse.** Many of the locals experience a sense of bias favouring the extractive industries. The perceived interconnection between industry and government is leading to cynicism and making many locals sceptical to land use change as it is seen to be led by external interests.
- **Effective land use governance requires local empowerment**. Local government is seen to have limited authority and decision-making powers when it comes to critical land use changes yet are seen to be burden with various negotiations and engagement functions. There is a 'governance in the gaps' scenario emerging from failures to create integrated planning frameworks to ensure coordination and collaboration.
- **New alliances are emerging within the Shire**. In the face of what is experienced as an antagonistic other, many local farmers and environmental groups meet and express a new forms of rural citizenship

There are now clearly articled warnings among Australian public health and medical organisations (copy attached) that CSG developments pose poorly assessed, yet potentially catastrophic health risks, that will leave a legacy of suffering for generations to come, and there is currently no regulatory framework that can be said to adequately protect public health.

Steve Hambleton, a former Present of the Australian Medical Association, said in May 2013, "Despite the rapid expansion of CSG developments, the health impacts have not been adequately researched, and effective regulations that protect public health are not in place. There is a lack of information on the chemicals used and wastes produced, insufficient data on cumulative health impacts, and a lack of comprehensive environmental monitoring and health impact assessments. In circumstances where there is insufficient evidence to ensure safety, the AMA recommends that the precautionary principle should apply. This is essential given the threat of serious and irreversible harms to human health."

Chief amongst my concerns is the potential threats to health arising from airborne pollution and the contamination of our soils, and surface and ground waters, particularly water used for drinking, everyday household tasks such as washing and showering, stock watering and food production.

The National Pollutant Inventory shows an exponential increase in air pollution in the areas close to gasfield developments in Queensland. Data from just one source of emissions in the Queensland gasfields, QGC's Kenya operations near Tara – compromising 299 wells, 3 field compressor stations

and 1 central processing plant - demonstrates that thousands of tonnes of pollutants are being released the air annually, exposing the families, businesses and communities who live in close proximity to the gasfields to unacceptable impacts and ongoing risks. Recently published data from 2015/2016 indicates the following chemicals are being released into the air each year:

- 80 tonnes of formaldehyde (up from zero in 2009/2010).
- 1,400 tonnes of nitrous oxides (up from 68 tonnes in 2009/2010)
- 880 tonnes of carbon monoxide (up from 18 tonnes in 2009/2010)
- 708 tonnes of dangerous dust particles (Particulate matter) (up from 4 tonnes in 2009/2010)
- 190 tonnes of volatile organic compounds (up from 1 tonne in 2009/2010)

Source: http://www.npi.gov.au/npidata/action/load/individual-facility-detail/criteria/state/QLD/year/2016/jurisdiction-facility/Q012QGC007

CSG-related air pollutants including carcinogenic silica dust, carcinogenic benzene and volatile organic compounds create ozone or smog. Exposure contributes to costly, disabling health problems, including premature death, asthma, stroke, heart attack and low birth weight.

The chemicals used in, and generated by, CSG mining, like biocides and bactericides, are highly toxic. They are being released to the environment and you can't bring them back. Some of the chemicals used will remain within the structure of the coal seam and can move through groundwater. Publicly available information on the chemicals used is limited at best but is known to include allergenic and carcinogenic substances. These chemicals present a high risk of groundwater contamination from the waste water that will impact the surface and subsurface water in the vital southern recharge area of the Great Artesian Basin, and also the vital Namoi alluvial aquifers.

CSG extraction also results in fugitive emissions of methane at every stage of the process and from all ancillary infrastructure along the way.

Waste water coming to the surface may also contain volatile organic compounds, high concentrations of ions, heavy metals, and radioactive substances. The health effects of some of these substances are known to cause eye, ear, nose and throat irrigations, respiratory infections, headaches, neurological impairment, nausea, skin rashes, liver and kidney damage and miscarriages. Many are known to cause cancer.

CSG companies frequently infer safety of these products due to the fact that some are components of everyday household products. However, just because we have hair bleach or antifreeze in the cupboard does not mean that it is safe to ingest it. The CSG companies also argue that only a very small percentage of each chemical is used, however, cumulatively these chemicals may still constitute literally truckloads in volume. There is no safe level for some of these substances and we need to be aware that some chemicals absorb to substances in the environment and can become concentrated.

From around the world and in Queensland, we are beginning to see significant evidence of the physical health impacts of living in, or in close proximity, to a gasfield. Most recently, a massive and unprecedented gas leak at Porter Ranch, California, caused many children and adults to become sick with complaints of headaches, nausea, and congestion. Thousands of residents were ordered to be

evacuated from their homes for several months. What will be the long-term health effects for residents who were exposed to methane, benzene, and other chemicals over an extended timeframe? (http://www.commondreams.org/views/2015/12/21/porter-ranch-gas-leak-catastrophe-not-seen-bp-oil-spill)

Neither the NSW Government nor Santos have investigated or dealt with the serious health effects of CSG now appearing in peer-reviewed research in the United States. Hundreds of peer-reviewed studies have been published in the last 2 years, with a 2016 review finding 84% (26 out of 31) studies point to public health hazards, risks and adverse health outcomes and 87% (40 out of 46) point to elevated air pollution. A thorough, less selective review of the existing literature must be undertaken prior to Project determination.

In the initial instance, more detailed information on health impacts of unconventional gas extraction can be found in the Compendium of Health Studies produced by the Concerned Health Professionals of New York (https://link.springer.com/article/10.1007/s40471-017-0097-9) and in a 2017 report by Shaina Stacy at the Brown University School of Public Health (https://link.springer.com/article/10.1007/s40471-017-0097-9).

Further information based on the Australian setting can be found in the initial instance here:
http://dea.org.au/images/general/viewpoint_issue_8_CSG.pdf
http://www.ntn.org.au/wp/wp-content/uploads/2013/05/Symptomatology-of-a-gas-field-An-independent-health-survey-in-the-Tara-rural-residential-estates-and-environs-April-2013.pdf
http://www.gabpg.org.au/wp-content/uploads/2013/10/CSG_Health_Risk_Management_Tools_Dr_Somerville.pdf

Contrary to what Santos claims, detailed below will be some of the real-life social impacts of the Narrabri Gas Project on residents of Narrabri -

• Property value decrease - "The value of their property has probably decreased due to coal seam gas which meant they had less equity to borrow money".
(https://www.chinchillanews.com.au/news/academic-research-into-csg-unveiled-at-chinchilla-/3115839/)

• Inability to borrow money – “Unable to use property with gas wells as loan security”.
(https://www.chinchillanews.com.au/news/academic-research-into-csg-unveiled-at-chinchilla-/3115839/)

• Cost to farmers of CSG mining on their land runs into the millions – “A sample area averaged a loss of $2.17 million over 20 years when CSG mining activity was present”.
(http://www.abc.net.au/news/2016-12-16/coal-seam-gas-mining-costs-farmers-millions-csiro-study-finds/8124834)

• House prices and rents increase then crash below original values – “In the past 12 months more than 1,000 houses have been listed for sale across Miles, Dalby Chinchilla and Roma but only 325 have been sold”; “the value of her unimproved land tripled in three years, before dropping more than $20,000 below its original value.”
(http://www.abc.net.au/news/2015-04-20/report-reveals-fall-in-qld-mining-town-property/6405190)

• Low income earners are driven out and rates increase – "local residents incur the majority of the costs in the form of rising house prices (for aspiring owners) and rising rates" (http://www.northerndailyleader.com.au/story/4562970/what-does-the-csg-industry-do-to-the-price-of-nearby-houses/)

• Families will leave town – "Rapid change can often lead to social instability, a reduction of community cohesiveness, and individual and community wellbeing decline." "Also affecting the character of certain towns is an outward migration of older residents who took the opportunity to sell their house for a good price. As a result, there are reports that towns are losing their volunteering resources and their informal childcare providers." (http://gastoday.com.au/news/lessons_csg_operators_can_learn_from_southern_queensland_towns/91959)

• The Big Bust – "In Dalby, many homes are worth $50,000-$100,000 less than they were at the height of the boom, and rents are $50-$60 a week lower. Miles and Chinchilla saw even higher peaks and bigger falls." (http://www.abc.net.au/radionational/programs/breakfast/csg-boomtime-over-for-south-west-qld/6050560)

• Tourism hit – "Grey nomads asked to return" (http://www.thegreynomads.com.au/van-park-owner-begs-grey-nomads-to-end-boycott/) (http://www.news.com.au/national/nsw-act/mining-leaves-a-bitter-taste-winemaker-david-clarkes-anti-coal-seam-gas-crusade-collapses/news-story/836a85f198718ec7d84cf1d5950c6723)

• Road damage (https://www.sunshinecoastdaily.com.au/news/central-queensland-councils-csg-mining-road-damage/2059655/)

• Weed spread – "Cattle farmer Allan Leech had to destock his property at Dalby, about an hour west of Toowoomba, after a sudden infestation of the noxious African lovegrass weed." Santos has already introduced galvanised burr into Bohena well area. (http://www.abc.net.au/news/2014-08-23/farmer-claims-csg-companies-spread-weeds-on-southern-qld-propert/5661016)

• Accidents that could impact homes and farms – "The blow-out was triggered when workers tried to install a pump and created a pressurised spout of water and gas which spewed for more than 24 hours until it was plugged. The farmer who owns the land around the well said it was the fourth gas-related incident on the property in 5 years" (http://www.smh.com.au/business/blowout-at-well-fuels-concerns-over-coal-seam-gas-20110523-1f0us.html)

• Vehicle traffic (https://www.crikey.com.au/2012/03/09/csg-and-the-land-straight-from-the-farmers-mouths/)

• Massive industrialisation of landscape - "It spreads like a web" (https://www.crikey.com.au/2012/03/09/csg-and-the-land-straight-from-the-farmers-mouths/)

• Controlled traffic farming with GPS not possible (https://www.crikey.com.au/2012/03/09/csg-and-the-land-straight-from-the-farmers-mouths/)

• Failing to compensate landholders – "Gas companies known to refuse to reimburse landowners until an agreement is signed". (https://www.chinchillanews.com.au/news/chinchilla-csg-crisis-meeting-mounts-case-for-chan/3054691/)

• Silencing complainants with confidentiality agreements – "Gagged by confidentiality clauses".

(http://www.abc.net.au/news/2011-09-30/coal-seam-gas-rights-feature/3193840)

• Risks to public health, in particular risks from fugitive emissions, particularly on respiratory illness and foetal development. (https://link.springer.com/article/10.1007/s40471-017-0097-9).

• Health impacts – excessive noise and light pollution, increases in traffic accidents and fatalities, increases in domestic violence, alcohol and drug use, crime and disruptions of family and community relationships.
(https://static1.squarespace.com/static/54949381e4b05fcc6a96c5c6/t/57f698edc534a51b9098b9f9/1475778798615/HealthEffectsofFrackingBriefChesapeakePSROctober2016DontFrackMD.pdf)

• Coal seam gas – Protecting Your Family – "AMA: threat of serious and irreversible harms to human health."
(http://www.ntn.org.au/wp/wp-content/uploads/2013/12/CSG-Health-Impacts-Dr-W-Somerville.pdf

• Hospital admissions increase – "Gas exposure could occur naturally as chemicals rise from the ground"
(https://www.sunshinecoastdaily.com.au/news/sick-fear-it-csg-exposure/1481344/)

• Cancer, respiratory and cardiac admissions increase: - "The CSG area showed increases in hospitalization rates compared only to the rural area for neoplasms (RR: 1.09, 95 % CI: 1.02–1.16) and blood/immune diseases (RR: 1.14, 95 % CI: 1.02–1.27)."
(http://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2787-5)

• Air pollution – ozone, volatile organic chemicals, methane, hydrogen sulphide in drifting air emissions; heavy metals, radioactive elements, high PH, in salty produced water – "migraine headaches, nosebleeds and fatigue, damage to multiple organ systems symptoms" (https://static1.squarespace.com/static/54949381e4b05fcc6a96c5c6/t/57f698edc534a51b9098b9f9/1475778798615/HealthEffectsofFrackingBriefChesapeakePSROctober2016DontFrackMD.pdf)

• Ozone air pollution and inversion layer conditions – "Gas extraction and related activities can spark reactions that lead to high levels of ozone pollution. When ozone levels spike, experts recommend that people, especially those in sensitive groups—children, the elderly, and anyone with pre-existing respiratory conditions—limit time outdoors."; "Volatile organic compounds (VOCs) build high enough that they can trigger pollution-forming reactions. Warm air aloft can trap cold air below, creating an inversion that concentrates ozone pollution VOCs."
(http://research.noaa.gov/News/NewsArchive/LatestNews/TabId/684/ArtMID/1768/ArticleID/10808/New-study-explains-wintertime-ozone-pollution-in-Utah-oil-and-gas-fields.aspx)

• Hydrogen sulphide emissions – "Invisible, toxic, explosive, flammable, heavier than air"
(http://gibraltarrisk.com/content/hidden-danger-oilfield-hydrogen-sulfide-gas)

• Rise in cancer rates and hospitalisations from coal seam gas chemicals, produced water chemicals and flaring air pollution - "Between 2007 and 2012 the population of the Darling Downs increased by 7% from 235,193 to 251,893. During the same time frame acute hospital admissions for respiratory conditions increased by 124%, acute hospital admissions for circulatory conditions increased by 114%, invasive cancer incidence increased by 14%, and hospital admissions for attempted suicides increased by 50%."
(https://www.chinchillanews.com.au/news/lack-of-investigation-into-health-statistics-conce/3124489/)

• Interpersonal conflict – families and landholders are pitted one against another over compensation, water damage and uneven 'royalty' payments.
(http://www.smh.com.au/federal-politics/political-news/barnaby-joyces-forecast-of-csg-royalty-riches-compared-to-100-lamb-roast-claim-20170323-gv4lqs.html)

• Emotional stress – "emotional stress as a result from gas company dealings". (https://www.chinchillanews.com.au/news/academic-research-into-csg-unveiled-at-chinchilla-/3115839/)
• Suicide rates – "Dad was sitting at the kitchen table every night studying the Petroleum and Gas Act" (http://www.couriermail.com.au/news/queensland/george-bender-a-bitter-harvest/news-story/71f04e163f143a1cc699a90b9356b944)
• Invasion of gas workers – "nine out of ten people you see on the street are strangers". "An influx of non-resident workers in fluorescent work gear has changed the look and character of some towns" (http://gastoday.com.au/news/lessons_csg_operators_can_learn_from_southern_queensland_towns/91959)
• National purchasing of food and materials; not local (https://www.centraltelegraph.com.au/news/farmer-sick-csg-workers-camp/804775/)
• Workers banned from town – misbehaviour, alcohol and violence. (https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/coal-seam-gas/Socioeconomic-impacts-of-coal-seam-gas-in-Queensland.pdf)
• Littering and rubbish (https://www.australianmining.com.au/news/csg-company-accused-of-dumping-rubbish-on-sacred-indigenous-sites/)
• Produced water and drilling fluid dumping – "Contamination and excessive salt levels at a drilling site in the state's north". (https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/coal-seam-gas/Socioeconomic-impacts-of-coal-seam-gas-in-Queensland.pdf)
• Failing to pay contractors – "Gas giant Santos has been blamed for the collapse of a major Brisbane-based LNG contractor after delaying payment terms". (http://www.couriermail.com.au/business/pipeline-company-collapses-claiming-late-payments-by-gas-giant-santos/news-story/22ae992bfc7140193f41be1590ce34c8)

Health Impact Assessments and Baseline Monitoring

The potential for water, soil and air pollution, degradation of agricultural land, and loss of amenity and landscape, can have a range of negative consequences, including mental health impacts, for local families and communities.

The NSW Government must insist that Santos conduct proper Health Impact Assessments, including Mental Health Assessments, and baseline testing and monitoring for a minimum of 2 years of every single resident currently living in, or in close proximity to, the proposed gasfield. It is essential that this be completed prior to Project determination. These studies should include, but not be limited to, exposure pathways, the possible effects of stress, chemical contact, generated emissions, airborne dust and contamination events, and alteration to existing lifestyle.

In addition to this, comprehensive air, water and soil baseline testing and monitoring for a minimum of 2 years is essential prior to Project determination. It needs to take into consideration all the gases and volatile organic compounds, both natural and derived, that are emitted via well drilling, gas, and pipeline valves, leaking wellheads, flaring, and any other processes. Water monitoring must include isotope testing and bacterial assessment.

All baseline studies of health, water, air, and soil must be fully funded, comprehensive, and genuinely independent, and available for real time public scrutiny. All historical results that have analyses of health, water, air, and soil should also be made available for public scrutiny.

Furthermore, it is imperative that there be timely, full, and open disclosure of all chemicals, the quantities of chemicals, the mixes of chemicals, used or planned to be used for drilling, and every other process at every other stage of the gas extraction process, and that the requirement to do so should be enshrined in legislation.

The current grossly inadequate assessment, monitoring and regulation of CSG related activities, and the complete lack of comprehensive baseline data, is insufficient to protect the health of current and future generations.

Cumulative impacts

CSG developments represent a substantial industrialisation of a previously rural landscape, and we know first-hand from Queensland the impacts that are likely to occur. Santos, through its incremental development-by-development approach, is leading the NSW Government through a very "non-strategic" approach to what the NSW Government declared as a State Significant Strategic Energy Project on the basis of the Memorandum of Understanding in February 2014.

Santos has failed to correctly assess cumulative impacts in the Environmental Impact Statement. The Environmental Impact Statement seeks to assess the impacts of the Narrabri Gas Project **on other developments** in the region rather than assessing the cumulative impact of the Narrabri Gas Project **and** the other developments **on the community and the environment** of the region.

It is inconceivable that Santos is not aware of the proper procedure for a cumulative impact assessment, having employed Eco Logical Australia to prepare parts of the Environmental Impact Statement. Eco Logical had previously developed the Namoi Cumulative Risk Assessment Tool (NCRAT) for the Namoi Catchment Management Authority.

The Namoi Cumulative Risk Assessment Tool was developed specifically to assess the cumulative impact of mining scenarios on bioregional assets in the Namoi Catchment, in which the NGP lies, and considers any mining scenario, be it a combination of one of more mines including open cut mines, long wall mines and coal seam gas operations. It quantifies the risk of cumulative impacts across ten natural resource assets in the Catchment, namely:

- Land use
- Soils
- Carbon
- Surface water
- Groundwater
- Vegetation extent
- Vegetation type

- Vegetation condition (intactness)
- Vegetation connectivity
- Threatened species.

The Namoi Cumulative Risk Assessment Tool is designed to:

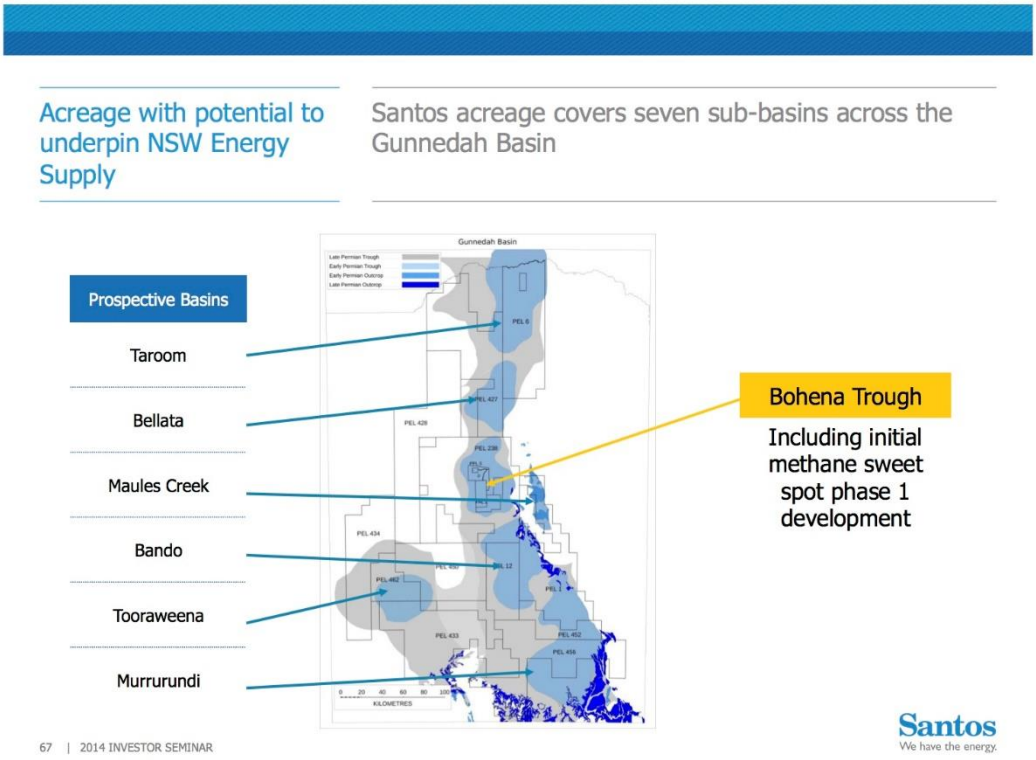
- analyse the cumulative impact of a scenario across a number of asset sensitivity surfaces
- call on respective risk tables that associate sensitivity and likeliness/magnitude with risk, and
- produce a risk report that includes maps, area statistics, single and cumulative risk diagrams, and statement about specific assets impacted.

In other words, the Namoi Cumulative Risk Assessment Tool is an ideal tool for assessing the cumulative risks associated with the Narrabri Gas Project with respect to the natural resources of the region. The Namoi Cumulative Risk Assessment Tool is housed in the Local Land Services office as well as the office of the Independent Expert Scientific Committee.

The project should not receive further consideration until the Namoi Cumulative Risk Assessment Tool is deployed to assess the cumulative risks of the development to the natural resources of the region.

In addition, the Narrabri Gas Project represents a significant expansion of the CSG industry in this region, and indeed, in this State and it is imperative that the Environmental Impact Statement be considered in the context of Santos' overall aspirations in North West NSW (almost equivalent in size to that of Tasmania), since it is clear that Santos has its sights set on more than the Pilliga and the vital southern recharge area of the Great Artesian Basin.

Santos is telling the local community that it is only focused on its Narrabri Gas Project, yet at the same time it is mapping to its investors (http://www.santos.com/ library/2014%20Investor%20Seminar%20FINAL_ASX.pdf) seven prospective gasfields across our extremely valuable and productive agricultural land of North West NSW, making it very clear their long-term plan is for gasfield expansion and pipelines throughout our region. The assessment process must take into consideration the cumulative impacts of multiple projects of this size and scale, rather than the current piecemeal approach to planning and approval.



Compensation for CSG activities

In 2015, the NSW Government directed the IPART to recommend benchmark compensation rates for landholders hosting CSG developments. The talk of compensation payments by both the NSW Government and the gas companies is designed as nothing more than an attempt to alleviate large scale community opposition and to engender community acceptance of an industry that is neither wanted (refer above) nor needed (refer above).

Compensation is defined as "something, typically money, awarded to someone as a recompense for loss, injury, or suffering". The entire basis of establishing benchmark compensation rates then implies that landholders will experience harm, loss and negative impacts and NSW landholders currently have no legislative protection to refuse access for drilling and gas related infrastructure (refer above).

It is also simply not fair or reasonable for landholders' to be negotiating compensation for damage with big CSG companies that should have been prevented in the first instance by the NSW Government putting appropriate safeguards in place to protect landholders and communities, and prevent the worst impacts of CSG.

On 23 September 2015, AgForce in Queensland revealed that landholders' believe that compensation has not matched the level of disruption or loss of value to their properties. (http://www.couriermail.com.au/subscribe/news/1/index.html?sourceCode=CMWEB_WRE170_a&mode=premium&dest=http://www.couriermail.com.au/business/csg-wells-give-queensland-farmers-a-200m-funding-boost/story-fnihsps3-)

In addition, the Hopeland Community Sustainability Group, a group of farmers in the centre of Queensland's gas region, have also noted that the $200 million in "compensation" payments over five years to 2,200 landholders' translates to an average of $18,000 a year, and in no way has this compensated for the pain, suffering and health impacts of coal seam gas. (http://www.lockthegate.org.au/community_says_the_gasfields_commission_is_hopeless_hopeland)

At the end of the day, landholders' in North West NSW are not looking for monetary compensation but are seeking vigorous protections against the impacts of unconventional gas. There seems to be a misguided notion that money will solve all ills, when nothing could be further from the truth. No amount of money is worth the risks associated with this industry, and no amount of money will "make good" when the worst impacts are realised.

NSW Chief Scientist's Final Report into CSG activities in NSW

The conclusions of the NSW Chief Scientist's Final Report were heavily qualified and were very much constrained by her Terms of Reference. She was not asked 'if' the industry should proceed, but rather 'how' the industry could proceed, and never did she comment in detail on what Santos were proposing at Narrabri.

Nevertheless, far from giving this industry the green light, the Chief Scientist's Final Report into CSG activities in NSW highlighted the significant risks posed by this industry and acknowledged that there will be "unintended consequences". The Final Report recommended a complete overhaul of the industry.

The NSW Government is yet to fully implement all 16 recommendations of the Chief Scientist, and ensure that they apply equally to all CSG projects, currently operating, seeking approval to operate or planned for the future, despite the Final Report being handed down on 30 September 2014.

In light of the Report's findings, an immediate CSG moratorium should be established, including Santos' Narrabri Gas Project, until far-reaching law reforms are implemented and all of the potential risks, including health risks, are assessed. Until such times as all recommendations are implemented in full, the community can have no confidence that the NSW Government has in place the most comprehensive and transparent regulatory controls for CSG in the country, and unless all licences fall under the new codes and regulations, and that these rules are applied retrospectively to existing licences and existing expired licences. Specifically, it is paramount that the Chief Scientist's recommendations for an insurance and rehabilitation mechanism be implemented in full before further CSG extraction is contemplated.

Methane Emissions

Recent work has shown that the levels of methane emissions from CSG operations including venting and leakage are high enough to pose significant risks to greenhouse gas levels, adding to climate change.

(http://www.resourcesandenergy.nsw.gov.au/__data/assets/pdf_file/0010/559549/Fugitive-Greenhouse-Gas-Emissions-from-Coal-Seam-Gas-Production-in-Australia-CSIRO-report.pdf) http://energy.unimelb.edu.au/__data/assets/pdf_file/0019/2136223/MEI-Review-of-Methane-Emissions-26-October-2016.pdf).

Need for a comprehensive approach

The NSW Government needs to urgently establish a legislative and regulatory framework for CSG mining that includes, as a minimum, -

1. A moratorium on any CSG exploration or production, including existing operations, until further important research has been completed and proper baselines put in place.
2. Exclusion zones to protect agricultural land, significant water resources, national landscapes and tourism icons, and residential dwellings from unconventional gas exploration and mining impacts.
3. Thorough and independent assessment of all environmental impacts, including cumulative impacts.
4. Long-term, independent strategic planning that achieves triple bottom line outcomes.
5. The creation of new legislation to implement the goals of the National Food Plan and to give statutory weight to the Australian Council on Food.
6. Improved environment laws that properly protect water sources, cultural heritage, and significant environmental areas.
7. Identification of best practice methods for baseline monitoring of health impacts, water resources, air quality, soil quality, and fugitive emissions.
8. The creation of a Clean Air and Water Act that sets minimum standards on pollution from CSG mining to protect human health
9. Proper measurement and accounting of greenhouse gas emissions from CSG operations.

This type of regulatory and legislative framework and oversight would provide an additional layer of protection and scrutiny for some of NSW's most important environmental assets, like our precious and finite water resources including the Great Artesian Basin, internationally recognised food bowls, our cultural and heritage sites, and our native flora and fauna; things that all current and future New South Welshmen, and indeed Australian's, have a stake in. To do otherwise is fundamentally at odds with the current landscape – where land use and resource conflicts, heightened environmental risks, climate change, and technology such as CSG extraction pose enormous threats to the environment and to communities.

Governments of all levels and of all persuasions have given much attention to the so-called economic benefits of CSG extraction, but little consideration of the large-scale costs and risks in terms of water, health, air quality, noise, and impacts on agriculture and local communities. The perceived NSW Government's framework that begins from the assumption and recommendation that these industries go ahead and that landholders wish to share in the supposed "benefits" of gas exploration and development, only further adds to the stress of the community, and the belief that the government is there to serve the gas companies, including Santos, and not the community which they were elected to represent.

Daily, my family and community live with the knowledge and ongoing stresses that we have a CSG licence covering not only our property, but also much of our region of North West NSW. This requires us to divert many hours and significant funds away from our core business, in an effort to protect our business, and the health and well-being of our family for the long term. Ask yourself why people who receive no financial gain would be so concerned that they are willing to dedicate countless hours and dollars to battle a company they see as representing a direct threat to our food and fibre producing regions and the underground water the flows beneath those regions.

Santos has grossly underestimated the commitment that rural people have for their land and their water. We are the families and communities that are, and will continue to be, directly and negatively impacted by the development of the CSG industry in our region – not politicians, no staffers, not beaucrats, not CSG executives and their families, because, by and large, they don't live here nor will they in the long-term.

We stand on the precipice. It's five minutes to midnight. Narrabri has seen but a tiny glimpse of what the future may hold if the CSG industry establishes a foothold here, and from where it will begin to spread its tentacles throughout North West NSW. It's not too late to learn the lessons of the disasterous Queensland experience of the CSG industry. **This is about so much more than money; it's about the things that are priceless - clean air, clean water, and land to grow clean, healthy food.**

Given the reasons outlined above, I call on you to immediately reject Santos' Environmental Impact Statement for the Narrabri Gas Project.

I look forward to your immediate action on this vital issue.

Kind Regards
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Public Health Association
AUSTRALIA

Warnings from Australian health organisations regarding the health and safety risks of Unconventional Gas exploration production and use

Early in 2013, the New South Wales Chief Scientist and Engineer began a detailed review of the evidence of the risks to public health and safety posed by coal seam gas (CSG) mining. Over 220 public submissions were received to assist this review. The initial report, a series of commissioned background papers and the public submissions are available at http://www.chief scientist.nsw.gov.au/coal-seam-gas-review. Several health organisations provided submissions reviewing the recent health research and peer reviewed publications relevant to CSG. The full review will continue for many months.

This information sheet provides a guide to the emerging consensus regarding the evidence of health risks of CSG among a number of Australian health organisations.

The **Doctors for the Environment Australia** (http://dea.org.au/images/uploads/submissions/Review_of_CSG_in_NSW-Chief _Scientist_Submission_05-13.pdf) reviewed the literature covering four groups of health threats raised by CSG mining:

1. Physical e.g. accidents, chemical exposures, worker health
2. Environmental impacts mediated through air, water, soil and food
3. Impacts on psycho-social wellbeing and mental health
4. Cumulative risks from CSG in a climate-changing world.

Based on this review, the DEA concluded:

- the development of unconventional gas (UCG) mining in NSW and Australia presents significant threats to public health.
- The current level of assessment, monitoring and regulation of UCG exploration and mining activities in Australia is inadequate to protect the health of current and future generations of Australians.
- There is the potential for public health to be affected by UCG operations directly, and indirectly via contamination of water, air, soil and food and from mental health impacts on communities who have had environmental changes imposed upon them.
- Human health relies on having clean safe drinking water and unpolluted air. UCG operations should not be allowed to endanger these basic health needs of Australians. Any development of this industry requires adequate scientific studies and the application of precautionary principle.
- The long-term impacts of UCG mining risk significant damage to the ecological systems upon which human life depends.
- UCG, like all fossil fuels, contributes to greenhouse gas emissions and therefore climate change. As such it potentially contributes to the globally increasing burden of ill health due to climate change.

This submission joined many from the DEA communicating the health risks and concerns associated with CSG to the medical profession, the public and Australian governments. These included submissions into two parliamentary committees and to two coal seam gas proposals in Sydney's water catchment and residential areas of in Western Sydney (http:// dea.org.au/resources/submissions).

The **Public Health Association of Australia**, which has also been actively advocating for precautions in relation to UCG, reported to the Chief Scientist (http://www.chief scientist.nsw.gov.au/_data/assets/pdf_file/0012/30027/CSG-Review-Submissions-0191.pdf):

"There are direct effects on the health of nearby residents as well as on the environment near CSG developments. There are secondary and flow on effects particularly on Australia's future capacity to provide drinking water and support agriculture/stock to grow food for ourselves and for export...In addition to any large scale effects, mental wellbeing, bush fire risks and future government liabilities are important extra issues that need to be included in accounting for effects of CSG and fossil fuel use".

In its submission to the Chief Scientist, the **National Toxics Network** described the many toxic chemicals potentially involved in the exploration and production of UCG (http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0006/29877/CSG-Review-Submiss ions-0039.pdf). It highlighted the lack of assessment of toxicity, persistence and environmental reactivity of chemicals introduced through hydraulic fracturing in Australia. It also identified the many known toxic contaminants within the vast volume of produced water containing fraccing and drilling chemicals and naturally occurring carcinogens, heavy metals, radioactive materials and salt.

A submission to the Chief Scientist by the **Climate and Health Alliance** http://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/29992/CSG-Review-Submissions-0157.pdf concludes:

"Communities living and working in proximity to CSG drilling, processing and transportation are being exposed to toxic air, water, and soil pollution, ... Without comprehensive studies, given the many apparent adverse impacts on human and animal health, a ban on CSG gas drilling is essential for the protection of public health."

In May 2013, the **Australian Medical Association** added their voice of concern with the AMA President publishing the following statement (https://ama.com.au/media/ama-calls-coal-seam-gas-health-checks):

"Despite the rapid expansion of CSG developments, the health impacts have not been adequately researched, and effective regulations that protect public health are not in place. There is a lack of information on the chemicals used and wastes produced, insufficient data on cumulative health impacts, and a lack of comprehensive environmental monitoring and health impact assessments... In circumstances where there is insufficient evidence to ensure safety, AMA recommends that the precautionary principle should apply. This is essential given the threat of serious and irreversible harms to human health".

The AMA's Federal Council also passed a policy resolution *"urging governments to ensure that:*

- all existing coal seam gas extraction projects are regularly monitored for any health impacts and the presence of air and ground-water pollutants in their local environment;
- all future proposals for coal seam gas mining are subject to rigorous and independent health risk assessments, which take into account the potential for exposure to pollutants through air and groundwater and any likely associated health risks. In circumstances where there is insufficient evidence to ensure safety, the precautionary principle should apply."

A network of health organisations joined together to vocalise serious concerns about energy *"policies that privilege and prioritise the extraction and combustion of fossil fuels over safer, healthier, lower emissions, renewable energy resources"*. A joint statement (http://caha.org.au/wp-content/ uploads/ 2010/01/Joint-statement-on-the-health-effects-of-Australias-minerals-and-energy-policy_130213. pdf) was signed by Public Health Association of Australia, Climate and Health Alliance, Heart Foundation, National Rural Health Alliance, Climate Change Health Research Network, Cancer Council Australia, Australian Healthcare and Hospitals Association, Australian Research Alliance for Children and Youth, National Toxics Network, Australian Physiotherapy Association, and NSW Nurses and Midwives' Association. It concludes:

"Health professionals have an important role to play in educating decision makers and the community about the health implications of energy choices and the health implications of climate change. The local and global effect of fossil fuel use on health and wellbeing is an immediate problem as well as an issue of intergenerational equity, with the exploitation of these resources causing irreversible harm to Earth's systems, compromising the health and security of future generations."

A recent DEA report entitled, "The health factor: ignored by industry, overlooked by government" (http://dea.org.au/images/general /DEA_-_The_Health_Factor_05-13.pdf) presented "inescapable conclusions" that the current level of assessment, monitoring and regulation of mining operations are failing to protect the health of current and future generations of Australians.

Conclusion

There are now clearly articulated warnings among public health and medical organisations that unconventional gas mining poses multiple serious threats to human health and the environment. Communities, individuals, academics and doctors are calling upon the government to recognize these risks and to protect the health and future of our residents, families, communities, climate and environment of Australia.