

Attn: Executive Director, Resource Assessments
Department of Planning and Environment
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Submission

by the

Mullaley Gas and Pipeline Accord Inc.

in relation to

SANTOS'

Narrabri Gas Project EIS

Table of Contents

Executive Summary	3
Well Integrity	4
Groundwater and Geology	5
Human Health Impacts	6
Terrestrial Ecology	7
Aboriginal Cultural Heritage	8
Social Licence	9
UNESCO Geopark for Warrumbungle region	11
Light Pollution	12
Conclusion	13
References	14

Executive Summary

This submission has been prepared on behalf of the Mullaley Gas and Pipeline Accord. It analyses and makes recommendations in relation to SANTOS' Narrabri Gas Project (NGP) Environmental Impact Statement (EIS)

Mullaley Gas and Pipeline Accord (MGPA) is an incorporated entity that represents community concerns of approximately 100 residents and businesses of Mullaley and surrounding districts. All members of the Mullaley Gas and Pipeline Accord are involved in primary production and associated industries.



The MGPA submits that the SANTOS' EIS makes misleading claims, omits to deal with certain issues relating to the NGP, includes some factual errors and draws conclusions based on insufficient information.

Well Integrity

The NSW government claims in its “Code of Practice for Coal Seam Gas Well Integrity”¹ that,

*Strict standards for casing and cementing well heads guarantee wells are built to maintain control at high pressures, prevent cross aquifer contamination and retain well integrity.*²

This is simply not true: there can be no guarantee that these standards will prevent cross aquifer contamination as the North American experience has shown.

Dr Conrad Volz of University of Pittsburgh in 2011 stated in a presentation to the Checks and Balances Project,

*I think we lose sight of the fact that there are 10s of thousands of leaking wells in North America. 10s of thousands! Not a few. It doesn't matter whether they are hydraulically fractured or horizontal well, they leak! In fact, it is the way of all wells sooner or later that they are going to leak. They are going to leak because the cement shrinks. And when the cement shrinks it pulls away from the geological layer that it's sealed from. Then it serves a conduit straight up into the groundwater aquifers.*³

The cement that is to intended to seal the annulus between steel casing and surrounding geological formation undergoes both shrinkage and creep over a very long period of time. While shrinkage occurs both as a result of loss of free water and loss of water held in gel pores it is the latter that causes the change in the volume. Under drying conditions, the gel water is lost progressively over a long time while creep is the time-dependent deformation that occurs in concrete when it is subjected to load. Both shrinkage and creep result in loss of volume of the cement which may allow water to flow along the contact edge between the well casing and formation or, post abandonment, the casing and the well plug to other aquifers.

Naik and Kumar (2003) state,

Contact with certain aggressive chemicals, such as chlorides, sulphides, acids, carbon dioxide, and even water, causes the deterioration of the concrete. Such deterioration involves either leaching of material (e.g., calcium hydroxide) from the concrete by a dissolution mechanism or by expansion of material inside the concrete.

Anderson et al (2013), list further reasons for well casing and concrete sealing of the annulus to fail and allow water movement between the toxic produced water contained within the coal seams and the water drawn for domestic, stock and irrigation use from overlying shallow aquifers or the Great Artesian Basin. They include:

The cement fill is permeable... The well casing fractures or corrodes... The cement cracks with time.. Fractures caused by in situ stresses.

Groundwater and Geology

We refer to SANTOS Narrabri Gas Project Environmental, Impact Statement, Chapter 11 Groundwater and Geology, page 11-1 which makes the general statement,

Overall, the Groundwater Impact Assessment concludes that the residual significance of potential impacts from the Narrabri Gas Project on groundwater are low.

And page 11-2,

No significant risks to groundwater from drill holes and installation of coal seam gas wells and groundwater monitoring bores have been identified.

Fault zones would be unlikely to act as conduits for preferential groundwater or gas flows between deep and shallow groundwater sources due to lack of faulting that extends from the Surat Basin into the underlying Gunnedah Basin.

There is insufficient information to substantiate these statements as there is inherent uncertain geological and hydrogeological conditions within and around the Narrabri Gas project area.

Regardless of how many direct measurements and indirect estimates are obtained over any period or scale, the uncertainty in hydraulic connectivity assessments cannot be fully removed (Anderson et al 2013)

There is in fact evidence to the contrary according to Atkins (2002),

In New South Wales, coal seam methane production has not been operating long enough to identify any similar changes to groundwater levels caused by dewatering coal seam methane drillholes. However, in the petroleum producing Cooper Basin in South Australia long term petroleum production has produced disturbing results. The producing horizons are very similar to the target horizons in the Pilliga region, that is, coal bearing rocks of Permian age. In both areas this sequence is overlain by rocks of the Surat Basin, eg the Pilliga sandstones in the Pilliga region. Traditional theories have emphasised the separate nature of the older and younger rocks and also emphasised that lowering or interfering in any way with the deeper Permian aquifers would have absolutely no effect shallower groundwater resources widely used by agriculture . The results from the Cooper Basin however show that previously unknown and unsuspected faults are acting as conduits allowing water to drain from the upper aquifers of the Artesian Basin into the previously separate lower lower, Permian layers

Recharge to the Great Artesian Basin (GAB) occurs across the project area from the Namoi in the north to the Warrumbungles in the south. Groundwater extracted for use in the area comes from higher aquifers and the GAB. These bore holes do not penetrate through the GAB. The gas wells will penetrate the GAB and provide pathways for higher level water to move down to the depressurized coal seams below.

If left to natural processes, depressurised coal seams will repressurise with time. ... There is an additional problem with allowing natural recharge and repressurisation; the water has to come from somewhere, subsequently it is likely to result in reduced water volumes in surface water bodies and/or shallow aquifers or in the soils where coal seams

outcrop. Essentially, natural recharge of these water systems could result in taking water that other water uses including vegetation could be relying on. Anderson et al (2013)

Shallow groundwater is essential for groundwater dependent ecosystems. The Pilliga Forest itself is just such an ecosystem, as are waterholes and billabongs along creeks and drainage lines such as Bohena Creek which lie within the Narrabri Gas project area.

The potential for the loss or contamination of aquifer and groundwater sources from coal seam gas activities is high. Numerous examples of such damage are to be found in Australia and overseas. The chemical makeup of the produced water presents a high risk to all water sources and this requires addressing. MGPA contends that “make good” clauses, bonds and penalties are ineffective and inadequate given both the probability and high level of detriment in such an event.

Recommendation: It is essential that mechanisms be put in place that make the gas field operator whether it be current owner/operator Santos or any other/future company liable for any such impacts on water quality and quantity. Such liability should be made indefinite as the effects may not be detected until long after the project is completed. However, there is a serious complication that arises here. There are fundamental limitations upon our ability to understand underground systems (we simply do not have the technology and it may never exist). It follows then that causation may be impossible to prove, allowing the gas field operator to escape liability. Until such a time that we can comprehensively understand these underground systems and be able to accurately determine causation of any impacts, we argue that the Narrabri Gas project should not be allowed to proceed. This argument should extend to the coal seam gas industry as a whole.

Human Health Impacts

In 2012 Bamberger and Oswald stated,

Without rigorous scientific studies the gas drilling boom sweeping the world will remain an uncontrolled health experiment on an enormous scale.

By 2015 there were at least 685 peer-reviewed papers on the health implications of the unconventional gas industry. This considerable documentation clearly shows that living in and near gasfields has a negative effect on human health. The peer-reviewed papers identify the health implications that landholders in and around the proposed NGP area would be exposed to and that all stages of the development of a CSG field create air pollution risks as nitrogen oxides, volatile organic compounds, endocrine- disrupting chemicals and hydrogen sulphide are emitted. Potential impacts of these air pollutants on developing fetuses and children are particularly concerning. Numerous reports identify significant negative outcomes among infants of mothers with the highest exposure potential based on length of time exposed, distance from and/or density of wells. These outcomes include reduced average birth weight, increased prevalence of low birth weight, preterm births, high-risk pregnancies and birth defects. (Haswell and Bethmont 2016)

It is worth noting Steingraber comment of 2010,

At what point does preliminary evidence of harm become definitive evidence of harm? When someone says, "We were not aware of the dangers of these chemicals back then," whom do they mean by we?

We now have definitive evidence of harm and that the degree of harm increases as the distance between people and gasfields diminishes.

In October 2013 the NSW Government introduced CSG exclusion zones to make residential areas 'off limits' to new coal seam gas activity. In January 2014 the NSW Government added future residential growth areas, another seven rural villages across NSW, and the equine and viticulture critical industry clusters in the Upper Hunter to the exclusion zones. These exclusion zones ban new coal seam gas activity within a two-kilometre buffer.

However, the NSW Government permits CSG wells to be placed as close as 200 metres from rural residences. Farmers necessarily live apart and not in clusters as do those people in villages, towns and cities. The Government has thereby created an underclass of people whose health will be sacrificed if the NGP is approved.

Recommendation: The precautionary approach to CSG concerning health impacts should be adopted. This has been endorsed by Doctors for the Environment Australia, Public Health Association of Australia, The Climate Health Alliance and the National Toxics Network but has been largely ignored by the Chief Scientist herself. As the esteemed Australian Medical Association states, "if in doubt, turn CSG off", ie do not approve the SANTOS' NGP.

Terrestrial Ecology

A review by Paull (2017) of the terrestrial ecology components of the NGP EIS identified many serious omissions within the assessment and questioned the adequacy of the assessment in particular:

- *The adequacy of the methodology used to describe direct impacts is questionable. The lack of a development footprint by which impact could be measured according to 'whole of government' guidelines gives uncertainty to the ecological outcomes.*
- *Levels of indirect impact have been significantly under-estimated. Using fox predation as a measure, pre-mitigation levels of indirect impact should be at least doubled in magnitude, based on available evidence.*
- *Survey effort for some key fauna species appears to be deficient and would have adversely affected the ability of the EIS to adequately account for some species.*
- *A NSW and Commonwealth-listed threatened ecological community White Box Blakely's Red Gum-Yellow Box Woodland (and derived native grassland) has been mis-identified and presumed to be not present in the study area. New data confirms its presence along Bohena Creek.*
- *The description of important habitat for a number of key fauna species, such as the Regent Honeyeater, Pilliga Mouse, Koala, Black-striped Wallaby and Five-clawed Worm-skink is not accurate.*
- *New information regarding the presence of the Koala in the study area discounts the assertion made in the EIS that it is not currently present.*

- *Due to deficiencies in the survey and assessment for two 'matters for further consideration' (Regent Honeyeater and Five-clawed Worm-skink), the Secretary's Requirements and requirements under the NSW Biodiversity Offset Policy have not been met. The Black-striped Wallaby also meets the requirements of being a MFFC.*
- *Direct impacts upon Brigalow Park State Conservation Area remains uncertain as do the magnitude of indirect impacts upon the adjacent Nature Reserve and existing biodiversity corridors.*
- *A Biodiversity Offset Strategy does not provide any surety for how well it will 'retire' the impact of the Project because the strategy provided in the EIS does not provide any like-or-like land-based offsets apart from an unproven rehabilitation plan and rests on the hypothetical efficacy of a feral animal control proposal. The suitability of the offset package with respect to the statutory requirements under the NSW Biodiversity Offset Policy is poor. The offset proposal is also not consistent with the requirements of the Commonwealth Offset Policy.*

Recommendation: The Terrestrial Ecology part of the EIS should be rejected as being data-deficient in relation to the Secretary's Requirements, and inadequate under the terms of NSW and Commonwealth Biodiversity Offset Policies.

Aboriginal Cultural Heritage

The EIS trivialises the Aboriginal view of Country. The NGP would desecrate Gomeroi Country (also referred to as Gamilaraay country) as Gomeroi People view people and country as interdependent entities linked through landscape, through culture and through spiritual significance. As such there is no separation of nature and culture. Theirs is a view based around landscape and connections, not just the presence or absence of artefacts.

SANTOS' plans for a total of seven gasfields in North West NSW would cover much of Gomeroi Country which extends broadly from the Queensland/NSW border region to Tamworth, Aberdeen/Muswellbrook, Coonabarabran and Walgett. As the Traditional Owners of the Gomeroi Nation, Gomeroi People hold inherent rights in our country that were never traded, given or signed away.

The EIS clearly illustrates that SANTOS' NGP would prevent Gomeroi People from carrying out their custodian and ownership rights in country, including their unique responsibility to care for land and water, the ecosystem and places of cultural significance. Ongoing access to the Pilliga as it is, in the absence of an 850 well gasfield, is essential to allow Gomeroi People to continue cultural practices, maintain connection with the land and care for Country.

Recommendation: That there be no further desecration of Gomeroi Country by SANTOS, that SANTOS are required to exit the Pilliga region and the Gomeroi People alone determine the future of their Culture and Heritage in the area.

Social Licence

SANTOS does not have a 'social licence' to operate in North West of NSW. This is clearly illustrated by the Gasfield Free Community Surveys. Over the last 4.5 years surveys have been diligently conducted by individual communities across our North West region. Community survey teams visited every house in their district, to invite residents to respond to the question "Do you want your land/road Gasfield Free?".

Mullaley was the first community in the North West NSW region to undertake the rigorous community based, neighbour to neighbour, surveys in December, 2012. The response recorded 98.5% of people answering "Yes".

Since then, over 100 communities in the North West have overwhelmingly rejected any proposed industrialisation of their land and surrounding environs by the CSG industry. Our evidence is based on a comprehensive data set which was methodically collected and collated. Overall 96% of all respondents want their homes, farms and communities Gasfield Free.

To express their determination and solidarity, these communities have subsequently declared themselves Gasfield Free 'by the will of the People' in an area covering 3.28 million hectares encircling The Pilliga, involving 9 local government areas.

What has been established is the undeniable proof that Santos has NO Social Licence to operate in The Pilliga and the North West region in general.

Coonamble, Coonabarabran, Gilgandra, Narromine, Moree and Walgett Local Government Areas within the North West region have also adopted moratoriums in regard to Coal Seam Gas and associated infrastructure in response to their community's stance.



UNESCO Geopark for Warrumbungle region

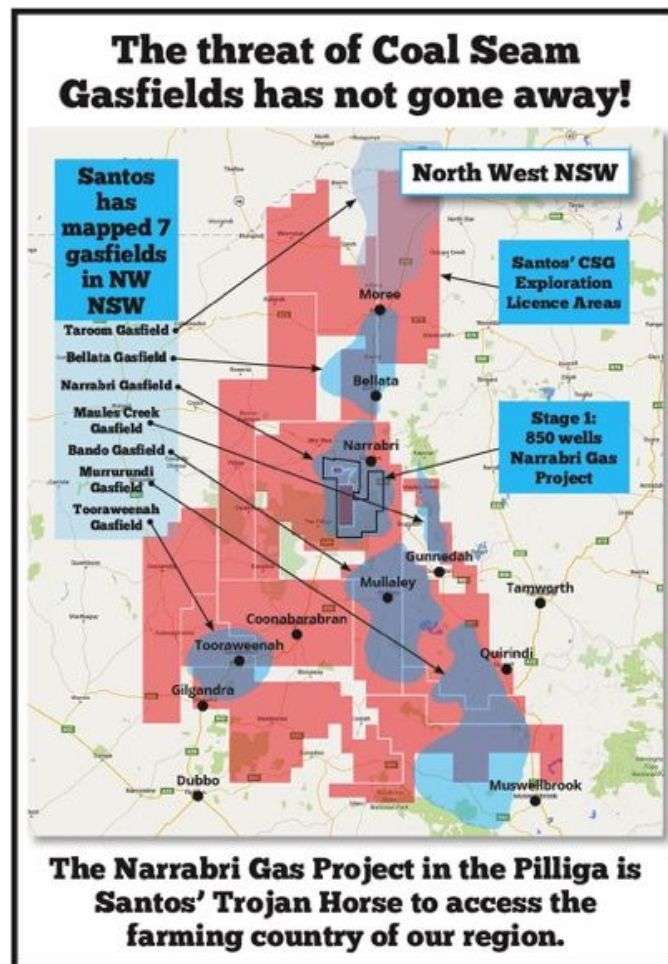
Most of the designated Geoparks are in Europe, United Kingdom and Asia, but despite Australia's rich geological heritage there are none in Australia.

The Geological Society of Australia considers the Warrumbungle area, comprising of the Warrumbungle National Park, Sandstone Caves, Macquarie Marshes and Coolah Tops, meets the criteria for a UNESCO Global Geopark.

A declaration of a UNESCO Geopark would draw attention to the unique landscape and serve as a drawcard for geotourism. The designation brings together tourism, education, science, culture, natural environment and geologists, providing the opportunity to market the region under the one brand.

A UNESCO Geopark will encourage visits to geological features, using geotrails, guided tours, geo-activities and patronage of visitor centres. Geotourism taps into a large and growing overseas market seeking high value and branded nature-based tourism experiences.

Given the uniqueness of this classification not only world-wide, but particularly in Australia, Santos' planned gasfield industrialisation of our region would undoubtedly risk this opportunity.



Light Pollution

Siding Springs Observatory (SSO) is an internationally important research facility using optical telescopes for astrophysics and astronomy. It hinges on collecting and analysing light that has travelled from galaxies, stars, nebulae and planets to Earth. SSO hosts over 50 telescopes used by over 30 universities, institutions and private businesses using cutting edge technology, with some of the most advanced telescopes being used is astrophysical research.

Future plans for SSO include another 50 telescopes to be built on site within the next decade. All this is reliant on keeping the Dark-Sky Park status awarded in 2016 by the International Dark-Sky Association. If this area was to lose the Dark-Sky Park status the observatory would not be replicated again in Australia, but moved elsewhere in the Southern Hemisphere.

Over the last 20 years SSO has experienced an increase in light pollution due to coal mining activities in the region. Since 2013 light emissions from the SANTOS gasfield exploration have increased to the point that a single flare at Bibblewindi creates more light pollution than the entire town of nearby Coonabarabran with over 3500 people residing there. SANTOS have plans to triple the amount of pilot flares and double the amount of large flares including constructing 50 metre high flare stacks, with an average 30 metre high flame above it.

Recommendation: As progression of the NGP would further compromise the research carried out at SSO, halt further expansion at the site and could ultimately force the closure of this internationally renowned research facility, therefore it should not be approved.

Conclusion

As this question posed by Hogan and McCallum in 2010,

It remains an open question whether royalties and taxes on the industry are high enough to compensate Australians for the eventual exhaustion of a valuable resource and the potential long-lived damage to land and water resources that results from the extraction process,

has not been answered by the EIS there are insufficient grounds for approval.

Santos and the government can expect community protests and legal problems will besiege the Narrabri Gas Project if it were to be approved;

- Since October 2013 the project has been dogged by unrelenting protests. Just as the communities of the Northern Rivers and Gloucester have prevented CSG proceeding in their area so will the communities of North West NSW.
- Class actions could come through reduced property values, water quality/quantity problems on a sub regional scale and disclosure problems from SANTOS.
- A constitutional challenge with water security as one of the key points is certainly possible according to constitutional lawyers.



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Table of Contents

Cumulative Impacts	3
Disposal of produced water	3
Conclusion	5
References	6

Cumulative Impacts

Cumulative impacts have not been assessed correctly. The Namoi Cumulative Risk Assessment Tool (NCRAT) should have been employed for assessing the cumulative risks of the proposed Narrabri Gas Project in combination with other existing and proposed mining activities in relation to the Namoi Catchment's Natural Resource Assets.

The expansion of extractive industries has been identified as a key driver of change for the Namoi Catchment. The NCRAT framework provides a way to develop a spatially interactive cumulative risk assessment tool that could be used to explore the potential cumulative impacts and unmitigated risk of mining scenarios on key natural resource management assets in the Namoi Catchment. It is consistent with the Australian Standard for Risk Assessment and incorporates the critical thresholds identified in the Namoi Catchment Action Plan.

NCRAT was developed specifically to assess the cumulative impact of mining scenarios on bioregional assets in the Namoi Catchment, in which the NGP lies. It is housed in the North West Local Land Services office as well as the office of the Independent Expert Scientific Committee.

The project should not receive further consideration until NCRAT is deployed to assess the cumulative risks of the development to the natural resources of the region.

Disposal of produced water

The salt component of the produced water is proposed to be disposed of in an EPA licensed waste disposal facility, but no such facilities are nominated. The project should not be considered further until or unless the salt disposal problem is resolved.

We refer to SANTOS Narrabri Gas Project Environmental, Impact Statement, Chapter 7 Produced Water Management, page 7-23 which makes the general statement,

The treatment process would produce a saline waste stream that would be further concentrated, crystallised into a solid salt product, and transported and disposed of to an off-site licensed landfill in accordance with regulatory requirements.

This is not a permanent solution to the disposal of a toxic cocktail of compounds. We refer to the following quote,

Stuart Khan, an engineer at the University of NSW, said the EIS raised questions about how salt waste would be handled. "Burying salt in a big hole in the ground is not a long-term sustainable solution," Professor Khan said. "It's simply transferring responsibility for managing the problem to future generations." ¹

The EIS presents no reasonable solution for the disposal of the produced water or the concentrated brine. A water sample was taken from an evaporative/holding pond in the Narrabri Gas Project area in 2011. The pond held untreated produced water, ie was not a byproduct of treatment facilities such as a Reverse Osmosis Plant. The sample was analysed by East West EnviroAg Laboratory and results are attached².

Geochemist John Polglase commented on the test results ,

"The major element ratios in this water are completely unlike freshwater," said geochemist John Polglase. This water cannot be remediated to agricultural or human consumption without intense treatment followed by further element supplementation to produce a more natural balance of elements. For instance, the potassium concentration and the sodium concentration are that high and the calcium concentration and magnesium concentration is so low that a process like desalination cannot rectify this major element imbalance"

A summary of East West Enviroag's comments on suitability of this produced water sample are,

Irrigation: This water is totally unsuitable for irrigation.

Stock: This water is not suitable for livestock to drink

Chemical Sprays: This water is not suitable for use with chemical sprays

Domestic: This water will be unsuitable for domestic use

Drinking: In regard to drinking this water is toxic

General: This sample of water is unacceptable for any use.

Conclusion

The broad community of North West NSW is very concerned about water resource security as it is being eroded at an ever increasing rate as large coal mine developments are approved and the application for the Narrabri gas project is being considered.

The NGP EIS is deeply flawed, is incomplete and not an objective assessment of potential environmental impacts. The failure to employ NCRAT for the Cumulative Impacts, the apparent underestimate of the quantity of waste produced and a lack of an appropriately licensed facility for its disposal adds to the community's concern about water resource security are just three of a multitude of reasons for the NGP not to be approved

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- 2.



COMMENTS

Project No: EW110492-1 **Location:** Tambar Vale

Sample Identification: Tambar Vale Effluent Water

ANALYTE	UNITS	RESULTS	DESIRABLE LEVELS			COMMENTS
			SPRAYS	IRRIGATION	DOMESTIC	
TDS	mg/L	26720	<1000	500-1500	<900	Extremely High
Conductivity	mS/cm	42.1	<1.5	<2.0	<4.5	Extremely High
pH	pH units	9.53	6	6.0-7.5	6.0-8.0	Very Alkaline
Total Alkalinity	mg/L	7444	<50	400	200	Extremely High
Chlorides	mg/L	16300	<50	<350	300	Extremely High
Nitrate-N	mg/L	0.38	<5	25-125	<10	Acceptable
Phosphorus	mg/L	0.48	<0.10	<0.8-12.0	<0.20	Acceptable
Manganese	mg/L	0.01	<0.25	<2.0	<0.5	Very Low
Iron	mg/L	0.18	<0.20	<1.5	<5.0	Low
Potassium	mg/L	2842	<1.0	<3.5	<2.5	Extremely High
Calcium	mg/L	0.1	<50	<200	200-400	Very Low
Magnesium	mg/L	0.1	<40	<100	100-150	Very Low
Sodium	mg/L	9626	<100	<150	<300	Extremely High
Sodium Adsorption Ratio		5126	<1.5	<4.5	<9	Extremely Toxic
Total Hardness	mg/L	0.7	<150	<350	<250	Very Soft
TPH Bands C10-C36	µg/L	<100	<100	<100	<100	Very Low

SUITABILITY FOR USE

Irrigation:	<i>This water has an elevated level of total dissolved salts (TDS) sodium, in particular sodium, potassium, chloride and carbonate. This water is totally unsuitable for irrigation. The sodium adsorption Ratio (SAR) is used to predict the danger of sodium (Na) accumulation in the soil. All ornamentals, fruit trees (inc. citrus) and vegetables are sensitive to overhead watering where the sodium absorption ratio (SAR) is between 4 to 8 and chlorides are above 350mg/L. There are no crops or pastures that are tolerant to the high levels of salts in this water. This water should not be applied to soils with restricted drainage. Even with adequate drainage, special management for salinity control would be required.</i>
Stock:	<i>Water is the single most important component of any livestock enterprise and this water is not suitable for any livestock to drink. The high level of salts in this water renders it toxic for all stock including sheep.</i>
Chemical Sprays:	<i>This water is not suitable for use with chemical sprays. This means it will not be recommended for use with certain pesticide, herbicide or fungicide products because of high alkalinity, sodium, potassium, chloride and pH.</i>
Domestic:	<i>This water will be unsuitable for domestic use. Household equipment requires TDS to be less than 500mg/L. In regard to hot water systems, the safe upper limit for salinity is about 1.6 mS/cm and for iron 0.3mg/L and this water exceeds the threshold for salinity. Marginal iron levels can result in staining of domestic pipes (laundry) and plumbing fittings with a rust brown precipitate.</i>
Drinking:	<i>In regard to drinking, this water is toxic. The upper limit in drinking water for chloride is 400mg/L, for sodium 180mg/L and TDS 500mg/L. Growths of iron bacteria, which concentrate iron, may cause taste and odour problems and lead to pipe restrictions, blockages and corrosion.</i>
In General:	<i>This sample of water is unacceptable for any use. It is reasonably soft water which also contains extreme levels of potassium, sodium, chloride and carbonates. This water should be stored and disposed of according to DECCW guidelines.</i>

S Cameron

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30/06/2011

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