PARLIAMENT OF SOUTH AUSTRALIA – NATURAL RESOURCES COMMITTEE

Inquiry into Unconventional Gas (Fracking) – Pursuant to section 16(1)(a) of the *Parliamentary Committees Act 1991.* Potential risks and impacts in the use of hydraulic fracture stimulation to produce gas in the South East of South Australia

SUPPLEMENTARY ADDENDUM

PREPARED BY ANNE ELIZABETH DAW

AGRICULTURAL ADVOCATE, LAND OWNER NEAR KINGSTON SE
MEMBER OF THE ROUND TABLE FOR UNCONVENTIONAL GAS PROJECTS IN SOUTH AUSTRALIA
SERVED AS MEMBER OF NATIONAL ROUND TABLE FOR HEALTH AND ENERGY IN CANBERRA
WINNER – JILL HUDSON AWARD FOR ENVIRONMENTAL PROTECTION 2013

***Figure 22** Categories of incidents in 2013.*

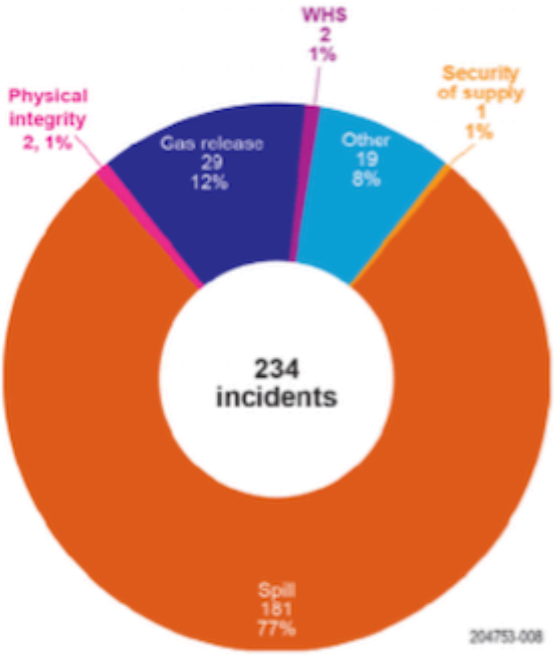


***Figure 23** Categories of incidents in 2015.*

ILLUSTRATIONS FROM PETROLEUM & GEOTHERMAL ENERGY ACT COMPLIANCE REPORTS FROM 2013 (122 INCIDENTS) AND 2015 (234 INCIDENTS)

Mobile – 0435 030 998 annedaw@bigpond.com

CONTENTS

PARLIAMENT OF SOUTH AUSTRALIA
NATURAL RESOURCES COMMITTEE

Inquiry into:

Unconventional Gas (Fracking)

Pursuant to section 16(1)(a) of the *Parliamentary Committees Act 1991*, the Committee is inquiring into potential risks and impacts in the use of hydraulic fracture stimulation (Fracking) to produce gas in the South-East of South Australia and in particular:

1. The risks of groundwater contamination;
2. The impacts upon landscape;
3. The effectiveness of existing legislation and regulation; and
4. The potential net economic outcomes to the region and the rest of the state.

The Committee is seeking written submissions and/or expressions of interest to appear before the Committee on this inquiry from interested individuals or organisations by **31 January 2015**. Submissions, expressions of interest and inquiries should be directed to:

Executive Officer
Natural Resources Committee
GPO Box 572
ADELAIDE SA 5001

Phone (08) 8237 9442, Fax (08) 8231 9130 or email patrick.dupont@parliament.sa.gov.au

INTRODUCTION

I wish to thank the Natural Resources Committee on the INQUIRY INTO POTENTIAL RISKS AND IMPACTS IN THE USE OF HYDRAULIC FRACTURE STIMULATION TO PRODUCE GAS IN THE SOUTH EAST OF SOUTH AUSTRALIA, for the privilege and the opportunity to write this addendum. There are a number of important updates or areas not covered previously, that I have included, which should help provide integral information to the committee for an informed decision. I have continued to attend the Round Table for Oil and Gas Projects in South Australia, previously known as the Round Table for Unconventional Gas Projects in South Australia. I attend as many presentations as I can at the National Centre for Groundwater Research and Training, based in Adelaide.

I have been quoted in a United Nations Report entitled "A GUIDE TO RIGHTS-BASED ADVOCACY, INTERNATIONAL HUMAN RIGHTS LAW AND FRACKING", putting the case forward for banning petroleum activities on land in the South East of Australia. I have recently spent time with farmers from Chinchilla and Hopeland. My heart goes out to them from the impacts of what is happening on their land, to their animals, water, and most of all, their dashed hope. Calves are being born blind – (the same occurrences around the gasfields in the United States of America), or the calves do not live long. Cows and other domestic animals have also been dying, in numbers that vets have never seen prior to the gasfields opening up in Queensland. They are distraught to say the least, and I understand suicide attempts and successful suicides continue to mount.

Evidence continues to rise against hydraulic fracture stimulation on high yielding agricultural land, that the South East and other areas of Australia. Where do we get water to replace contaminated water? Desalinisation is not the answer. I also cover this topic in more depth. Firstly, concentrated brine affects sea grasses, which in turn affects the ocean food chain. I also cover sea level rise in South Australia, which results from climate change. It is an understatement to say that the predictions for sea level rise in South Australia are staggering. **This fits in under the terms of reference under all topics in regard to impacts on water, impacts on the landscape (coastal), economics, and legislation.** Climate change is exacerbated by the fossil fuel industry. Sea level rise impacts the potable water on the coast, both at surface level and the underlying aquifers. I explain this in detail.

It is also interesting to note that the Rann Government brought in the **"Climate Change and Greenhouse Emissions Reduction Act 2007".**
http://www.environment.sa.gov.au/Science/Science_research/climate-change/climate-change-initiatives-in-south-australia/sa-climate-change-legislation I understand this Act was under review recently, as required under Section 21, to review the act and its operation on a four yearly basis. The Minister for Climate Change is currently Ian Hunter MLC. It is obvious that the Labor Party in South Australia acknowledge that climate change is occurring.

Climate change fits into the terms of reference, again under water, as lack of recharge affects our aquifers. There is enough scientific evidence to show the role the fossil fuel industry has in exacerbating climate change. In areas of heavier rainfall, due to climate change, this can result in overflowing of waste-water ponds, contaminating the aquifers from the surface, down through the soil to the potable bodies of water. None of us can accurately predict what is going to happen in the years ahead, as far as weather and rain in the South East of South Australia.

On the other hand, the Liberal Party in South Australia have just printed a hard copy document entitled '2036' and posted to their Liberal supporters. Section 1.0 states that '*The prosperity of the State demands vibrant and productive regional communities'.* Section 6.0 says that *"community safety is paramount and that emergency services and the justice system must be focused on effectively protecting South Australians from harm and crime."* There is much evidence that has already been provided to the inquiry to show that unconventional gas is harmful, and in some areas, as the result of contamination, some of the industry's exploits are now considered a crime. I discuss this in further

detail within this document. Section 6.5 states the following *"You deserve to feel safe in your home & community".* I need no further comment on this – self explanatory. Section 7 is entitled 'Protecting our Environment'. I think the following statement in section 7.0 should be held in the highest regard. **'A clean and healthy environment is key to South Australia's future – we need to protect our landscapes and waterways for our children and our grandchildren'.** The Liberal Party added that promoting scientifically-based evidence should be achieved. Combining my previous submission, with what is in here, my experiment with the limestone rock in Parliament House, and other submissions, presentations and peer - reviewed papers, the scientific evidence against unconventional gas, in my opinion, scientifically-based evidence has been achieved. In section 7.5, it is stated '*The River Murray is the lifeblood of our regions and our cities, and we must always remain committed to maintaining our water security'.* It is comforting and reassuring to be aware of Labor's endeavor regarding climate change, and what the Liberals have quoted in '2036'. What really counts are the actions to ensure that the words on water and environment and the **"Climate Change and Greenhouse Emissions Reduction Act 2007"** regarding climate change are enacted and carried out in the strictest fashion as quickly as possible.

I have updated earthquake information, including the latest 20 earthquakes in the South East. Groundwater modeling uncertainty is included. How much groundwater is estimated to be on the planet, and the fact we are using our groundwater faster than it is being renewed are explained, with illustrations, including from the United States Government Survey – the most credible document one could source on the planet. I have shown what is in the waste-water plans, and why the waste-water should not have been 'irrigated' on the agricultural land.

A very long list of contaminants and chemicals has been included, that were not included in the waste-water analysis. The sodium analysis and acceptable levels are recorded. I have also included comments on the Beach Energy Ltd. Environmental Assessment Report and Environmental Impact Report – I am not aware that the committee has had the opportunity to see this before. I have a section on the United States EPA being taken to task for dismissing important evidence. There are 3 topics on renewable industry, not discussed before. I have included the latest on the Victorian ban on unconventional gas. Lastly, I cover more on the law that I have not previously covered.

My submission and addendum are the result of many years of thorough research, attending presentations, conferences and forums, including those on the side of industry. I acknowledge and thank the many professional people in their fields from around Australia and the world, and colleagues who have helped me along the way.

If any further information or documentation is required, I am happy to provide the committee with it.

FRACKING SCHOOL – (THE CENTRE FOR ONSHORE PETROLEUM EXCELLENCE)

I have taken part in a number of activities, since doing my presentation in Parliament House, and also sending in my submission. I attended 'Fracking school' – the Onshore Petroleum Centre of Excellence, based in Adelaide, during an excursion with the Round Table for Oil and Gas Projects in SA (formerly known as the Round Table for Unconventional Gas Projects in SA). People who are connected in any way to the Petroleum industry, especially in regard to hydraulic fracture stimulation in Australia, come to Adelaide for training and certification. One of the heads admitted to me that hydrogen sulphide and anaerobic bacteria are the industry's biggest problem, and they cause corrosion and breakdown of the cement and casings. He had assumed I was with the government, and when I told him I was an agricultural advocate, he looked less than happy that he had revealed this information to me. This conclusively confirms that no one can guarantee well integrity in both the short-term future and long term, long after the Petroleum companies have left the production/exploration areas.

Anne Daw attended 'fracking school', 2015 with Round Table for Oil & Gas Projects in South Australia.

This also backs up what I have previously included in my submission. I have not gone into detail before, but I believe the following facts need to be included in this addendum. This information is from "MICROBES – OILFIELD ENEMIES OR ALLIES." (Oilfield Review Summer 2012, 24 no. 2), published by Schlumberger. Although under 'oilfield', I understand the same applies for any petroleum activities. Bacteria and Archaea (a type of microorganism) form that are known as prokaryotes. Microbes are always present during exploration and production. They live in extreme conditions and produce hydrogen sulphide. **The prokaryotes can remain dormant for 1000's of years, but can reactivate rapidly in days or weeks**. Some microbes are indigenous to reservoirs while others may be introduced during drilling, workover or water injection. (According to Oil Voice, workover is "*Re-entry into a completed field well for modification or repair. Restoring well productivity by cleaning out accumulations of sand, silt or other substances that clog production tubing.")* These single-cell life forms have an innate tendency to cling to rock and metal surfaces and assemble into masses called biofilms, which provide a safe harbor and growth and may eventually lead to serious problems in both equipment and reservoirs. Microbiologically Influenced Corrosion (MIC) can occur anywhere during the production environment in downhole tubulars, topside equipment and in pipelines. This type of corrosion can cause ruptures that seriously impede operations. Biocides are used and only kill a portion of the microbe population, but microbe survivors may recover between doses.

In this addendum, I go into the waste-water from Jolly 1 being 'irrigated on the land'. A number of tests were omitted on the waste-water, including bacteria**. What is of concern is the fact that as these microbes can recover, and what exactly may have been spread on the agricultural land or even will become reactivated after time!** There is no way the waste-water should have been 'irrigated' on this prime land, even 'as an experiment'.

http://www.slb.com/~/media/Files/resources/oilfield_review/ors12/sum12/1_microbes.pdf

SUBSIDENCE UPDATE

In my submission I mentioned about subsidence occurring in Gippsland. I understand that subsidence has started to occur in the vicinity of the Queensland gas fields.

CONDAMINE RIVER UPDATE

There has been much media attention on methane bubbling to the surface of the Condamine River in Queensland, in an area of coal seam gas production. This particular area has never been 'fracked'. As the coal seam was dewatered to get to the gas, depressurisation occurred, impacting the faults and opening a small fault along the Condamine River, allowing methane to bubble to the surface continually.

Even though we don't have coal seam gas exploration in the SE, this demonstrates that we can't control what happens under the ground, and with the hydraulic fracture stimulation activities, how many faults could be impacted and reactiviated in the SE, if this was allowed to proceed? One cannot say that any area is geologically stable in South Australia. Take for example what happened at Marryat Creek in the North of South Australia, as described in the document: "GEOLOGIC INVESTIGATIONS OF THE 1986 MARRYAT CREEK, AUSTRALIA, EARTHQUAKE IMPLICATIONS FOR PALEOSEISMICITY IN STABLE CONTINENTAL REGIONS" By Michael N. Machette, Anthony J. Crone, and J. Roger Bowman.

On March 30, 1986, an earthquake of surface-wave magnitude (Ms) 5.8 generated about 13 km of surface ruptures in the remote northern part of South Australia. This earthquake is significant because it occurred in the interior of the tectonically stable Precambrian shield (craton) of the Australian plate, about 2,000 km from the nearest plate margin. Movement during the 1986 earthquake was mostly confined to the most prominent slip plane within a wider zone of older faults. Intensely fractured and altered bedrock adjacent to the 1986 failure planes indicates that the 1986 earthquake reactivated preexisting ancient faults that are part of a major fault zone or zones. So in other words, **it cannot be claimed that there would not be any reactivation of ancient faults as the result of hydraulic fracture stimulation, drilling or mining activities in the South East.**

http://pubs.usgs.gov/bul/2032b/report.pdf

MAP OF KNOWN FAULTS IN THE SOUTH EAST OF SOUTH AUSTRALIA – I did not have access to this map for my previous submission.

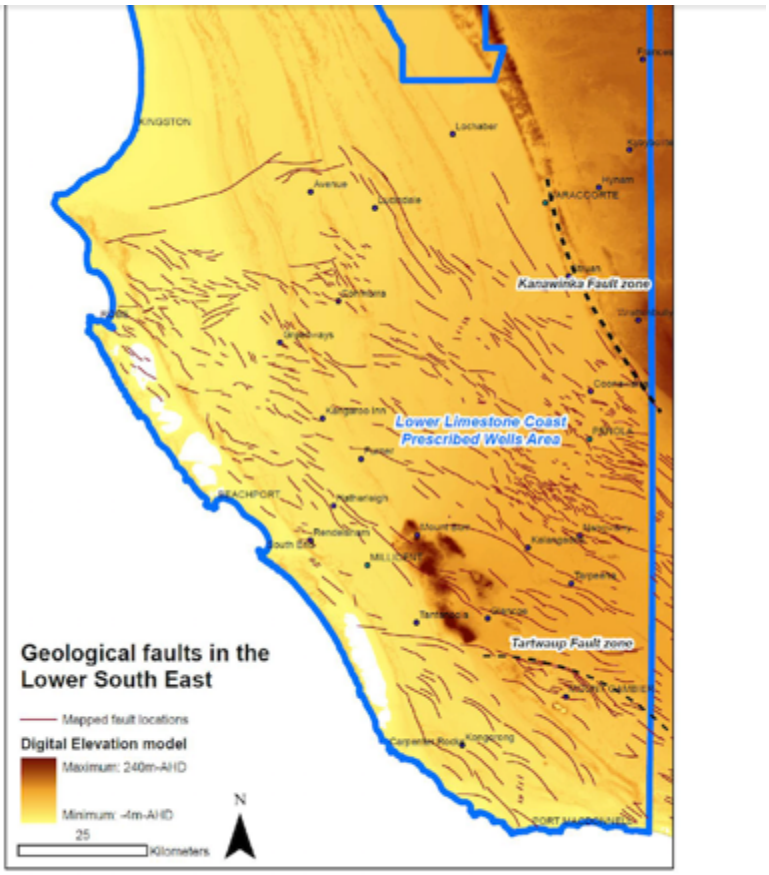


Figure 10. Location of stratigraphic faults in the South East (note: faults have only been mapped for the Otway Basin)

Known faults in the Lower South East including where Jolly 1 and Bungaloo 1 have been drilled
Department for Water | Technical Report DFW 2011/12

https://www.waterconnect.sa.gov.au/Content/Publications/DEWNR/DFW_TR_2011_12.pdf

PROFESSOR BILL FISHER SAYS NEVER DRILL NEAR A FAULT

Since presenting evidence in Parliament House, I have attended a lecture given by Professor Bill Fisher, when he visited Adelaide and I had the opportunity to question him. In my submission, I presented evidence of how Beach Energy have drilled through vertical fault lines that extend up into the potable aquifer, for both Jolly 1 and Bungaloo 1 exploration wells. Professor Fisher is the past president of the American Association of Petroleum Geologists, member of the National Academy of Engineering and serves currently as a member of the National Petroleum Council.

I do not agree with everything he says as I have conflicting evidence. However we were both in agreement in relation to faults and earthquakes. I was surprised when he mentioned there could be up to 60 stages of fracking. http://www.groundwater.com.au/videos I have put the approximate times of the video stages for the important points. At 8 mins 33 secs Re injection of waste water***. "If you re-inject near some geological faults you can lubricate the fault and create earthquakes."*** At 16 mins 52 seconds - can be 60 stages of fracking. At 41 minutes 36 seconds ***"If drilling near faults, and there is a high enough amplitude on vertical fracture patterns this can cause leakage up into the aquifers……. Hydraulic fracturing can potentially give rise to induced seismicity if it hits a pre-existing fault****……. Blackworth in Great Britain - they drilled into a fault* ***- one of the things you do when hydraulic fracturing is never drill into a fault…… You stay away from a fault because it is***

likely to set off an earthquake". Hydraulic fracture stimulation should not be near any faults – there is risk to contaminant pathways and activating earthquakes. This should be taken seriously by the Petroleum Industry, as Professor Fisher is considered the Petroleum Industry's 'one of their own'.

20 EARTHQUAKES RECORDED 8 MONTHS PRIOR TO 22ND MAY 2016 IN SE OF SA

I have included earthquakes in my submission, in relation to the South East. Here is an update on what has been happening since my presentation. The South East of South Australia also continues to experience earthquakes. In the last 8 months up until 22nd May 2016, 20 earthquakes have been recorded:

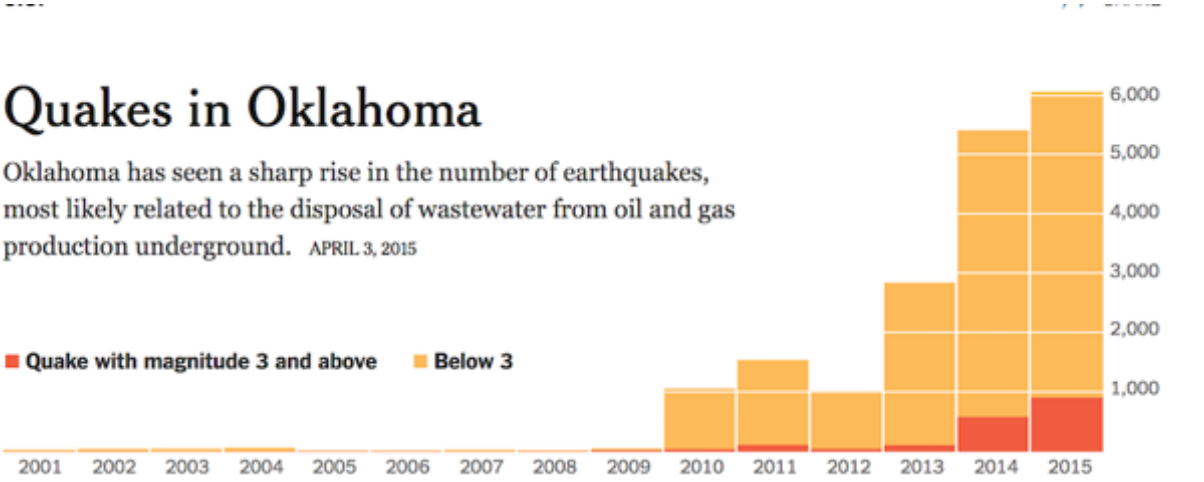
https://sarig.pir.sa.gov.au/Map

18-9-15 mag. 2.2 depth 39.19 68 km SW Mt Gambier
20-9-15 mag. 4 depth 21.18 100 km east of Kingston SE
23-9-15 mag. 1.4 depth 25.81 23 km NW of Beachport
25-9-15 mag. 2.1 depth 37.84 km 37 km SW Mt Gambier
25-9-15 mag. 1.5 depth 24.34 off of Robe
12-10-15 mag. 1.7 depth 35 km 75 km SW of Mt Gambier
27-10-15 mag. 2.9 depth 35 km 43 km SW Mt Gambier
30-10-15 mag 2.3 depth 35 40 km SW Beachport
15-12-15 mag 2.7 no depth 63 km W of Mt Gambier
27-12-15 mag 1.1 depth nil 51 km W of Keith
09-2-16 mag. 2.5 depth nil 36 km SW Mt Gambier
15-2-16 mag. 1.6 no depth 145 km W Robe
10-3-16 mag. 2.3 no depth 22 km SW Port MacDonnell
10-3-16 mag. 2.1 no depth 23 km SW Port MacDonnell
15-3-16 mag. 2.9 no depth 32 km SW Port MacDonnell
16-3-16 mag. 2.2 (can't bring up extra details)
16-3-16 mag. 2.4 no depth 24 km SW Port MacDonnell
09-4-16 mag. 2.5 (can't bring up extra details)
08-5-16 mag. 1.4 no depth 50 km SW Beachport
22-5-16 mag. 2.4 no depth 40 km N Naracoorte

UPDATE ON OKLAHOMA EARTHQUAKES

Before hydraulic fracture stimulation activities in Oklahoma prior to 2010, there were rarely earthquakes. I mentioned in my previous submission, the earthquakes occurring in this area. As can seen by this graft, there are now over 6000 earthquakes occurring per annum

.http://earthquaketrack.com/p/united-states/oklahoma/recent



http://www.nytimes.com/interactive/2015/02/23/us/oklahoma-quakes.html

'MINOR ANOMALOUS SEISMICITY': CAPP

The Canadian Association of Petroleum Producers (CAPP) describes hydraulic fracturing as a "safe and proven" technology to extract natural gas and oil, even though one recent Alberta fracturing incident broke cap rock and released nearly 12,000 barrels of bitumen into aquifers (see my comments at end of article) and the boreal forest at a Canadian Natural Resources Ltd. operation.

CAPP states that "*certain oil and gas basins, such as the Horn River Basin of British Columbia, have a distinctive geology, and hydraulic fracturing has caused rare and minor anomalous seismicity.*"

Earthquake hazard scientists argue the industry has routinely underestimated the complexity of geology for unconventional hydrocarbons everywhere, and is now encountering unknown faults and triggering earthquake swarms by negligent design.

In Australia, one group of scientists at Southern Cross University recently argued that the fracking industry has moved as fast as a hare, while public policy and good baseline science has proceeded with the pace of a tortoise.

http://thetyee.ca/News/2015/01/29/Alberta-Fracking-Earthquake/

GLOBAL WARMING IMPACTS ON EARTHQUAKES

In the publication 'INTERNATIONAL JOURNAL OF ENGINEERING SCIENCE INVENTION' July 2013, an article entitled "IMPACT OF GLOBAL WARMING ON THE PROBABLE EARTHQUAKE IN THE BENGAL BASIN AREA WITH RESPECT TO THE GLOBAL SCENARIO " by Dr Sujib Kar M Sc. (Geo.), M. Sc., Env. Mng, this scientific paper looks at the temperature change of the earth surface due to global warming, and the study has tried to analyse the co-efficient of expansion of the surface due to temperature deviation that can easily co-relate the impact of Global Warming on earthquakes. It is stated:

*"**At present the quick rate of global warming increases the sea level which indirectly indicates the occurrence of imbalance in the isostacy** (Ref. Fundamentals of Geophysics by William Lowrie, Pg. – 179 to 186). The either pole of the earth is also shifting very slowly in respect to its actual position, as a result the west coast of North America and South America, east coast of Asia and South-East Asia and the great extension of the Himalaya is located at the most effective belt due to the location of subduction zones. The east coast of Australia also indicates such a typical subduction. All these subductions are located far from the coastline that will cause transformation of body waves in the*

oceanic surface and will cause tremendous earthquake and tsunamis in these coastal tracts of Japan, China, Sumatra, Borneo, Thailand and Malaysia. The impact of such tsunami will also be observed in the coastal tracts of Bay of Bengal."

"At present it is an astonishing fact that ***various types of disaster are partly or partially under the control of the technical man but earthquake is beyond such control****. It is because the internal heat of the earth, that is not manageable to date. Present research indicates the industrially developed countries are those that have increased the global temperature to a greater extent by releasing excessive amounts of carbon dioxide, carbon monoxide and smoke."*

Kar also makes the point that due to prolonged winters in the Northern Hemisphere, more heat has caused excessive temperature variation of the interior of the earth. As the result, unequal expansion and contraction of the crust have occurred in the crustal layer. As a result the outer most part of the crust and the inner most part of the crust experience transverse wave motion and compressional wave motion mainly at the subduction zone or along the fault or rapture occurring in the plate margins, are the main causes of such devastating earthquake. The plates become much more active and cause powerful divergence or subduction that is the main cause of such sudden quakes, due to excessive variation of temperature between crust and mantle in some parts.

He believes it is obvious that the added heat to the global temperature caused by Global Warming changes the volume of the interval material by increasing the Kinetic energy of the molecules. With the increase of the kinetic energy causing unequal expansion and contraction that may not only cause faults of fractures, it also may hamper the stability of the plates.

It is indicated in the paper that the apparent movement of the sun partially regulates earthquakes. The increasing temperature of the atmosphere and global warming also are increasing seismicity and probability of earthquakes. The temperature deviation at the plate margin (mainly at the spreading sites and subduction zones) are causing such earthquakes.

http://www.ijesi.org/papers/Vol%202(7)/Version-5/D0275020028.pdf

Bill McGuire, a professor of geophysical and climate hazards at University College London, has written a book "WAKING THE GIANT: HOW A CHANGING CLIMATE TRIGGERS EARTHQUAKES, TSUNAMIS AND VOLCANOES." In it, he states that as sea levels rise remorselessly across the world, the load-related bending of the crust around the margins of the ocean basins might – in time – act to sufficiently 'unclamp' coastal faults."

CLIMATE CHANGE INTRODUCTION

I have not discussed climate change in any substantial way in my submission. For those on the committee for the 'Fracking' Inquiry **who say that climate change has always occurred, I agree with them.** When I visited the Naracoorte Caves, I was shown a stalactite that had been sawn in half, which reveals lines (like tree circles) to show the different climate changes occurring. What one must take into account is that species have become extinct with past climate changes. One doesn't see mammoths running around anymore. I have observed mammoth bones being pulled out of the Le Brea tar pits in Los Angeles. Therefore, they must have existed at one point in time. We are also aware as South Australians, that Kangaroo Island was once attached to the mainland, but cut off by sea level rise, possibly around 9000 years ago as the result of the post glacial rise in sea levels. http://www.apscience.org.au/projects/APSF_06_7/apsf_06_7.htm So what is different about today? There is plenty of proof that the fossil fuel industry is emitting greenhouse gases, thus accelerating climate change. This in turn, creates sea level rise, which I cover in this document. There are

thousands of people that live on or close to the coast of South Australia. The population has never been greater, therefore this point needs to be addressed. Whether we like it or not, current climate change with global warming will have impacts to a much greater level than ever before. **This does fit into the reference for the inquiry under water – fossil fuels affecting climate change, resulting in sea level rise, in turn putting pressure on the potable shoreline aquifer, which I will explain.**

GLOBAL RISKS REPORT

According to the Global Risks Report 2016 (World Economic Forum), failure of climate change mitigation and adaption, water crisis and biodiversity loss and ecosystem collapse are the greatest concerns.

http://www.weforum.org/reports/the-global-risks-report-2016

CLIMATE DISASTER UNFOLDING AT THE TOP OF THE WORLD

According to a report both on television and in print media, by China correspondent Matthew Carney and photographer, Wayne McAllister, a climate disaster is unfolding that will impact the lives of more than 1 billion people. A remote research station is monitoring an alarming trend in climate change, and the pace of global warming, deep in the Himalayas, also known as the Third Pole. This will be devastating for the most populated region of the world. The Third Pole, outside of the North and South Poles, contains the largest area of frozen water. This area is also the source of Asia's largest rivers, including the Yangzi, Irrawaddy, Ganges, Yellow and Mekong Rivers. These rivers have fertile deltas. At the moment, around 1.3 billion people in China, India, Bangladesh, Afghanistan, Pakistan and Nepal depend on the flows from the glaciers of this region. Now the glaciers are melting quickly.

"Half a century of research shows the temperature has increased by 1.5 degrees in the area, more than double the global average. More than 500 glaciers have completely disappeared, and the biggest ones are retreating rapidly."

Today, an extensive irrigation system has harnessed the glacial waters. This system sustains a population of 5 million in what's known as the Hexi Corridor. As the result, there are crops of sunflowers, corn, and wheat, but the glacier melt means the desert will eventually reclaim this land. The oasis lakes are under threat, as the glaciers that feed them are drying up. As the glaciers melt, the volumes of water will increase short term, according to Professor Qin Xiang, one of China's leading glaciologists, but with the shrinking of glaciers in the next 30 years it will decrease, and drastically affect agriculture and life here," he says. Qin says the glacier melt from the Tiger Valley area, where the research station is located, is occurring much more rapidly than first anticipated, in fact, the rate of melting has almost doubled in the past decade.

"Based on the figures from 1960 to 2005, in that 45 years, it only retreated by 260 metres. But in [the most] recent 10 years it retreated by 140 metres," he says. He goes into a lot more detail which I won't include, but suffice to say that a recent report he compiled found 509 smaller glaciers have vanished in the past 50 years and many more will go by 2050. His greatest fear is that the bigger glaciers will shrink dramatically. *"He says the reason for the great melt is that the temperature has been increasing at a much faster rate up in the Qinghai Tibetan Plateau."* From data collected in the area from the past 50 years, this shows that the temperature has increased by 1.5 degrees Celsius. *"It is because, in the high altitude areas, the temperature is sensitive to the global warming."* Vehicle exhaust and coal burners are not helping the situation.

"*The Third Pole is one of the first indicators of the scale of climate change to come, and up on the*

Qinghai Tibetan Plateau it's happening at double the size and speed than the rest of the world." Nearly 46,000 glaciers are estimated in the Third Pole.

There are major concerns that the glacial melt will set off a chain of climate disasters such as the recent epic floods in Pakistan and China, or unprecedented heat waves in India, or increasing desertification across the region. The changes at the Third Pole will also affect weather patters, such as monsoons and El Nino. Professor Qin also believes the world has not done enough to avert a potential crisis, as global warming is getting worse. This is a huge reason, I believe in itself, that transition from fossil fuels to renewables must be made as quickly as possible, leaving no room for gas projects in the SE of SA.

http://www.abc.net.au/news/2016-07-25/climate-change-the-third-pole-under-threat/7657672?WT.mc_id=newsmail

CLIMATE COUNCIL REPORT RELEASED IN 2016

The Climate Council Report for 2015, which was released in 2016, states the following:

"2015 was the hottest year on record globally…" "Temperature records are being smashed across many regions of the world, largely through the influence of climate change."

According to a publication "ATTRIBUTION OF EXTREME WEATHER EVENTS IN THE CONTEXT OF CLIMATE CHANGE" recently released by the National Academy of Sciences, in USA, in the abstract is the following description.

"As climate has warmed over recent years, a new pattern of more frequent and more intense weather events has unfolded across the globe. Climate models simulate such changes in extreme events, and some of the reasons for the changes are well understood. Warming increases the likelihood of extremely hot days and nights, favors increased atmospheric moisture that may result in more frequent heavy rainfall and snowfall, and leads to evaporation that can exacerbate droughts."

On the preface page, the following quotes can be found:

"*Humans' use of fossil fuel since the start of the Industrial Revolution has begun to modify the Earth's climate in ways that few could have imagined a century ago. The consequences of this change to the climate are seemingly everywhere: average temperatures are rising, precipitation patterns are changing, ice sheets are melting, and sea levels are rising. These changes are affecting the availability and quality of water supplies, how and where food is grown, and even the very fabric of ecosystems on land and in the sea. Despite these profound changes, climate change and its associated risks still may appear to many people as distant and remote in both time and space. The natural daily and seasonal variability of the weather can mask the changes in the overall climate. Yet, when people experience extreme events that they believe may be occurring with different—usually greater—frequency or with increased intensity, many ask about the connection between climate change and extreme events."*

On page 7, it states: *"Heavy rainfall is influenced by a moister atmosphere, which is a relatively direct consequence of human-induced warming, though not as direct as the increase in temperature itself."*

Observations of weather patterns in Australia and flooding rains in the last couple of years certainly would fit in with this statement.

http://www.nap.edu/catalog/21852/attribution-of-extreme-weather-events-in-the-context-of-climate-change?utm_source=NAP+Newsletter&utm_campaign=6f23644044-NAP_mail_new_2016_08_02&utm_medium=email&utm_term=0_96101de015-6f23644044-103995501&goal=0_96101de015-6f23644044-103995501&mc_cid=6f23644044&mc_eid=e4185af319

POTENT GREENHOUSE GAS

Methane, the main component of gas, is a much more potent greenhouse gas than carbon dioxide—some 34 times more effective at trapping heat over a 100-year timescale and 86 times more effective over a 20-year timescale.

http://www.ucsusa.org/clean-energy/our-energy-choices/coal-and-other-fossil-fuels/hidden-cost-of-fossils#.V8ZI9LTlfzI

CLIMATE CHANGE AND IMPACTS - CSIRO

On the CSIRO site under the title "CLIMATE CHANGE INFORMATION FOR AUSTRALIA", information relating to Australia's past, current and future climate is considered to help industries, governments and communities plan for and adapt to a variable and changing climate. The CSIRO believe that changes to the climate system have occurred and will continue to. Increases in greenhouse gases due to human activity having been the dominant cause of observed global warming since the mid-20th century, has been accepted by the international scientific community. The CSIRO believe that emissions of greenhouse gases will cause further warming and changes in all components of the climate system.
This represents a significant challenge in Australia to individuals, communities, governments, businesses, industry and the environment. Australia has already experienced increases in average temperatures over the past 60 years, with more frequent hot weather, fewer cold days, shifting rainfall patterns and rising sea levels. More of the same is expected in future.

The CSIRO worked with the Australian Bureau of Meteorology to produce the most comprehensive set of climate change projections for Australia ever released. Projections were done for eight distinct regions of Australia, each of which would be affected differently by climate change.

Research showed that most of the changes observed over recent decades will continue into the future. Projections suggest that for Australia:

Hot days will become more frequent and hotter.
Sea levels will rise.
Oceans will become more acidic.
Snow depths will decline.
Extreme rainfall events are likely to become more intense - already happening.
Seasonal-average rainfall changes will vary across Australia.

In southern mainland Australia, winter and spring rainfall is projected to decrease, but increases are projected for Tasmania in winter. In eastern Australia, there is high confidence that in the near future (2030) natural variability will predominate over trends due to greenhouse gas emissions. For late in the century (2090), - - there is medium confidence in a winter rainfall decrease. In northern Australia and northern inland areas, there is high confidence that in the near future (2030), natural variability will predominate over trends due to greenhouse gas emissions. There is low confidence in the direction of future rainfall change by late in the century (2090), but substantial changes to wet-season and annual rainfall cannot be ruled out.

The time in drought is projected to increase over southern Australia.
There is high confidence in increasing potential evapotranspiration (atmospheric moisture demand).
There is high confidence in decreasing soil moisture in the southern regions (particularly in winter and spring) driven by the projected decrease in rainfall and higher evaporative demand.
There is medium confidence in decreasing soil moisture elsewhere in Australia where evaporative demand is projected to increase but the direction of rainfall change in uncertain.
Southern and eastern Australia are projected to experience harsher fire weather.
Tropical cyclones may occur less often, but become more intense.
Projected changes will be superimposed on significant natural climate variability.

http://www.csiro.au/en/Research/OandA/Areas/Oceans-and-climate/Climate-change-information

SEA-LEVEL RISE

Climate change ties in with sea level rise. Rising sea levels will impact the population, environment and infrastructure. On the CSIRO site, under the title of "PLANNING FOR SEA-LEVEL RISE, the following information is revealed. *"Around the world, rising sea levels, as a result of human induced climate change, are already having an impact."*

The CSIRO recommend that Government, industry and the community need to work together to consider how best to plan for rising sea levels that will affect coastal communities, industries and ecosystems. Risks to population, infrastructure and the environment need to be reduced.
"*In Australia the consequences of sea level rise will include increased flooding of low-lying coastal, including tidal, areas and are likely to result in coastal erosion, loss of beaches, and higher storm surges that will affect coastal communities, infrastructure, industries and the environment."*

Our coastline is becoming more developed with people and industries. Around 85% of the population lives within 50 km of the coast. Beaches, coral reefs and other tidal systems such as estuaries, and wetlands are all likely to be affected by sea level rise.

http://www.csiro.au/en/Research/OandA/Areas/Oceans-and-climate/Sea-level-rise-planning

EXPLAINING HOW SEA-LEVEL RISE FITS INTO THE TERMS OF REFERENCE

In the terms of reference, impacts on water are included. On the next page is an illustration from a document published by the Co-operative Research Centre for Irrigation Futures. This shows how the confined and unconfined Dilwyn aquifers extend out under the sea. In my submission, I covered sea-water intrusion, but not sea- level rise.

I quote from my submission *"There is evidence of a direct hydraulic connection of the Dilwyn aquifer to the sea in the form of tidal pressure effects." "Preliminary Investigation of Seawater Intrusion into a Freshwater Coastal Aquifer: Lower South-East, September 2012"* - This document, as cited in my submission, states the following ***"This fresh groundwater aquifer is vulnerable to salinisation by seawater intrusion due to over exploitation of the resource and climatic changes, which may respectively cause the lowering of the groundwater hydraulic head, and reduced recharge into the unconfined aquifer."***

If there is any change in pressures, such as sea level rise and extreme weather conditions accompanied by king tides, I believe it would be safe to assume that because there is already proven interconnection between the sea and the aquifers through the tidal affects in the SE, as discussed in my submission, that it is likely that the risk of sea water intrusion could be further increased. Hence, I

believe Sea Level Rise fits into the terms of reference and should be included as an integral part of the overall picture.

ILLUSTRATION OF AQUIFERS EXTENDING UNDER THE SEA, IN THE SOUTH EAST

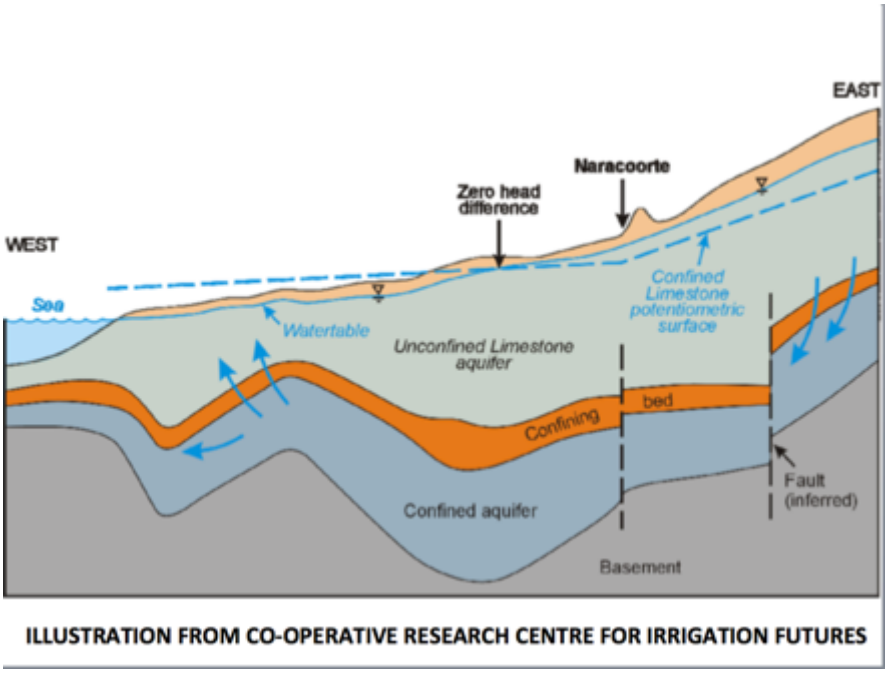


Illustration from the Co-operative Research Centre for irrigation futures, showing how the Dilwyn aquifers, including the confined aquifer, extend under the sea

IMPACT OF CLIMATE CHANGE ON DEVELOPMENT & CONSERVATION OF SOUTH AUSTRALIA'S COAST

Rob Tucker has written a document for DEWNR on '*THE IMPACT OF CLIMATE CHANGE ON DEVELOPMENT AND CONSERVATION OF SOUTH AUSTRALIA'S COAST'.* Please see the chart from this document, on estimated sea level rise over the last 20 years in relation to climate change. Higher sea levels can mean: Increased severity and frequency of sea flood events and increased coastal erosion. In the report, it is stated that major developments must consider *'full range possible climate change and sea level rise affects*'. Fossil fuels are having a major impact on climate change.

Therefore, hydraulic fracture stimulation in the South East, needs to be taken into account as causing additional impacts to climate change. This must taken into account, not only from the cost of health impacts of humans and animals, as the result of contamination of air, soil and water from hydraulic fracture stimulation, but the larger picture of sea water inundation in coastal communities including the Adelaide plains and the costs associated with this sort of possible scenario as the result of climate change.

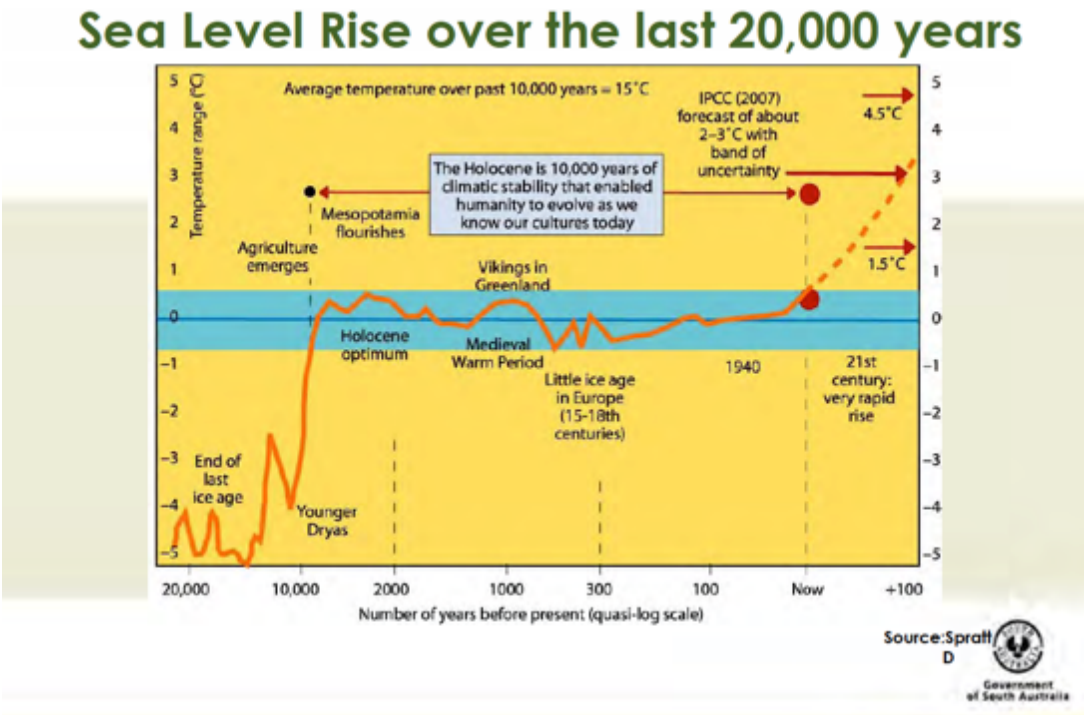
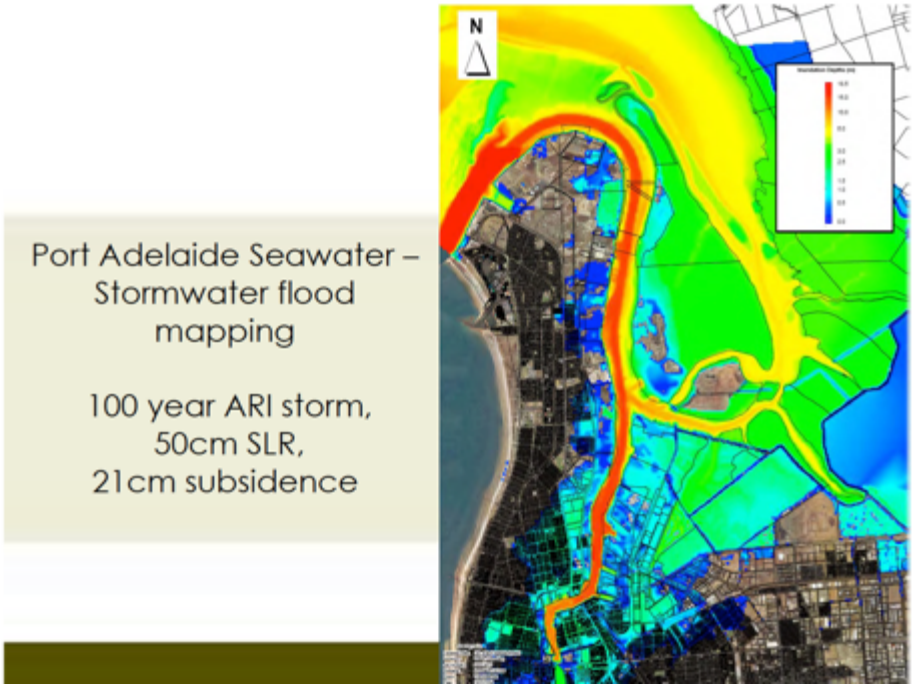


Chart from '*The impact of climate change on development and conservation of South Australia's coast'.* Diagram below is from same document.



The picture above is a model of a Port Adelaide Seawater- Stormwater flooding map for a 100 year Average Recurrent Interval storm, resulting in 50 cm Sea Level Rise and 21 cm subsidence. The red colour is 18.5 metre inundation depth. Orange represents 15 metre inundation depth, yellow is 5 metre, green is 3 metre and aqua 0.5 metre inundation depth.

https://www.lga.sa.gov.au/webdata/resources/files/Rob%20Tucker.pdf

NATIONAL-SCALE VULNERABILITY ASSESSMENT OF SEAWATER INTRUSION: SUMMARY REPORT

This report was released by the Australian Government National Water Commission in August 2012. On page 10 /182 Australian coastal aquifers are vulnerable to seawater intrusion (SWI) that is

described as the landward encroachment of seawater into coastal aquifers. This leads to degrading of the water quality and reduction of available freshwater. "*The increasing demands for fresh water in coastal areas and the anticipated impacts of climate change (such as sea-level rise and variations in rainfall recharge) may result in increases in the incidence and severity of SWI."*

Page 13/182 Low-lying areas that may be susceptible to surface inundation by seawater due to sea-level rise were identified using a Digital Elevation Model. *"Areas with an elevation less than one metre AHD (Australian height datum, an approximation of mean sea level) were considered highly susceptible to future seawater inundation, which is likely to cause substantial losses to freshwater resources for unconfined aquifer systems."*

Case study areas of aquifers and integrated vulnerability rankings showed high rankings in areas of SA, NSW, Vic, WA and Qld. Areas in SA included Adelaide with T1 and T2 aquifers, Le Fevre with Q1, T1 and T2 aquifers, Port MacDonnell Tertiary Sands Aquifer, Port MacDonnell Gambier Limestone aquifer, Willunga with the Port Willunga Formation Aquifer and also the Maslin Sands Aquifer, the Uley South Wanilla Sands Aquifer and also Bridgewater Formation Aquifer and the Willunga Quaternary Aquifer. Seawater intrusion had already occurred at some of the case study sites around Australia.

On page 15/182, All Australian states and the Northern Territory coastal aquifers, according to available data, are threatened by seawater intrusion. Page 17/182 As well as increasing demands for fresh water in coastal areas of Australia, sea water intrusion is also a concern with the anticipated impacts of climate change, such as sea level rise and variations in rainfall recharge. This may result in more incidents and more severe impacts of seawater intrusion.

On page 18/182, *"this study could be described as an assessment of the vulnerability of Australian freshwater coastal aquifers (system and attribute of concern to seawater intrusion as a consequence of over extraction and sea-level rise and/or recharge – discharge variations associated with climate change (hazards) in the present and future (temporal reference)"*

"The Intergovernmental Panel on Climate Change (IPCC) has defined vulnerability in the specific context of climate change as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change" (IPCC 2007) Barnett et al (2007).

By combining vulnerability definitions for the purposes of the report for this study, one of the key points of exposure to hazards is seawater intrusion as a result of groundwater extraction and climate change.

On page 23, apart from groundwater extraction for agriculture and domestic use, seawater intrusion may occur naturally, including from, tsunamis, flooding, and climate variability. Although not listed in this document, we cannot say that tsunamis won't occur in the open ocean area of the South East as the result of an earthquake (naturally occurring or triggered through petroleum activities). As the result of the various incidents that may occur, resulting in seawater intrusion, as I understand, this can lead to alteration of the hydrology of an aquifer system.

On page 25/182, the impacts of reduced groundwater recharge may increase in the future as a consequence of the anticipated climate change-induced reductions in rainfall. The aquifer water quality, as the result of low groundwater recharge will be exacerbated by increased groundwater extraction during droughts – this is another reason that unconventional gas should be banned in the SE of SA, due to the high volumes of water that are required. Even if water is obtained from deep down, the aquifer water will be higher in salt and contaminants, as previously explained.

Page 26/182 *"Sea-level rise, in response to a changing global climate, can also change the position of the transition zone. Climate change predictions by the IPCC indicate a possible rising sea level of 59 centimetres (plus 10–20 centimetres for ice sheet melt) by 2100 (IPCC 2007), which would lead to the inland migration of the freshwater–saltwater interface (Werner and Simmons 2009). In order to re-establish equilibrium with fresh groundwater in response to rising sea levels, the transition zone is expected to move landward and intrude coastal aquifers. Based on prehistoric cases of the influence of sea-level rise, SWI may cause a landward shift in the transition zone that does not return to its original position and may be difficult to remediate, emphasising that prevention of SWI is a better option than post-intrusion remediation (Barlow 2003)."*

"In addition to the subsurface impacts, sea-level rise may also result in the permanent surface inundation of low-lying coastal regions and increase the frequency and intensity of temporary inundation through the occurrence of storm surges. This could result in the intrusion of salt water into freshwater reserves by movement of the interface, similar to tidal changes (discussed below), or by downward seepage."

According to page 100/182, it is noted that there are many knowledge gaps. Implications to seawater intrusion, as the result of climate change and climate variation and their implications are not well understood on a national scale. More research needs to be undertaken on the effects of future sea-level rise, over-extraction and population growth on coastal groundwater resources. So, in other words, preservation of our potable aquifers is critical, as well as reduction in greenhouse gas emissions caused by fossil fuel extraction.

On page 101/182, I was surprised to learn that there is no information about offshore hydrogeology, including offshore aquifers. As I understand, there is lack of information regarding the detailed coastal aquifer settings around Australia and consequent groundwater-oceanic water interactions in these unknown aquifers. Although this inquiry is around hydraulic fracture stimulation in the SE, this very critical information (or lack thereof) should not allow the Government to ratify offshore oil and gas activities in South Australian waters. I understand from this report that things are being put in place, but if lack of information re hydrology under the sea is unchanged since this report was written, it is a national disgrace – resources are urgently needed in this area for future planning and development. Perhaps Government would do well to correct this, and stop propping up an unwanted industry with heavy subsidies.

http://www.nwc.gov.au/__data/assets/pdf_file/0014/23162/85-Seawater-intrusion.pdf

DEFINING THE SEA LEVEL RISE PROBLEM IN SOUTH AUSTRALIA – SA Govt Paper

In June, 2014, the Local Government Association of South Australia in partnership with the Climate Change Unit, Water & Climate Change Branch, Department for Environment, Water and Natural Resources, and Coast Protection Board released a very important document entitled **"DEFINING THE SEA LEVEL RISE PROBLEM IN SOUTH AUSTRALIA, ISSUES PAPER – URPS."** On page 7/149, it is stated that all South Australians will be affected because of environmental, economic and social systems that are threatened by sea level rise. The document discusses warming oceans, melting glaciers and ice sheets causing the sea levels to rise around the world at an increasing rate because of the global warming climate systems. Direct impacts on the coastal environment and infrastructure will increase coastal management costs. These areas and their amenities will be devalued. This will impact the provision of public services, business, industry, eco system services, in turn, impacting the health and well being of communities.

It is stated that the government must make decisions about sea level rise and determine acceptable and unacceptable levels of risk. As it is scientifically well documented, including by the CSIRO as previously explained, that the fossil fuels are a large factor impacting climate change, therefore the government should act accordingly and decide that proceeding with unconventional gas in the SE of SA qualifies as an unacceptable level of risk.

On this same page it is stated that there are current examples of decisions being made that are placing communities and assets at risk of coastal hazards, risks that are being exacerbated by sea level rise. Organizations and officers of those organizations have raised concerns that poor decisions are being made. **In April 2013, a sea level rise forum was hosted by the Premier.**

On page 10, it is stated that awareness and understanding of sea level rise needs to be raised among the broader community. I believe part of this awareness is of the impacts of climate change on sea level rise associated with the use of fossil fuels. On page 12, one of the recommendations is to identify state-wide objectives for sea level rise management and their relationship with various coastal management systems. I believe that impacts from unconventional gas, including hydraulic fracture stimulation, is easily identified as a precursor for climate change impacts**, therefore if sea level rise management were to be successful, the first thing would be to rule out any unconventional gas projects in the SE of SA, and transition the state across to 100% renewables**.

On page 15 a recent report by the Intergovernmental Panel on Climate Change (IPCC) reconfirmed that warming of the global climate system is unequivocal. Global average sea levels have risen over the last century, and more quickly in recent years. Our state is vulnerable to sea level rise. **Data collected at Port Stanvac shows that sea levels have risen at an average rate of 5.1mm per year since 1992, compared to 1.5mm per year over the previous century (calculated from tidal records). If the climate were to stabilize through global climate change mitigation efforts, sea levels will still continue to rise for many centuries, posing a risk to coastal areas both in itself, and in combination with other climate change caused risks such as more frequent storm surges.** Please see the next section on the storm damage at Kingston SE in July 2016.

When one really considers the facts and that the 5.1 mm rise per year has only occurred in the last 24 years, is this government report too conservative, and not allowing for the fact that in the next 20 years, the sea level rise could be much greater that the average of 5.1 mm, and could even be 10 mm per year or more, accounting for melting of polar ice caps and glaciers?

On page 19 it is stated that global emissions currently are in excess of the highest emissions scenario considered by the IPCC. The IPCC believes that the global average sea level rise will likely be in the range of from 0.45 metres up to 0.81 metres from around 2018 – 2100. Geoscience Australia and the Commonwealth Department of Climate Change and Energy Efficiency have mapped projected sea level rise in parts of South Australia, including from Outer Harbour to south of Marino. Areas of Yorke Peninsula have also been mapped out. I am also aware that studies have been done in the area of Kingston SE, but the findings have not been made public at the time of writing this addendum.

On page 21 it is stated that during storm surge events, the impacts of sea level rise will be seen. Coastal erosion will accelerate above natural rates. As the sea level rises, low-lying areas will be permanently inundated as the sea level rises. The combined impact of sea level rise with storm surge and catchment inflows will exacerbate coastal inundation, erosion, land subsidence, loss or damage to coastal wetlands and saltmarshes, and saltwater intrusion to groundwater systems. These cumulative impacts can be further exacerbated by various influences including factors that are both climate-related and non-climate related.

I ask, that taking these facts into account from a Government sourced document, understanding that some of these impacts will occur, is it fair to take more risks in allowing unconventional gas to go ahead, therefore exacerbating climate change, and increasing these impacts even further, when already, SA is facing economic, social and environmental impacts as the result of climate change and sea level rise, when departments are already stretched to the limit?

On page 22, it is stated that the effects of sea level rise resulting from climate change include storm surges resulting in flooding from the sea, erosion, backwater effect as the result of flooded rivers, wetland loss, salt water intrusion into surface water and ground water and also land subsidence (both of which I previously discussed in my submission).

2 pages on is a map from page 23. The total estimated replacement cost of assets when the SA coast is exposed to a 1.1 metre sea level rise, predicted by 2100, and based on data sourced in 2011, is expected to be around $46 billion. It is interesting to note the impacts estimated on some specific district council areas, as the result of the 1.1 metre estimated sea level rise by 2100. These include the following:

City of Port Adelaide Enfield – up to 506 commercial buildings, 692 light industry buildings and up to 45 km of rail will be at risk.

City of Charles Sturt – 141 commercial buildings, 14,100 residential buildings will be at risk.

City of Holdfast Bay – 121 light industry buildings, up to 1000 residential buildings will be at risk.

District Council of Port Pirie – 171 commercial buildings and 2000 residential buildings will be at risk.

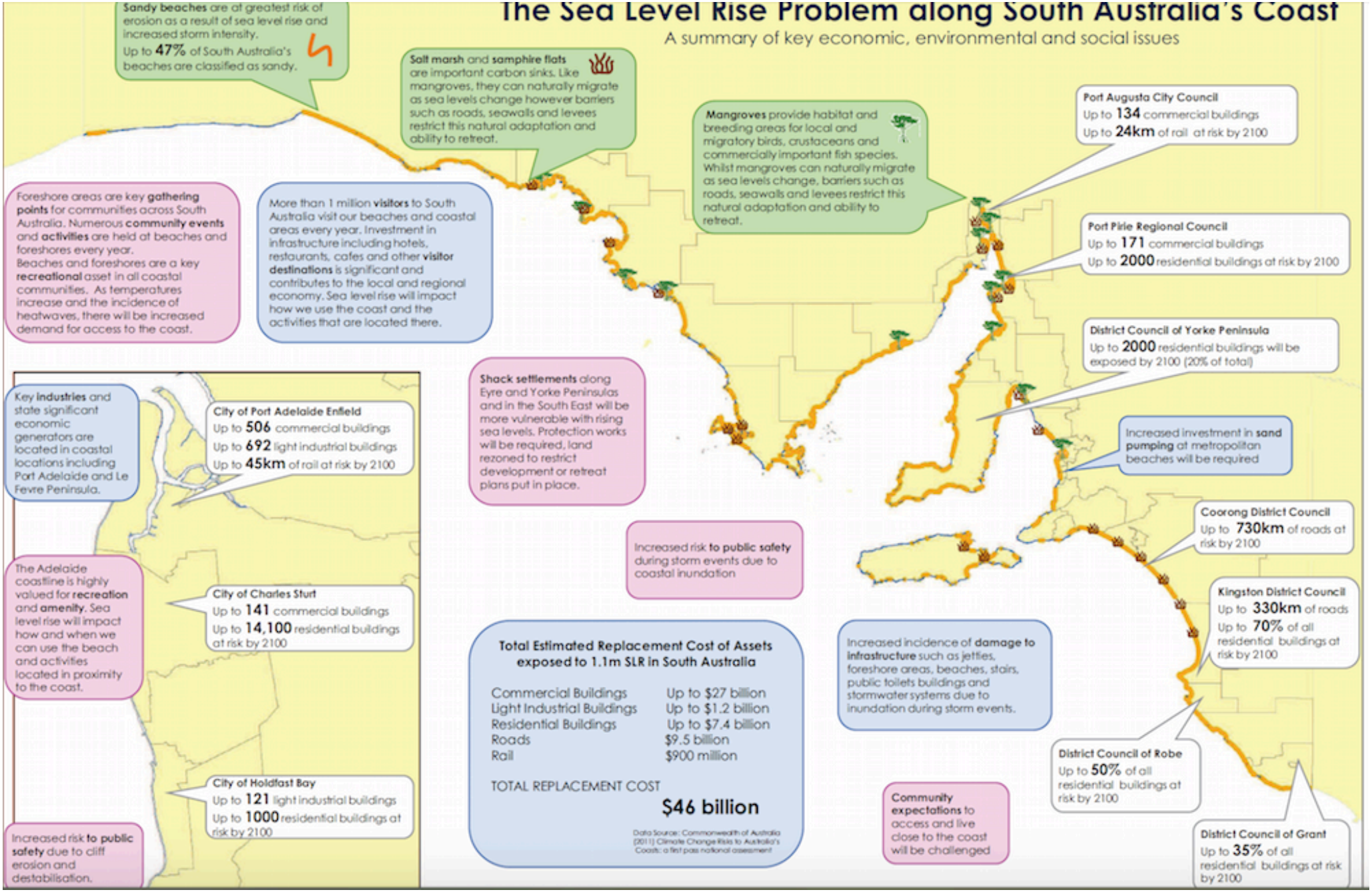
Coorong District Council – up to 730 km of roads will be at risk.

Kingston District Council – up to 330 km of roads, up to 70% of all residential buildings will be at risk.

District Council of Robe – 50% of all residential buildings will be at risk.

District Council of Grant – up to 35% of all residential buildings will be at risk.

This is very concerning, both for any onshore and OFFSHORE petroleum activities. Imagine a blowout as the result of oil and gas activities offshore and all of these issues on top of it. A decision to help mitigate climate change as the result of using 100% renewables, and not allowing unconventional gas in the SE cannot be ignored for the state's future. Hopefully, this would reduce some of these perceived impacts and horrendous costs that face future generations.


The Sea Level Rise Problem along South Australia's Coast
A summary of key economic, environmental and social issues
Sandy beaches are at greatest risk of erosion as a result of sea level rise and increased storm intensity.
Up to 47% of South Australia's beaches are classified as sandy.
Salt marsh and samphire flats are important carbon sinks. Like mangroves, they can naturally migrate as sea levels change however barriers such as roads, seawalls and levees restrict this natural adaptation and ability to retreat.
Mangroves provide habitat and breeding areas for local and migratory birds, crustaceans and commercially important fish species. Whilst mangroves can naturally migrate as sea levels change, barriers such as roads, seawalls and levees restrict this natural adaptation and ability to retreat.
Port Augusta City Council
Up to 134 commercial buildings
Up to 24km of rail at risk by 2100
Port Pirie Regional Council
Up to 171 commercial buildings
Up to 2000 residential buildings at risk by 2100
Foreshore areas are key gathering points for communities across South Australia. Numerous community events and activities are held at beaches and foreshores every year.
Beaches and foreshores are a key recreational asset in all coastal communities. As temperatures increase and the incidence of heatwaves, there will be increased demand for access to the coast.
More than 1 million visitors to South Australia visit our beaches and coastal areas every year. Investment in infrastructure including hotels, restaurants, cafes and other visitor destinations is significant and contributes to the local and regional economy. Sea level rise will impact how we use the coast and the activities that are located there.
District Council of Yorke Peninsula
Up to 2000 residential buildings will be exposed by 2100 (20% of total)
Shack settlements along Eyre and Yorke Peninsulas and in the South East will be more vulnerable with rising sea levels. Protection works will be required, land rezoned to restrict development or retreat plans put in place.
Increased investment in sand pumping at metropolitan beaches will be required
Key industries and state significant economic generators are located in coastal locations including Port Adelaide and Le Fevre Peninsula.
City of Port Adelaide Enfield
Up to 506 commercial buildings
Up to 692 light industrial buildings
Up to 45km of rail at risk by 2100
Coorong District Council
Up to 730km of roads at risk by 2100
Increased risk to public safety during storm events due to coastal inundation
Kingston District Council
Up to 330km of roads
Up to 70% of all residential buildings at risk by 2100
The Adelaide coastline is highly valued for recreation and amenity. Sea level rise will impact how and when we can use the beach and activities located in proximity to the coast.
City of Charles Sturt
Up to 141 commercial buildings
Up to 14,100 residential buildings at risk by 2100
Total Estimated Replacement Cost of Assets exposed to 1.1m SLR in South Australia
Commercial Buildings Up to $27 billion
Light Industrial Buildings Up to $1.2 billion
Residential Buildings Up to $7.4 billion
Roads $9.5 billion
Rail $900 million
TOTAL REPLACEMENT COST
$46 billion
Data Source: Commonwealth of Australia (2011) Climate Change Risks to Australia's Coasts: a first pass national assessment
Increased incidence of damage to infrastructure such as jetties, foreshore areas, beaches, stairs, public toilets buildings and stormwater systems due to inundation during storm events.
District Council of Robe
Up to 50% of all residential buildings at risk by 2100
Community expectations to access and live close to the coast will be challenged
City of Holdfast Bay
Up to 121 light industrial buildings
Up to 1000 residential buildings at risk by 2100
Increased risk to public safety due to cliff erosion and destabilisation.
District Council of Grant
Up to 35% of all residential buildings at risk by 2100

Previous page - Diagram from 'DEFINING THE SEA LEVEL RISE PROBLEM IN SOUTH AUSTRALIA, ISSUES PAPER – URPS'

On page 25 the estuarine, near-shore and coastal ecosystems that provide natural protection and coast stabilization will be threatened by sea level rise. These systems usually provide natural protection and coast stabilisation. I understand, if these natural protection barriers disappear, then more severe damage and associated massive economic costs will be much greater. Salt flats and marshes and mangroves are found between the low and high tide levels. Changes in tide levels will impact these ecosystems. Migratory bird breeding areas, fish and crustaceans are dependent on these areas. Salt flats and marshes are important carbon sinks as well. I understand this is likely impact both commercial and recreational fishing.

Page 26 discusses the rise of sea temperature and acidity of the sea and detrimental effects on the ecology. Sediment deposition, sea grass being smothered and inhibited growth are issues. I understand that without healthy and abundant sea grass, fish breeding and feeding grounds in turn are affected. Again seawater intrusion into ground water systems is discussed as the result of sea level rise, affecting potable groundwater near the coast.

On page 28 Integrated Coastal Zone Management (ICZM) is discussed. "The Australian Government's 2006 ICZM Framework and Implementation Plan, defines the goal of ICZM as to "maintain, restore or improve the quality of coastal ecosystems and the societies they support... [and] address both development and conservation needs within a geographically specific place ... within a specified timeframe". **If the Australian Government has taken seriously ICZM on one hand, then how can any Australian Government encourage unconventional gas on the other hand, understanding the links between fossil fuels, climate change and sea level rise, therefore, I believe, negating the ICZM plans that are meant to be in place**.

Critical environmental assets having special attention are meant to fit within the framework of the ICZM plans. **What makes this more staggering is that there is meant to be close cooperation between all levels of government (I would presume across Australia) with coastal zone planning, and yet the track record at Federal level and in other states appears to fall completely short.** There is meant to be innovation in policy planning and management, which should go across all departments, but from what I have been witnessing, including in my role as being the only agricultural advocate that attends the Round Table for Gas and Oil in SA, this is simply not occurring. My thoughts are backed up by page 29 of the report. In 2009 the Australian Government had an inquiry into climate change and management of the coastal zone. A document was released called "National Cooperative Approach to Integrated Coastal Zone Management: Framework and Implementation Plan". Even though this report was released, **it appears that the Federal or State Governments have not made any significant commitments.** Part of governments' roles is protection of its people!!

This is most concerning, given that government at all levels has been given volumes of evidence on impacts of the fossil fuel industry, health, economic and ecological impacts, they appear to be turning a deaf ear. The question needs to be asked, are politicians placing themselves in a culpable position, and setting themselves up for massive court cases, class actions and being sued, because they were given the knowledge and did nothing to respond or act upon it. I understand this has already happened in other areas. One example involves the Linc Energy contamination case, which involves underground gasification, with the Hopeland community near Chinchilla, who are taking class action against both Linc Energy and the Queensland Government. The class action has been instigated. There are around 130 landowners living within the exclusion zone of around 320 square kilometres (32,000 hectares). The landowners have added the Queensland Government into the equation, because they say the Queensland Government should have never allowed the project to proceed. It is clear that the

government have placed itself in a culpable position. Underground coal gasification has now been banned in Queensland, and yet plans are afoot for this type of project at Leigh Creek, with drilling of exploration holes recently being announced. I believe the time is coming quickly when not only the government, but also individual politicians will also be held responsible, sued and dismissed.

http://www.queenslandcountrylife.com.au/story/3859079/farmers-to-sue-linc-qld-government-map/?cs=4785#!

http://www.theaustralian.com.au/life/weekend-australian-magazine/linc-energys-ucg-plant-at-chinchilla-a-smart-state-disaster/news-story/89096454ced60874c5d8e2e967fb9c1c

Even though this is related to underground coal gasification, there are similarities. The farmers objected. Things 'happened' that were never meant to happen, and now the government has placed itself in a very precarious position because the community warnings were not heeded.

On page 34: Weak and inconsistent legislation, and not focusing on prevention are concerning issues that, I believe, should be addressed as soon as possible, including banning of unconventional gas in the SE and transitioning to 100% renewables in South Australia. Uncertainty around liability, inconsistent or weak legislation, and prevention needs to be addressed.

On page 44, the Coast Protection Act 1972 defines the coastal zone as State waters to 100 metres inland from the high water mark (HWM), and provides for the conservation and protection of the beaches and coast of South Australia through establishment of the Coast Protection Board. Under Section 14 of the Act, the functions of the Coast Protection Board are to: Protect the coast from erosion, damage, deterioration, pollution and misuse; Therefore, one could argue that if the coast line is being put at risk through erosion, damage, deterioration, pollution and misuse; because of sea level rise, because of climate change which is exacerbated by the use of fossil fuels, then the regulator for Petroleum is technically breaking the law under the Coast Protection Act 1972.

On page 58 and further pages is the "30-Year Plan for Greater Adelaide 2010". On page 59 the document mentions that policy must include taking measures to protect coastal development. This would be impossible, for reasons already given in this addendum, unless South Australia becomes 100% renewable with energy, in the hope that global warming is kept to the lowest point possible. On page 69 the minister is required to develop policies, under the Climate Change and Greenhouse Emissions Reduction Act 2007 that promote or implement adaptation to climate change impacts. Again, I repeat, if this act is taken seriously, then the push for 100% renewable energy in South Australia must be in place in a time frame that can be reached as fast as possible.

On page 78, the objects of the Natural Resources Management Act 2004 (NRM Act) are to promote sustainable and integrated management of the State's natural resources, and provide to protect the State's natural resources. Under the NRM Act, the Natural Resources Council and the Regional Natural Resources Management (NRM) Boards have legislative responsibility to plan for the management of natural resources in a holistic integrated way for the whole state for all aspects of NRM. Coastal, estuarine and marine environment planning is the legislative responsibility of the NRM board. It must plan for both the land and the State water limits, which are 3 nautical miles out. As this is an issues paper on sea-level rise including impacts from climate change (exacerbated by fossil fuel use), then this needs to seriously by the Government who should consider this huge responsibility and act upon it, and do what is best for the state in the long run.

On page 84 - I quote the following: **"***Flood and extreme weather as a result of climate change will be experienced in the coastal zone. Sea level rise as a result of climate change will exacerbate risk of*

flooding and extreme weather events for which emergency management planning is undertaken.

On page 94 - The Insurance Council of Australia (ICA) identified that some risks including storm surge, landslip and sea level rise that are not generally covered by insurance products. This is further complicated by the fact that no common definitions of risks (inclusive of storm surge, landslip and sea level rise) are adopted across the insurance industry. Policies generally deal with "saltwater risks or action of the sea" via exclusions. I am aware that there is difficulty getting insurance in gas production areas, for the farmers. This is an area I had not even thought of. This is another reason why climate change must be taken into account, and that we as a nation do everything we can to ensure that some affects can be stopped, through transitioning to 100% renewables and away from fossil fuels, with no fossil fuels being given the go ahead in the SE of SA.

Also, in response to the inquiry, multinational insurance company Insurance Australia Group (IAG), has said that Australia is facing an "insurance gap" because land values are not currently insured". Land value on the coast forms a significant component of overall property value. Coastal buildings may be protected by insurance to some extent. Land values of properties are not insured. It is also highly likely that legal actions may be brought against the local government councils.

On page 97 it is quoted ***"The State Government is also potentially liable for climate change related actions,"*** and given that the governments have all levels have been many warnings on climate change and the dangers of fossil fuels, this is not surprising. If someone has been given a warning, as I understand, and does not act on the warning, then they have placed themselves in a culpable position.

On page 111 it is obvious also that the Commonwealth Government is also aware of sea level rise as the result of climate change, as there was an inquiry recommending a national role in distributing information between the research sector, local governments and other stakeholders. I assume this also includes the taxpayers.

https://www.lga.sa.gov.au/webdata/resources/files/Sea%20Level%20Rise%20Problem%20Definition%20Paper.pdf

STORM DAMAGE KINGSTON SE JULY 2016

You may question why I have included the 3 pictures below. Firstly, there are Petroleum Exploration Licences for shale and tight gas along the coast-line of the South East. There appears to be relentless, extreme weather conditions happening around the world, including Australia. During July, 2016, South Australia was lashed with winds up to 120 kph.

http://www.ewn.com.au/alerts/sa-severe-weather-warning-damaging-winds-272625.weather
Cape Jaffa, South of Kingston SE recorded 111 kph winds. The Kingston Jetty, built in 1876, fell apart – see link below. http://www.coastalleader.com.au/story/4027668/kingston-jetty-damaged-in-storms-photos/#slide=1

The cost of the storm damage is extensive to both repair the jetty and shoreline. As I do this addendum, I am waiting for the estimated repair figures to be released by the Kingston Council. As I have previously explained, if 5 mm sea level rise is occurring per year, imagine the inundation of one of these 'super storms' occurring, causing king tides, with increased sea level rise in 20 years time (100 cm). What planning has the government got in place for repairs of sea level rise, exacerbated by global warming, in big part, by the use of fossil fuels? How much is this type of repeated scenario going to impact the South Australian coastline, affecting both rural and city communities? If this

trend is going to continue, surely the costs over time for repair of structures, and even possible re-location of communities will run into the billions. For this reason alone, given the evidence on climate change that is acknowledged by the Federal Government (Julie Bishop attended the Climate Change talks in Paris) we must change to renewable energy sources, not allow any new petroleum projects in the South East, and transition over to renewables in places like the Cooper Basin. The question needs to be asked – if the State Government refuses to take heed on the warnings of these matters and act accordingly to preventative planning by exclusion of fossil fuels in the SE of SA, and transitioning from fossil fuels to renewables in other areas of the state, are the government placing themselves in a place of culpability?

Tim Buckley - Director of Energy Resource Studies, Australasia, Institute for Energy Economics and Financial Analysis, Bruce Robertson – Financial Analysist of the Northern Gas Pipeline, Mark Ogge and Roderick Campbell of The Australia Institute, and Kobad Bhavnagri, Head of Australia for Bloomberg New Energy Finance all gave excellent presentations on the real economics of gas, ranging from local to global levels, and explained the concerning issues, including stranded assets.

I believe that had I not brought up the issues of Sea Level Rise in conjunction with climate change in this addendum, that the government would not have even considered this important subject as part of the unconventional debate, nor even considered the possible enormous economic impacts on this state as the result of these occurrences. I believe I have clearly demonstrated that the economic risk to the state, when this is carefully considered and should not be ignored under any circumstance, out-weighs any economic gains in the area of unconventional gas for this state.

8 metre width of land went crashing into the sea, south of Kingston SE July 2016, taking with it part of the bike track - Photos Anne Daw

Kingston jetty, built in 1876, fell apart during the storm and sea surge in July 2016.
Both photos Anne Daw

Seaweed piled high on the jetty as the result of the sea surge and tide.

EXPERT SAYS KEY ADELAIDE BEACHES AT RISK DISAPPEARING WITHIN DECADE

According to an article in the Sunday Mail (SA), Dr. Ian Dyson, geologist and coastal expert, says key Adelaide beaches could disappear within a decade because of rising sea levels and erosion. Adelaide's beaches are renown for their wonderful long sandy stretches, and a mecca for tourists. However, he claims that the Adelaide coastline is facing an uncertain future, and at risk of disappearing within a decade because of rising sea levels and erosion, leaving just three 400m-long "pocket" beaches. If he is correct, beaches at Glenelg, Henley Beach and Semaphore will be all that remains of the metropolitan coast beyond 2026. He predicts the rest of the coastline will become a rocky foreshore, like Hallett Cove, and will be lined by rock walls.

"At an average tide you won't be able to walk along the beach," he said. "I'm concerned we've reached the point where it goes from coastal protection and maintaining beaches to property protection."

Rising sea levels are making it more difficult to retain beaches. Massive storms (the same as those affecting Kingston SE) on May 9 and July 13, highlighted problems, cutting back sand dunes by up to 7m, leaving walkways in disrepair and threatening coastal infrastructure. Dr. Dyson believes that several locations had been left exposed to the full effect of waves and winter storms because of a gradual lowering of the seabed and beach level.

It is interesting to note that the 20-year 'Adelaide's Living Beaches Strategy' was launched in 2005 and originally included a sand pipeline along the metro coast, but budget constraints meant only two sections — one at West Beach and another between Glenelg and Kingston Park — were built. The State Government, according to Dr. Dyson, spent $1 million trucking sand and $2.25 million pumping sand last financial year. *"It's been under-engineered and I think the pumping, that's what Coast Protection Board has hung everything on, hasn't been able to keep up," Dr. Dyson said. "Trucking is more efficient but residents don't like the rumble of trucks along The Esplanade or the beach."*
"There's going to need to be some harder questions answered," he said. "Ongoing sea level rise will make it more difficult to retain sand along the coast," Mr. Guy, Environment Department coastal programs leader said. More than 70,000 cubic metres of sand has been dumped at West Beach since the May 9 storms, compared with 96,000 cubic metres in the 2014-15 financial year.

http://www.adelaidenow.com.au/news/south-australia/expert-says-key-adelaide-beaches-at-risk-disappearing-within-a-decade-because-of-rising-sea-levels-and-erosion/news-story/6a2755e5010938c3ca2e16d82752bedd

ADELAIDE'S LIVING BEACHES – A STRATEGY FOR 2005 – 2015

The Department of Environment and Heritage in South Australia released a document in 2005 called "ADELAIDE'S LIVING BEACHES – A STRATEGY FOR 2005 – 2015". There is a specific section on global climate change. In the opening page, there is a quote from Kofi Annan, Secretary General of the United Nations at the time. I have added the full quote. *"We all know that in our personal lives, no less than in affairs of state, it can be difficult to heed long-term and unclear risks, no matter how potentially serious. This is what makes leadership so essential today. The global community will not solve the climate change problem at one stroke in Kyoto but, by moving from general pledges to a first phase of legally binding national targets for reducing emissions, it will have made a solution possible."*

http://unfccc.int/cop3/fccc/info/annan.htm

UNITED NATIONS ENVIRONMENT PROGRAMME – KYOTO

In the document – INFORMATION UNIT FOR CONVENTIONS (IUC), UNITED NATIONS ENVIRONMENT PROGRAMME, is the following quote by Kofi Annan.

"The Kyoto Conference on the United Nations Framework Convention on Climate Change will be such a moment. At Kyoto, the industrialized countries will have an opportunity to exercise their power and wealth in the interest of sustainable development for the planet. By taking decisive action to reduce their emissions of greenhouse gases to below 1990 levels by 2010, they will fulfill their commitment to lead a global and cooperative response to global warming in the next century - thereby driving the requisite technological changes and motivating developing countries, in turn, to limit the growth of their emissions."

Annan goes on to discuss the subject further. He said that decisive action in Kyoto was needed to limit greenhouse emissions. He went on to say that industrialized countries needed to exercise their power and wealth in the interest of sustainable development for the planet and take decisive action to reduce their emissions of greenhouse gases to below 1990 levels by 2010, to fulfill their commitment to lead a global and cooperative response to global warming in the next century, thereby driving the requisite technological changes and motivating developing countries, in turn, to limit the growth of their emissions.

"The recognition that the developed countries should take the lead in tackling climate change is one of the political cornerstones of the Convention. Not only are these countries responsible for the bulk of past and present emissions of the gases that are warming our atmospheric blanket; they will continue for many decades to have the highest rate of emissions per head. Moreover, they have the greatest economic and technological capacity for making emission cuts. Thus, the world expects a clear message from these countries in Kyoto: that they are committed to targets and timetables for emissions cuts that are significant, binding and verifiable. Arrangements for increasing the flexibility and lowering the costs of these cuts, such as emissions trading and joint implementation, must be seen to enhance - and not postpone - serious domestic measures to put production and consumption on climate-friendly paths."

The huge volume of greenhouse gases emitted from developed countries is such that no global effort to control emissions can succeed without a progressively greater contribution from them, consistent with their aims to enable their people to enjoy a better life. These countries have to be serious about limiting their own emissions and providing financial and technological support to help others do the same. Species and ecosystems are being destroyed at a rapid pace, and future climate change will accelerate these losses. Fortunately, reforestation and other strategies to protect biodiversity can also help to reduce net greenhouse gas emissions (by absorbing carbon dioxide from the atmosphere). **The paper also reminds us that the** precautionary approach has served us well in our narrow escape from destroying the earth's stratospheric ozone layer. Now this is another major risk we face. The best global insurance policy against this risk will be an early start on emissions reductions.

http://unfccc.int/cop3/fccc/info/annan.htm

KYOTO

In April 2001 a report by the Commonwealth Joint Standing Committee on Treaties called 'THE KYOTO PROTOCOL DISCUSSION PAPER, Report 38' was released. After the death of my father, Verne McLaren AM, I discovered in this paper, that the book he wrote 'LET THE EARTH LIVE', was on display at the Government inquiry into the Kyoto Protocol, September 2000 in Melbourne.

The Kyoto Protocol came about as part of the United Nations Framework Convention on Climate Change, adopted in 1997. This inquiry was based on the domestic impact of the emissions targets specified in the Protocol. In the forward, it was stated: (in part) *"The Government should continue to put the national interest first in these negotiations. This means ensuring that: Australia's economic growth, employment and industry competitiveness are not jeopardised;"* On of the terms of reference was *"The implications for Australia proceeding or not proceeding to ratifying the Kyoto Protocol and meeting its target emissions levels by 2008 with regard to anticipated and/or predicted economic, environmental and social outcomes both nationally and in specific regional areas."*

Advocates of the Protocol argued that it represented an important step towards successfully managing the impact of global warming, a potentially catastrophic environmental problem. The International Panel on Climate Change First Assessment Report, published in 1990, concluded that:

"*emissions resulting from human activities were substantially increasing the atmospheric concentrations of greenhouse gases which resulted in additional warming of the Earth's surface; over the previous 100 years, the global mean surface temperature had increased by between 0.3 and 0.6oC and the global sea level had risen between 10 and 20 cm; the global mean temperature would increase by about 3o C by 2100; and the global sea level would rise by about 65cm by 2100."*

The IPCC's Third Assessment Report, published in January 2001, confirmed that: *"the Earth has warmed by between 0.4 and 0.8oC over the last century, with the 1990s being the hottest decade this century; the global mean surface temperature would increase by about 1.4 to 5.8oC by 2100; and global mean sea level would rise by 9 to 88 cm by 2100, caused primarily by thermal expansion of the oceans and melting of glaciers."*

The Bureau of Meteorology (BoM) supported the IPCC's assessments and stated: *"There is now wide acceptance that the world has warmed significantly over the past century. This finding is based not just on the direct instrumental record of the land surface and of the oceans but is confirmed and extended back further in time by a range of independent proxy indicators of temperature, such as ice cores, tree rings and coral cores."*

This paper is very detailed, and I have not got the time to add everything here, but am happy to forward it to the committee, if requested. Even back in 1997, climate change impacts were being discussed, along with sea level rise. It appears that no government in Australia (nor many in the world for that matter) have heeded the warnings, and yet, heeding the warnings is dependent on our very existence into the future, for the sake of now and generations to come. **I hope, for the sake of our future, a wise decision is made to ban hydraulic fracture stimulation in the South East of South Australia, and not add to the woes of impending doom, if this topic in relation to fossil fuels is to be taken seriously.**

WATER UNCERTAINTY

UNCERTAINTY OF GROUND WATER MODELLING AND PUMPING.

I attend presentations when I can at the National Groundwater Centre for Research and Training, which is based in Adelaide and headed up by Professor Craig Simmons. Professor Simmons won South Australian Scientist of the Year in 2015.

6 hydrologists took part recently in one presentation on the uncertainty of groundwater modelling and groundwater pumping. This presents key issues. Modelists cannot provide certainty. There is groundwater uncertainty because of allocation, demand, use, eflows and other management initiatives. We don't know what emissions are going to do because of climate change. Rainfall predictions will all be wrong in some way. Actual future climate, aquifer recharge, pumping, etc. will differ from scenarios. Traditional guidelines are not the best starting point. We don't know what is going to happen in the future.

There are an infinite number of prediction scenarios that could be run in relation to pumping tests, recharge, etc. Pumping rates also change over time. Changes in recharge and pumping regimes could invalidate model predictions. The question is asked, how well did the model predict the drought three years later? Models assume wrongly that pumping is going to be the same for the next 30 years. Clients are now asking more complex questions. **Wrong modelling impacts economic and ecological areas. There is no capacity to deal with uncertainty.** The amount of recharge in aquifers continues to change. The chance of three average years of weather conditions including rainfall,

occurring in a row, is very low. Modellers should be quantifying how much their predictions may be wrong.

One of my questions on this is how often modelling takes into account the possibility of earthquakes, which also impacts contamination pathways for aquifers, and further vertical leakage, resulting in the change of water levels in the aquifers. We only have to look at the methane bubbling in the Condamine River, which has been well publicised. What most people don't understand, is that the methane bubbling up was not caused by hydraulic fracture stimulation, but in fact was caused by depressurisation due to dewatering of the coal seam. This in turn impacted the faults because of the changes underground, triggering the small fault line in the base of the Condamine River. Anyone who advocates against hydraulic fracture stimulation but thinks even conventional gas wells are fine for the South East, clearly shows lack of knowledge on both geology and water, and has not done any reading or research on this.

Both conventional, unconventional and exploration drill holes penetrate geological formations and aquifers, including faults. Unfortunately, we do not know what damage has been done, other than what I have presented in my original submission, as no base levels were taken that I am aware of (even if they had been, it would be safe to presume the tests would not have been exhaustive and not included testing for all possible contaminants as was the case for Beach Energy testing which I will go into.) Wells and drill holes are meant to be decommissioned (there would be a number, it would be safe to say, based on the Kingston lignite drill holes that haven't been) with cement plugs, the cement and casings break down, and as all of this is underground, we have no way of knowing what detrimental affects have already been or will occur. This makes the case against hydraulic fracture stimulation, and indeed, any further petroleum activities in the South East, (which I realize is not in the terms of reference), much stronger.

Hydraulic fracture stimulation requires large volumes of water. Going deeper into saline aquifers that would even be more toxic, to use this water, is not the answer and should not be risked. Bringing this water to the surface for this use would be extremely risky, through surface spills, overflowing of pond water through large amounts of rain and flooding, and also with loss of integrity of the drill hole, contaminate pathways of allowing this toxic and saline water to escape, would be a further issue. This factor is such a huge factor to be taken into account just on its own merit, therefore as no modelling can be done with any accuracy, no further petroleum activities should be allowed in the South East of South Australia.

As far as the South East aquifers, I have noticed huge changes on our own property. We have a couple of perched aquifers on our property, which are formed in limestone. All aquifers and bodies of water are usually interconnected, including confined aquifers, as there are breaches in the aquifer walls. I have included a picture of one of the perched aquifers taken around 35 years ago – plenty of clean water. The next picture was taken in 2010 and the third picture taken in June, 2016. As you will see, there has been a significant drop in the perched aquifer. This provides further evidence that water in the aquifers in the South East are already under significant stress and should not be put under further stress as the result of allowing unconventional gas projects to go ahead.

3 PHOTOS OF A PERCHED AQUIFER ON ANNE DAW'S PROPERTY NEAR KINGSTON SE
BEACH ENERGY PUTS SHALE POND WASTE WATER ONTO PRIME AGRICULTURAL LAND IN THE SOUTH EAST OF SOUTH AUST. THERE HAS BEEN AROUND 152 CM DROP PHOTOS: ANNE DAW

UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO) STANCE ON WATER SECURITY

According to the UNESCO site on water security, it is stated:
"Freshwater is the most important resource for mankind, cross-cutting all social, economic and environmental activities. It is a condition for all life on our planet, an enabling or limiting factor for any social and technological development, a possible source of welfare or misery, cooperation or conflict."

http://en.unesco.org/themes/water-security

Below is a quote by Ban Ki-Moon, from the newly released document "THE UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2016 – WATER AND JOBS".

"Sustainable development, human migration, conflict and natural disasters: water cuts across these and many other major issues on the global agenda. Employment is another key factor in population movements, civil unrest and environmental sustainability. The 2016 edition of the United Nations World Water Development Report, which was coordinated by the United Nations World Water Assessment Programme of UNESCO in collaboration with UN-Water Members and other partners, illustrates how the connection between water and jobs holds the promise of inclusive and sustainable economic growth for all countries. Its findings can serve to help reach the Sustainable Development Goals, which are all interlinked, including Goal 6 covering water and sanitation for all, and Goal 8 addressing decent work for all.

Among its findings, this report shows that many jobs in the global workforce depend on water. It demonstrates that water stress and the lack of decent work can exacerbate security challenges. It also traces the link between scarce or poor quality water, damaged ecosystems and instability that can lead to forced migration. The main message of the report is clear: water is essential to decent jobs and sustainable development. Now is the time to increase investments in protecting and rehabilitating water resources, including drinking water, as well as sanitation while focusing on generating employment. I commend this report to all those interested in joining forces to realize our bold vision for sustainable development aimed at creating a future where all people live in dignity on a healthy and peaceful planet."

http://unesdoc.unesco.org/images/0024/002439/243938e.pdf

The world faces potable water shortages as never before. According to the Global Risks Report 2016 (World Economic Forum), failure of climate change mitigation and adaption, water crisis and biodiversity loss and ecosystem collapse are the greatest concerns.

http://www.weforum.org/reports/the-global-risks-report-2016

The total of the world's water supply is about 332.5 million cubic miles of water. Over 96% is saline. Over 68% of the total freshwater is locked up in ice and glaciers. Another 30% of freshwater is in the ground.

http://water.usgs.gov/edu/watercycle.html

ONE THIRD OF THE LARGEST AQUIFERS IN THE WORLD ARE STRESSED

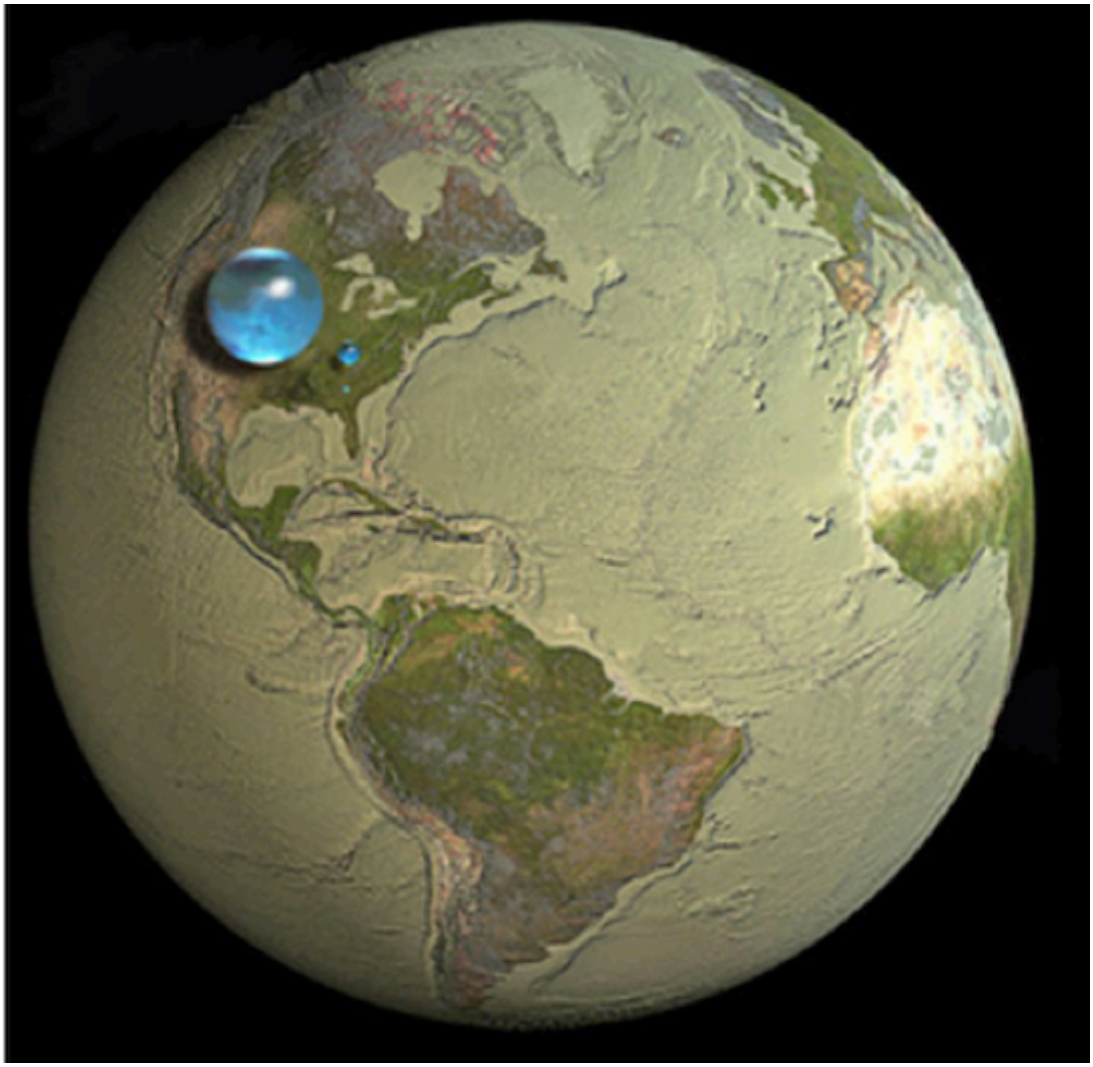
One third of the largest aquifers in the world are stressed. There is uncertainty as to how much water the largest aquifers contain. *"Imagine if your bank statement arrived each month and told you*

how much money you had withdrawn and deposited, but told you nothing about how much money you had at the beginning or end of the month. You'd know whether your balance had grown or shrunk, but you'd have no idea whether you could afford to buy a new house, take a vacation, or make it through that last year of college without bussing tables on the weekends. This is pretty much the state we're in with the world's groundwater accounts, which supply 2 billion people with drinking water and irrigate a large share of the world's food. "[I]n most cases, we do not know how much groundwater exists in storage," write the authors of a study published last month in Water Resources Research (WRR), a journal of the American Geophysical Union. As a result, we're clueless about how long we can keep drawing down these water reserves before they run out. And we are indeed drawing many of them down."

But without knowing how much water each aquifer holds in storage to begin with, there's no way to gage how long such depletion can go on, and which areas might run out of water first. Ground water is relied on during droughts. Once aquifers become depleted (or polluted), they can't easily be refilled.

http://voices.nationalgeographic.com/2015/07/09/with-one-third-of-largest-aquifers-highly-stressed-its-time-to-explore-and-assess-the-planets-groundwater/

HOW MUCH WATER IS LEFT ON EARTH?



Spheres showing the world's water – USGS, Howard Periman, Jack Cook, Adam Nieman.
***BIGGEST** = All water - sphere over western U.S., 1,385 km. diameter*
MIDDLE** = Fresh liquid water in the ground, lakes, swamps, and rivers - sphere over Kentucky, 272.8 km. diameter **DOT** = Fresh-water lakes and rivers - sphere over Georgia, **56.2 km. diameter.

According to the USGS, around 71% of the Earth's surface is covered by water. The oceans hold about 96.5% of all Earth's water. Water vapour is in the air, and water is in rivers, lakes, icecaps and glaciers and in the ground as soil moisture and in aquifers. The blue spheres represent volume and show relative amounts of Earth's water in comparison to the size of the Earth. This image attempts to show three dimensions, so each sphere represents "volume." The volume of the largest sphere, representing all water on, in, and above the Earth, is about 1,386,000,000 km^3 (cubic kilometres) and has a diameter of about 1,385 km in diameter.

The smaller sphere represents Earth's liquid fresh water in groundwater, swamp water, rivers, and lakes. The volume of this sphere would be about 10,633,450 km^3 and has a diameter of about 272.8 km in diameter. The tiny minute dot represents fresh water in all the lakes and rivers on the planet. This is where most people and life on earth get their water each day. The volume of this sphere is about 93,113 km^3. The diameter of this sphere is about 56.2 km.

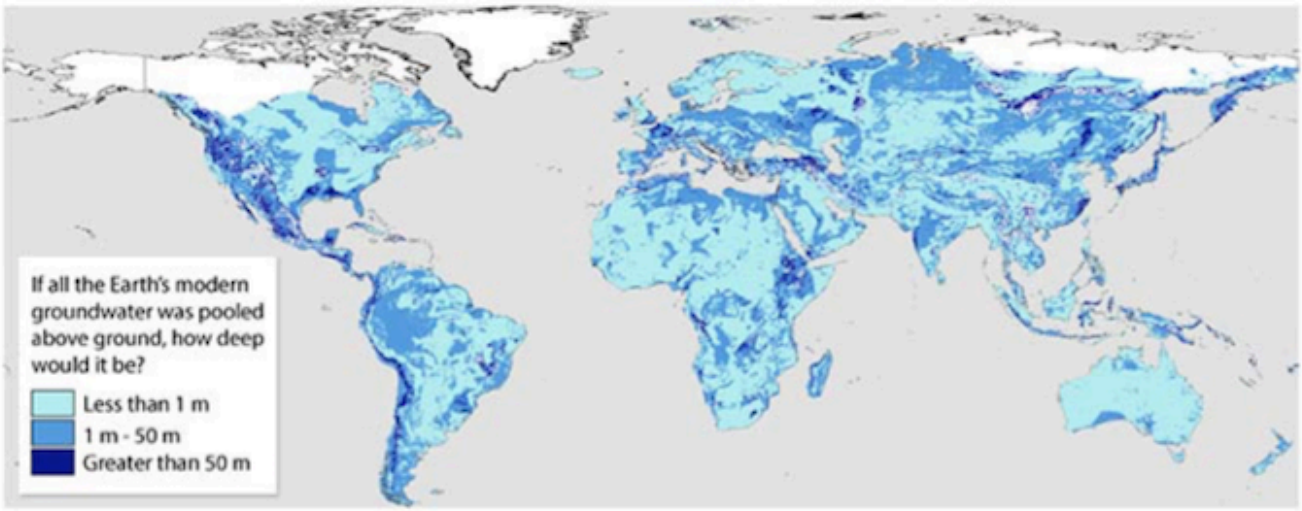
Rainfall recharge is no good if it recharges into already contaminated aquifers and rivers as they still remain contaminated.

http://water.usgs.gov/edu/gallery/global-water-volume.html
http://water.usgs.gov/edu/earthhowmuch.html

WE ARE USING OUR GROUNDWATER RESOURCES FASTER THAN THEY ARE BEING RENEWED

According to an article in ABC SCIENCE, 17 Nov 2015, 12:50pm

"Less than 6 per cent of ground water in the upper two kilometres of the Earth's landmass is renewable within a human lifetime, according to a new map showing the world's hidden groundwater." The study's lead author is Dr Tom Gleeson of the University of Victoria in Canada. He says that a lot of aquifers are experiencing water levels dropping. *"Groundwater resources are being used too fast - faster than they're being renewed*." A group of hydrologists from around the world have been using data and computer models to estimate the total groundwater supply of the earth. The study was published in NATURE GEOSCIENCE.



Tom Gleeson, Kevin M. Befus, Scott Jasechko, Elco Luijendijk and M. Bayani Cardenas (2015). *Nature Geoscience*, DOI: 10.1038/NGEO2590.

INFOGRAPHIC: *If all the Earth's modern groundwater was pooled above ground, how deep would it be? (Tom Gleeson, Kevin M. Befus, Scott Jasechko, Elco Luijendijk, M. Bayani Cardenas)*

Water found closer to the surface is more sensitive to contamination and climate change. *"According to the study, most groundwater is found in tropical and mountainous regions, with some of the largest deposits in the Amazon Basin, the Congo, Indonesia and along the western borders of North and South America. Not surprisingly,* ***the least amount is in arid regions such as Australia,*** *the Sahara and Gobi Deserts and central North America."*

http://www.abc.net.au/news/2015-11-17/new-map-will-help-estimate-when-earths-groundwater-will-run-out/6947038

WHY DESALINISATION WON'T SOLVE OUR PROBLEMS AND WILL EXACERBATE MORE PROBLEMS

This may be an odd topic to include, but from the mutterings I have heard, desalinisation (also spelt as desalinization) is one of the possibilities that has arisen in regard to water for hydraulic fracture stimulation. I believe this is not acceptable, given the amount of water required per well and the amount of wells that could possibly be drilled across the SE if these unwanted activities went ahead, especially taking into account the red queen effect that I described in my submission.

We have got our own desalinisation plant in South Australia. But what are the long tem affects from reliance on excessive desalinisation plants, on our planet? In an article in "THE IMPACTS ON RELYING ON DESALINATION FOR WATER", SCIENTIFIC AMERICAN, the following facts are revealed. Impacts on climate, ocean salinity and other natural processes need to be taken into account. Intense pressure is being put on existing fresh water supplies in desert areas, as communities turn to desalinisation. I was surprised to read that the process of desalinisation burns up many more fossil fuels than sourcing the equivalent amount of fresh water from fresh water bodies.

It is staggering to note that there are 13,000 desalinisation plants around the world, supplying water in 120 nations, primarily in the Middle East, North Africa and Caribbean. This is classified as both a reaction to and one of many contributors to global warming. Warnings are issued by marine biologists that widespread desalinization could affect ocean biodiversity in a huge way, with intake pipes essentially vacuuming up and inadvertently killing millions of plankton, fish eggs, fish larvae and other microbial organisms that constitute the base layer of the marine food chain.

"And, according to Jeffrey Graham of the Scripps Institute of Oceanography's Center for Marine Biotechnology and Biomedicine, the salty sludge leftover after desalinization for every gallon of freshwater produced, another gallon of doubly concentrated salt water must be disposed of can wreak havoc on marine ecosystems if dumped willy-nilly offshore. For some desalinization operations, says Graham, it is thought that the disappearance of some organisms from discharge areas may be related to the salty outflow."

http://www.scientificamerican.com/article/the-impacts-of-relying-on-desalination/

CHEVRON SAY POTENTIAL FOR TOXIC EFFECTS FOR REVERSE OSMOSIS

Chevron Australia Pty. Ltd. released a document entitled "EFFECTS OF A DESALINATION PLANT DISCHARGE ON THE MARINE ENVIRONMENT OF BARROW ISLAND". Under the title TOXIC EFFECTS on page 10, I quote:

"There is limited systematic information on the direct toxicity of desalination waste brine on marine species (Hopner & Windelberg 1996; The Ecology Lab 2005; Raventos et al. 2006; Bleninger & Jirka 2008). There is potential for both short and long-term toxic effects of RO waste brine on marine ecosystems, but any such effects remain unquantified. In addition, although whole effluent testing

(WET) ecotoxicology research is being conducted in association with the construction of a number of desalination plants across Australia, at present little reliable WET test information is available publicly."

Under the CONCLUSION on page 23: *"Research on the impact of desalination plant construction and discharge on the marine environment is limited. Nevertheless, studies have been completed which provide some background and insight into the potential impacts on marine ecosystems."* I ask the question, what rigorous testing has the Government of South Australia done for the impact of, say 3 or 4 desalinisation plants in our waters, and if so, under what guidelines? I haven't sighted such a study.

https://www.chevronaustralia.com/docs/default-source/default-document-library/gorgon-emp-effects-of-desalination-plant-discharge-on-marine-environment-of-barrow-island.pdf?sfvrsn=2

ENVIRONMENTAL CONCERNS FOR DESALINATING SEAWATER USING REVERSE OSMOSIS

The topic is the name of a paper written by Gurudeo Anand Tularam and Mahbub Ilahee who are from the Griffith School of Environmental, and the Faculty of Environmental Sciences (AES), Griffith University, Australia. They go on to explain a few disturbing concerns. ***"****The Reverse Osmosis membranes are susceptible to fouling and scaling, and as such, they need to be cleaned with chemicals regularly that may be toxic to receiving waters."* No long-term effects have been documented regarding the discharge concentrate. Even small traces of cleaning chemicals that are known to be toxic, may be harmful to marine life and ecosystem.

"The piping is often lengthy and underground as it is in Tugun (QLD, Australia), passing below the ground. Leakage of the concentrate via cracks in rocks to aquifers is a concern."

These plants can be noisy due to the use of high-pressure pumps, and are an annoyance to those in the vicinity. They discharge concentrated brine together with sludge and also chemical agents needed for in the pre/post treatment of seawater and discharge respectively and require plants careful attention due to membrane fouling. There are adverse effects on land use: Seashores serve as the sites for industrial plants and for pumping stations rather than for recreation and tourism.

Leakage from the pipes may result in penetration of salt water and therefore presents a danger to the aquifer, (which is dependent upon by the communities, both for domestic, industrial and agricultural use). As a result of returning the concentrated brine to the sea, there are impacts on the marine environment, already under threat by acidification. Pre-treatment can include chlorination, clarification, coagulation, acidification, and degasification. Pre-treatment is applied to feedwater to minimize algae growth, scaling, and corrosion of the plant generally.

Typical pre-treatment chemicals used in desalination plants are: NaOCI or free chlorine which prevents biological regrowth, FeCI3 or AlCI3 – flocculation and removal of suspended matter from water. H2SO4 or HCI, responsible for ph adjustment, and NaHSO3 which neutralizes chlorine and also remains in the feedwater. Various scale inhibitors are used to prevent scale formation on the pipes and membranes. The type of chemicals used for cleaning for fouling depends on the type of membrane and for RO systems include:

Enzymes to break down bacterial slimes;
- Detergents and surfactants to resuspend particulate material and dissolve organic material;
- Biocides to kill bacteria;
- Chelators to remove scale;

• Acids to dissolve in-organics.
• Caustics to dissolve organic substances and silica.

The major pollutant of distillation processes is chlorine, which is added to prevent bio-fouling on heat exchanger surfaces. Chlorine, which is classified as a pollutant in the US, and copper, which becomes toxic whenever excess amounts of it become biologically available, are the two major pollutants in reverse osmosis processes.

Chlorine is a common biocide. Most modern plants operate on polyamide membranes, which are sensitive to oxidizing chemicals such as chlorine. Treatment is usually required before the feedwater enters the RO unit. *"Chlorine is a strong oxidant and highly effective biocide and residual levels in the discharge may be toxic to marine life close to the discharge site. Following discharge, self-degradation and dilution lowers the environmental chlorine levels to lower concentrations but even such low concentrations are adverse to aquatic life (California coastal commission, 2003). Chlorine reacts with organic compounds in seawater forming a large number of chlorinated and halogenated organic by-products. Studies show that many of these compounds are carcinogenic or otherwise harmful to aquatic life (California coastal commission, 2003)."*

The Pre and post treatment is needed to treat excess carbon dioxide and oxygenate to compensate the lack of oxygen in the discharge concentrate. The degasification of CO2 is also an issue as CO2 contributes to global warming. The foul smell is at times noted in product water and this is due to **hydrogen sulphide** that is removed through aeration. Oxygen is added to treat hypoxic conditions.

http://www98.griffith.edu.au/dspace/bitstream/handle/10072/18023/47826_1.pdf?sequence=1

NO LARGE-SCALE STUDIES OR MODELLING DONE ON 1 IN 100 YEAR FLOODING

In my submission, I stated that the LCPA understand that the holding ponds waste-water is being allowed to settle the drilling muds and then the water will be used for irrigation on agricultural land in the area. I touched briefly on how the water from the holding ponds had been moved to Katnook, but did not go into any detail.

In July 2016, the Mount Gambier area, as Troy Bell mentioned, has 90 mm of rain in 2 days. Imagine what could have happened if this had occurred when this pond still had water in it, or there were 100s of gas wells around the South East, all with holding ponds, which, if this rainfall event was repeated, would be at risk of overflowing, thus contaminating the soil and seeping through into the aquifer**. What has been taken into account as far as heavy vehicle compaction and paddock damage? As far as I am aware, there has been no large-scale studies or modelling done on 1 in 100 year flooding, throughout the whole South East.**

What are the State requirements for bunding in a 100 year flood? I did not notice any bunding around the waste-water pond when it was in use. There should have been adequate bunding in place, with width, height and material to accommodate any overland flow from heavy rain events. Beach Energy Ltd. couldn't get this correct, hence the waste-water had to be moved under an emergency license.

According to a letter written from Beach Energy on 22nd August 2014, to John Best at the Wattle Range Council, regarding the Katnook gas facility, acquired by Beach Energy Ltd, raw gas, free condensate and produced water are separated at the front end of the plant in a High Pressure Separator, produced water from the plant inlet High Pressure Separator is then directed to the liquids handling tank to enable hydrocarbon gas and liquids to be separated from the water under

atmospheric condition. The water from the liquids handling tank then gravity flows to the Evaporation Pond 1 via the Katnook interceptor tank as a final hydrocarbon reduction measure. Water from Evaporation Pond 1 is transferred to Evaporation Pond 2 as required. During times of the year when water production and gas processing and rainfall exceed the evaporation capacity, excess water is disposed of to an EPA licensed facility on a batching disposal basis. Given the contamination of produced water, the question was asked how this water was to be disposed of, including the concentrated high saline brine, heavy metals, etc. The letter went on to say that due to the time of the year, the drill sump contents associated with some of these wells has not yet evaporated and given current and predicted rainfall rates, it was considered a risk to keep the drilling sump waste water in situ. To avoid over topping, Beach Energy Ltd (under the name of Adelaide Energy acquired EPA emergency authorization 45682 to enable Katnook to receive and temporarily store up to 1 ML of drilling sump waste water from the Bungaloo 1 and Jolly 1 exploratory drilling well sumps. Beach Energy Ltd now seek to amend the EPA licence 23644 associated with the existing gas production facility at Katnook to include the receipt of fluids from their other licenced operations in the area.

WASTE WATER FROM HOLDING PONDS REMOVED TO KATNOOK

In September 2014 Beach Energy Limited had moved the toxic and highly salty water from the very full holding ponds to the Katnook gas storage facility pond. How can there be any confidence in the regulatory system and "world's best practice", when estimating the correct size of a holding pond cannot be determined properly? The ridiculous part is that then the water, according to the information above may have to be sent of to an EPA facility. The more contaminated water is handled, the more likely it is to be spilt.

The weight of the pond water is an issue. This can lead to subsidence. Being in a very faulted area, puts the holding pond even at far greater risk. We have already seen inadequate liner specification and leakage from perforated pond liners at the Panax Geothermal waste-water ponds. What stones were in the foundation of the Jolly 1 and Bungaloo 1 drill hole platforms?

http://www.naracoortelucindale.sa.gov.au/webdata/resources/minutesAgendas/September%202014%20Attachments%20Items%2011%20to%2014.pdf

BEACH ENERGY LTD. BACKS DOWN

In June 2016,The Limestone Coast Protection Alliance, represented by lawyer Ruth Beach, were prepared to take to court, a bid to prevent further movement of any waste water to Katnook by Beach Energy Ltd. Beach Energy Ltd. agreed to the LCPA request before going into the court room, thus, a court case was avoided.

WATER SPREAD ON AGRICULTURAL LAND, AND MANY TESTS FOR POSSIBLE CONTAMINENTS NOT DONE FOR BEACH ENERGY BY ASL LABORATORY

The holding ponds waste-water has been irrigated on agricultural land in the area. This is absurd, given the holding ponds analysis, as explained earlier, showed high salinity and other contaminants. Farmers in the South East were been lead to believe that the waste water from the Jolly 1 well was meant to be an acceptable procedure. "Irrigation" is to supply the land with water. Whether it is a once off, or done more than that, the fact is, waste-water has been spread or "irrigated" over 3 properties in the SE as a means of disposal. This procedure was, in my opinion, not properly addressed in the operator's Environmental Impact Report that was approved by the regulator. The excuse of 'fertiliser', when facts are clearly assessed, is, in my opinion, unacceptable. From my extensive research, it is clear to see that the waste-water should not have been spread on the 3 areas

in the South East for disposal. What social license to 'aid and abett' the spread of surficial salinity (air current aerosols) up and down an agriculturally fragile catchment, did the landowners have?

SODIUM ADSORBTION RATIO

The sodium adsorbtion ratio in the waste-water analysis is 238, which is very high and would literally hammer the soil. At the bottom of the email is a comparison from the Western Australian Government site (appendix 1). The most tolerant plants for agriculture are at 102 maximum level. Clover (pasture) is between 18 and 46. Please read below the toxicity and salinity effect. This is not what we want in the SE on prime agricultural land or anywhere in Australia. Our clean and green image should not be put at risk for export markets for wine, beef, cattle and any other agricultural produce.

ACCEPTABLE AND NON ACCEPTABLE LEVELS FOR µS/cm (micro Siemens per cm) (salinity measurement)

Jolly One analysis for waste-water was 31,700 µS/cm and 20,600 TDS. (appendix 1) Yet here, we can do a comparison with Dr. Ian Wilson's statement - (when he was with the Department of Environment and Resource Management in Queensland). He is well qualified to make correct comments.

https://www.linkedin.com/in/ian-wilson-1154647a

Prior to the role of Director of the EPA in Queensland., he was Principal Geologist with the Department of Mines in Queensland. Wilson states that The beneficial use Guideline would not allow water containing more than about 1000 mg/L to be used for irrigation ("irrigation water shall not exceed 1,500 µS/cm'') And yet, the reading for the waste water is 31,700 µS cm. This is 20 x the recommended limit for irrigation. On the Victorian government site (appendix 1): 3000 µS/cm is considered not suitable for human consumption. Some stock can use up to 10,000 µS/cm. Again the pond water was 3 x this. Over 10,000 µS/cm is not suitable for irrigation at all.

BORON LEVELS

Boron level from the waste-water of Jolly 1 is .33 mg/L. In the NATIONAL WATER QUALITY MANAGEMENT STRATEGY PAPER No. 4 Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3 Primary Industries — Rationale and Background Information (Irrigation and general water uses, stock drinking water, aquaculture and human consumers of aquatic foods) (Chapter 9), the long term trigger value in irrigation water is .5mg/L. The cumulative contaminant loading in soil receiving irrigation water has not yet been determined, which is of concern. It is toxic to all plants when present in excess. High boron concentrations in soils have been shown to cause plant toxicity in Northern Victoria.

OTHER CONTAMINANTS IN THE JOLLY 1 ANALYSIS

The waste-water analysis showed that it was half to three quarters as salty as seawater with high levels of potassium and virtually no calcium and magnesium. There were elevated levels of metals above the recommended drinking water, and Polynuclear Aromatic Hydrocarbons - phenol, phenanthrene, fluroanthrene, pyrene and chrysene. These Polynuclear Aromatic Hydrocarbons are highly toxic substances that should never be applied to any soil. Many of these substances and all of the metals are persistent pollutants and some are known to cause cancer as well as other human health effects. The amount of Barium is 20 times the recommended amount. Page 2 of the analysis report of the Jolly 1 waste-water pond sample states that there was a poor matrix spike

recovery due to the presence of high contaminants. Please see the link from the South Australian Government site on the dangers of Polynuclear Aromatic Hydrocarbons.

http://www.health.sa.gov.au/pehs/PDF-files/ph-factsheet-PAHs-health.pdf

There was also heavy metals contamination in the Jolly 1 waste-water analysis. The levels are compared the Australian Drinking Water Recommended Guidelines. Of most concern are the following:

Arsenic should be .007	Jolly 1 (1) .024	(2) .064
Barium (20x over) should be .7	Jolly 1 (1) 14.5	(2) 9.65
Chromium should be .05	Jolly 1 (1) .614	(2) .07

Also the following are over the recommended level, but it depends on what the soil levels are, as to any impacts if they that may occur.

Manganese should be .5	Jolly 1 (1) .995	(2) 2.82
Nickel should be .02	Jolly 1 (1) .046	(2) .07

TESTINGS OMITTED IN THE JOLLY 1 HOLDING POND ANALYSIS

The following items, as far as I am aware, were not listed on the analysis done for Beach Energy Ltd. The biggest problem the Petroleum industry has admitted it faces with corrosion – hydrogen sulfide and anaerobic bacteria. There is nothing to indicate on the Beach Energy analysis report to show the following items had been tested. Hydrocarbon utilizing bacteria, sulfate reducing bacteria, iron reducing bacteria, acid producing bacteria, de-nitrafying bacteria, a total anaerobic count, aluminium, antimony, bromine, fluorine, iron, tin, sulfur, sulfate, phosphorus, halogenated aliphatics, acetone, formaldehyde, the specific chemicals used in drilling the drill holes, hydrogen sulfide scavangers and defoamers. Please see a detailed list on the next page.

Solid wastes, cuttings, sludges, efforescences, mineral and chemical dusts and powders (especially those that can be blown around by the wind), reaction products including flocs, polymers and precipitates all should be taken into account and tested. Gas and volatile wastes, fuel and chemical vapours, machinery particulate (from diesel that was easily detected by nose from the highway), noise levels, micro-seismic activity, cleaning, de-scaling, degreasing and other maintenance chemicals should be tested for. If any of these things were monitored or tested, then the results should be made public. There was certainly no monitoring over the neighbour's fence, when I inspected the rig and waste-water pond at close range, and there was an absence of 'foghorn' noise measuring devices.

Solid, liquid and gaseous phases of matter, as I understand, co-exist and interact. Slurry or sludge comprises water, suspended solid particulates, organic matter and dissolved gases also may be present. The atmosphere may entrain (pull or draw along after itself), dusts and condensates. As I understand, a 'holistic' environmental survey of any one environmental compartment will involve assaying solid, liquid and gaseous species. **In the very least, there should have been the necessity of a 'frame of reference' via duplicated, repeated, testing of uncontaminated, off-site groundwater bore waters.**

Other possible contaminants that I was unable to find in the ASL waste-water analysis are as follows. (THIS LIST IS NOT EXHAUSTIVE)

THE INCLUSIVITY OF THIS LIST OF CHEMICALS IS IN PART DUE TO:

a. coal chemistry (coal in SE http://www.ga.gov.au/data-pubs/data-and-publications-search/publications/australian-minerals-resource-assessment/coal)
b. natural organic and inorganic hydrogeochemistry and microbiology at depth
c. natural organic and inorganic hydrogeochemistry and microbiology on or near the Earth's surface (the oxygen interface)
d. the variety of chemical species introduced to aid gas extraction (esp. in drilling and fracking), and the variety of reaction and synthesised products resulting from same.
e. the various proposed usages of the co-produced fluids (eg. surface-spreading; release into waterways; water treatment; irrigation; domestic; ...).
f. the organic and microbiological chemistry resultant of water treatment (eg. the introduced chemicals, heat and pressures of RO process chains)]

SURFACE SOLIDS AND LIQUIDS (SOME ARE AIR AS WELL)

Given threshold changes in temperature, pressure, chemical conditions and chemical concentrations, there is often a continuum in nature between solid, liquid and gaseous states of matter. E.g. formerly hydrostatically retained hydrocarbons and noble gases diffusing into the atmosphere; precipitants; condensates; VOCs; etc.]
Halogenated (esp. chlorinated) C2, C12 alkanes and alkenes
Monocyclic aromatic compounds.
Halogenated (esp. chlorinated) monocyclic aromatic compounds
Heterocyclic aromatic compounds
Alcohols
Diols
Aldehydes
Aldenhydes
Carboxylic Acids
Esters
Ethers
Ketones and cyclic kentones
Organo-sulphur compounds
Organo-nitrogen compounds (e.g. CS2, simple thiols)
Organo-metal compounds
Terpenes
Regulated solid chemical waste suite

MICROBIAL OUTBREAK, HUMAN AND ANIMAL HEALTH, BOTANICAL IMPACT

Corrosion inhibitors
Friction Reducers
Microbial
Biocides – these were used on drilling muds to stop the rotten egg smell for Jolly 1. Bacteriacides
Dusts and respirable suspended particles - WHAT DUST MONITORING WAS PUT IN PLACE FOR THE NEIGHBOUR'S PADDOCK OVER THE FENCE? I DID NOT SEE ANY SIGN OF ANY MONITORING DEVICE WHEN I DID AN INSPECTION.

GENERAL

Total Cyanide

Total Dissolved Solids
Total Suspended Solids
(Prefiltered total metal)
(Unfiltered total metal)
Total Cations
Total Anions
Ionic Balance

CARBON

Total Carbon
Total Inorganic Carbon
Total Organic Carbon
Dissolved Organic Carbon
Dissolved CO2
Free CO2
Total CO2
Hydrocarbon fractions
Volatile acids as acetic acid

OXYGEN

Dissolved Oxygen
Biological Oxygen Demand
Chemical Oxygen Demand
Ozone

INORGANIC CHEMISTRY

Ferrous
Ferric
Arsenic III and arsenic V
Ammonium
Hydroxyammonium
Nitrate
Nitrite
Cyanate
Thiocyanate
Sulphide
Sulphite
Bisulphate
Thiosulphate
Persulphate
Borate
Flouride
Iodide
Bromide
Bromate
Reactive phosphorus (ortho-phosphorus)
Aluminium
Antimony

Bismuth
Gallium
Indium
Iron
Lithium
Molybdenum
Nickel
Rubidium
Silver
Sulphur
Tellurium
Tin
Titanium
Caesium
Carbon (Carbon -12, Carbon – 13)
Hydrogen (Protium, Deuterium)
Helium
Ozone
Bromine
Phosphorus
Carbon Monoxide
Carbon dioxide
Nitrous Oxide
Nitrogen monoxide
Nitrogen dioxide
Hydrazine (diazane)
Hydrogen sulphide
Disulphur monoxide
Sulphur monoxide
Sulphur Dioxide
Hydrogen halides

ALKANES

Methane
Ethane
Propane
2-Methylpropane
Butane
2-Methylbutane
2,2-Dimethylbutane
2,3-Dimethylbutane
Pentane
2-Methylpentane
3-Methylpentane
2,3-Dimethylpentane
2,4-Dimethylpentane
2,2,4-Trimethylpentane
2,3,4-Trimethylpentane
Hexane
2-Methylhexane

3-Methylhexane
2,3-Dimethylhexane
Heptane
2-Methylheptane
3-Methylheptane
2,2,4,6,6-pentamethylheptane
Octane
2-Methyloctane
Nonane
Decane
Undecane
Dodecane

CYCLOALKANES

Cyclopentane
Cyclohexane
Methylcyclopentane
Methylcyclohexane

HALOGENATED ALKANES

Chloromethane
Dichloromethane
Chloroform
Chlorodifluoromethane
Dichlorofluoromethane
Dichlorodifluoromethane
Trichlorofluoromethane
Carbon tetrachloride
Bromomethane
Bromochloromethane
Bromodichloromethane
Dibromomethane
Dibromochloromethane
Bromoform
Chloroethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
1,2-Dichloro-1,1,2,2-tetrafluoroethane
1,1,2-Trichloro-1,2,2-trifluoroethane
1,2-Dibromoethane
1,2-Dichloropropane

ALKENES

Ethylene

Propene
1-Butene
cis-2-Butene
trans-2-Butene
Isobutylene
1-Pentene
trans-2-Pentene
cis-2-Pentene
1-Hexene
2,4-Dimethyl-1-hexene
2,3,3- Trimethyl- 1 – Pentene (Trimethyl pentene)

HALOGENATED ALKENES

Vinyl chloride
Vinyl bromide
1,1-Dichloroethylene
trans-1,2-Dichloroethylene
cis-1,2-Dichloroethylene
Trichloroethylene
Tetrachloroethylene
1,1-Dichloropropene
trans-1,3-Dichloropropene
cis-1,3-Dichloropropene
3-Chloropropene

ALKYNES

Acetylene

ALLENES, DIENES AND CUMULENES

1,3- Butadiene
3- Chloropropene
2- Chloroprene
Hexachlorobutadiene
2,4 Hexadiene
2-Methyl- 1,3 – pentadiene
1,3-Butadiene
2-Chloroprene
Hexachlorobutadiene
2-Methyl-1,3-butadiene

MONOCYCLIC AROMATIC COMPOUNDS

Styrene
Cumene
Propylbenzene
2-Ethyltoluene
3-Ethyltoluene
4-Ethyltoluene

1,2,3-Trimethylbenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
Cymene
Butylbenzene
sec-Butylbenzene
tert-Butylbenzene
1,3-Diethylbenzene
1,4-Diethylbenzene
Chlorobenzene
Benzyl chloride
2-Chlorotoluene
4-Chlorotoluene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
Bromobenzene

HETEROCYCLIC AROMATIC COMPOUNDS

2-Ethylfuran
Tetrahydrofuran
Benzothiazole
Phenylmaleic anhydride
Dioxins
2,3,7,8 - Tetrachlorodibenzo-p-dioxin
2,3,7,8 – Tetrachlorodibenzofuran
3,3', 4, 4', 5,5' – Hexachlorobiphenyl
1,4 – Dioxane

HALOGENATED AROMATIC COMPOUNDS

Chlorobenzene
Bromobenzene
1,2 – Dichlorobenzene
1,3 - - Dichlorobenzene
1,4 – Dichlorbenzene
1,2,3 – Trichlorbenzene
1-3-5 – Trichlorbenzene
1,2,3,4 – Tetrachlorbenzene
1,2,3,5 - Tetrachlorbenzene
1,2,4,5 - Tetrachlorbenzene
Pentachlorobenzene
Hexachlorobenzene
2 – Chlorotoluene
4 – Chlorotoluene
Benzyl chloride

PHENOLIC AND HALOGENATED PHENOLIC COMPOUNDS

2 – Methyl – 4.6 dinitrophenol
4 – tert- octylphenol
Dinoseb
2 – Cyclohexyl – 4 .6 Dinitrophenol

ALCOHOLS

Methanol
Ethanol
2 – Butoxyethanol (Ethylene glycol monobutyl ether)
Isopropanol
n-Propanol
Isobutanol
n-Butanol
tert-Butyl alcohol (TBA)
Hexanol (2-ethyl-1-hexanol
Methanol
Ethanol
Isopropyl alcohol
Isobutanol
tert-Butyl alcohol
1-Methoxy-2-propanol
Hexanol
2-Butoxyethanol

DIOLS

Methanediol
Ethane – 1,2 – diol (Ethylene glycol)
Propane – 1,2 – diolButane – 1, 4 – diol
Butane – 1, 4 diol
Bisphenol A (BPA)

ALDEHYDES

Formaldehyde (Methanal)
Acetaldehyde
Acrolein (Propenal)
Propionaldehyde
Crotonaldehyde
Butyraldehyde
Isovaleraldehyde
Hexaldehyde
Formaldehyde
Acetaldehyde
Acrolein
Propionaldehyde
Crotonaldehyde
Methacrolein
Butyraldehyde

Benzaldehyde
Isovaleraldehyde
Valeraldehyde
3-Methylbenzaldehyde
4-Methylbenzaldehyde
Hexaldehyde

CARBOXYLIC ACIDS

Formic acid
Acetic Acid
Monochloroacetic acid (MCA)
Dechloracetic acid (DCA)
Trichloracetic acid (TCA)
Monobromoacetic acid (MBA)
Dibromoacetic acid (DBA)
Trifluoroacetic acid
Oxalic acid
Pentanoic acid (Valeric acid)
Benzoic acid
Acrylic acid (prop-2enoic acid)Phthalic anhydride
Polyacrylic acid
Fumaric acid (trans-Butenedioic acid)

ACETATES

Ethyl acetate
Vinyl acetate
Butyl acetate
1-Methoxy-2-propyl acetate

ACYL CHLORIDES

Acetyl chloride
Carbonyl dichloride

ESTERS

Ethyl acetate
Vinyl acetate
Methyl methacrylate
Bis(2-ethylhexyl) phthalate
Polyacrylates

ETHERS

Ethylene oxide
Propylene oxide
Diethyl ether
1,4 – Dioxane

Methyl tert-butyl ether (MTBE)
Ethyl tert-butyl ether (ETBE)
Ethylene Glycol mono-Butyl Ether
Tert-Amyl methyl ether (TAME)
Tert-Amyl ethyl ether (TAEE)
Diisopropyl ether (DIPE)
2 – Chloroethyl Vinyl Ether
Oxirane
Propylene oxide
1,4-Dioxane
Methyl tert-butyl ether
Ethyl tert-butyl ether
tert-Amyl methyl ether
Di-isopropyl ether
2-Chloroethyl vinyl ether

KETONES AND CYCLIC KETONES

Acetone
Methyl ethyl ketone (2-Butanone) (MEK)
Methyl butyl ketone (2-Hexanone) (MBK)
Methyl isobutyl ketone (MIBK)
Acetophenone
Cyclopentanone
Cyclohexanone

ORGANO-SULPHUR COMPOUNDS

Carbonyl sulphide (OCS)
Carbon disulphide
Dimethyl sulphide (DMS)
Dimethyl disulphide (DMDS)
Polysulphides
Methanethiol (MeSH)
Ethanethiol
Methylthiobutane
Dimethyl sulphoxide (DMSO)
Dimethyl Sulphate
Thiophene (thiofuran)
2 – Methylthiophene
3 – Methylthiophene
Methyl methanesulphonate (MMS)
Ethyl methanesulponate (EMS)
Perfluorooctane sulphonate (PFOS)
Perfluorooctanoic acid (PFOA)
Thiourea
Carbonyl sulphide
Carbon disulphide
Dimethyl sulphide
Dimethyl sulphoxide
Methanethiol

Ethanethiol
1-Propanethiol
2-Propanethiol
Ethyl methyl sulphide
1-Butanethiol
Diethyl sulphide
Thiophenol

ORGANO-NITROGEN COMPOUNDS

Acetonitrile
Acrilonitrile
Acrylamide
Formamide (Methanamide)
Dimethyl formamide
Acrilonitrile
Diethanolamine (Bis(hydroxythyl)amine)
Nitrilotriacetic acid
N-Methyl-2-pyrrolidone
Nitroaromatics

MICROBES

Heterotroph counts
Blue-Green Algae
Hydrocarbon Utilising Bacteria (HUB)
Naphthalene Utilising Bacteria (NUB)
Methanogens
Methanotrophs
Sulphate-Reducing Bacteria (SRB)
Sulphur-Oxidising Bacteria (SOB)
Iron-Reducing Bacteria (IRB)
Iron-Oxidising Bacteria (IOB)
Acetate Utilising Bacteria
Methanol Utilising Bacteria
Formate Utilising Bacteria

BIOCIDES AND BACTERIACIDES

This next group are Biocides and Bacteriacides and would be dependent on what was used to overcome the rotten egg smell, so what ever was used out of these should have been tested to see if still present in the waste water.

Glutaraldehyde
Sodium hypochlorite
Phosphonium sulphae
Tetrakis hydoxymethyl phosphonium sulfate (THPS)
2 – Bromo – 2 – nitro – 1, 3 – propanediol (Bronopol)
2,2 – Dibromo – 3 – nitrilopropionamide (DBNPA)
5 – chloro – 2 – methyl – 2h- isothiazolol – 3 – one
2 – ethyl – 2h – isothiazol – 3 - one

HAS BEACH ENERGY LTD. MISLEAD THE EPA, AND ARE THEY CULPABLE FOR LACK OF DUE CARE?

I believe that Beach Energy Ltd. should be held accountable for misleading the EPA, with what appears to be lack of proper testing, and are also culpable for not behaving in a responsible manner by having a much wider range of contaminants tested for, that are found to occur in other gas well areas. I believe this equates to nothing short of lack of due care, and is a serious matter. I believe Beach Energy Ltd. have already demonstrated that they simply cannot be trusted. This is a very strong reason why petroleum activities should not be allowed in the South East of South Australia.

I attended the 'water pitching' presentations for the Round Table for Oil and Gas projects. **One of the companies, as I recall, said that once the waste-water has evaporated, and the solid waste is left behind, it is then used for landfill.** As I am aware that the solid waste is toxic, I am very concerned with leaching contamination as rain passes through the toxic waste down into the soil and may proceed into the potable aquifer.

The industry doesn't intend to allow the chemicals all to be publically named. This question was asked at one of the Round Tables for Unconventional Gas Projects, and we were told that any chemicals listed as 'proprietry' did not have the ingredients listed because of patents. And yet farming neighbours are meant to accept this nonsense, when drilling goes on beside them. Not only is this lack of freedom of democracy – it is downright dangerous and needs to be addressed by both Federal and State laws. **Aquifers, air and soil do not have buffer fences that stop contamination that may occur, from going onto neighbouring properties, and general communities for that matter.**

QUESTIONS THAT NEED TO BE ADDRESSED

Why was spreading of the waste-water on the land allowed to be done in the first place?

Why wasn't the community informed, before spreading of waste-water took place?

If more exploration is allowed, (let alone hydraulic fracture stimulation), what studies have been done to show accumulative effects from pond waste-water over prime agricultural land?

What modelling has been done in the South East, in regard to the amount of salt that may be mobilized, as the result of hydraulic fracture stimulation activities?

In 2012, the Queensland Government commissioned the Healthy Headwaters Study https://www.dnrm.qld.gov.au/water/catchments-planning/healthy-headwaters/coal-seam-gas-water-feasibility-study in relation to coal seam gas, and the report stated that scientists were unable to predict the amount of salt mobilisation. This is clearly a warning for catastrophic effects that may follow down the track.

ACCEPTABLE AND UNACCEPTABLE LEVELS OF SODIUM FOR QUEENSLAND, WESTERN AUSTRALIA AND NEW SOUTH WALES GOVERNMENTS WHICH ARE WAY BELOW THE BEACH ENERGY LTD ANALYSIS OF 31,700 µS/cm AND SODIUM ADSORBTION RATION OF 238

QUEENSLAND GOVT. SITE

Dr. Ian Wilson (DERM) outlines his concerns about Santos' proposed disposal of CSG water in his email of 13 March 2010. [1] *"The amendment process actually increases the salt load appreciably and poses significant risk ...they intend to add gypsum .... and that will add another 20% or so of solids ...The beneficial use Guideline would not allow water containing more than about 1000 mg/L to be used for*

*irrigation (irrigation water shall not exceed 1,500 µS/cm'') I think there is a significant risk to soil structure and future movement of stored salts if we allow irrigation using saltier water "because the company has found a plant that it does not kill." That is not a useful criterion. There are tales of disastrous decreases in water infiltration rates after a single year of irrigation with untreated water at one farm near Chinchilla. We have made it very clear that we do not want water with >2000 mg/L TDS used for dust suppression for similar reasons"(*Dr Ian Wilson, DERM 13 March 2010)

WESTERN AUSTRALIAN GOVT. SITE (SAR)

https://www.agric.wa.gov.au/fruit/water-salinity-and-plant-irrigation The direct toxic effects of sodium concentrations in irrigation water on different plants are shown in Table 1, which lists the effect of the sodium adsorption ratio (SAR) of the irrigation water. The SAR measures the relative percentage of sodium ions in water to calcium and magnesium ions. A high SAR indicates there is potential for sodium to accumulate in the soil. This can degrade soil structure by breaking down clay aggregates, which results in waterlogging and poor plant growth.

Table 1 Tolerance of crops to sodium Tolerance Sodium adsorption ratio of irrigation water.
Crops Very sensitive 2-8 Avocado, citrus, deciduous fruits and nuts
Sensitive 8-18 Beans Moderately tolerant 18-46 Clover, oats, tall fescue, rice
Tolerant 46-102 Barley, beets, lucerne, tomatoes, wheat

Salinity effect Plant roots generally take up moisture through membranes in root cells by osmosis. This is a natural process where water, passing through a semi-permeable membrane, moves from a solution of low levels of dissolved salts to one with higher salts. This continues until the plant cells become full. If the irrigation water is moderately saline, the plant has to work harder to absorb water from the soil and growth is slowed, with reduced yields. If highly saline irrigation water is used, the process of osmosis can reverse. Where the solution outside the plant roots is higher in salt concentration than that of the root cells, water will move from the roots into the surrounding solution. The plant loses moisture and suffers stress. This is why symptoms of high salt damage are similar to those of high moisture stress.

Toxicity effect Excessive concentrations of sodium and chloride ions in irrigation water can cause toxicities in plants. These ions can be taken up either by the roots or by direct contact on the leaves. More damage is caused by direct absorption through the leaves.

VICTORIAN GOVT. SITE

http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/salinity/measuring-the-salinity-of-water

Usefulness of water 0 - 800

Good drinking water for humans (provided there is no organic pollution and not too much suspended clay material). Generally good for irrigation, though above 300 µS/cm, some care must be taken, particularly with overhead sprinklers that may cause leaf scorch on some salt sensitive plants.

Suitable for all livestock 800 - 2,500

Can be consumed by humans although most would prefer water in the lower half of this range if available. When used for irrigation, requires special management including suitable soils, good drainage and consideration of salt tolerance of plants.

2,500 - 10,000

Not recommended for human consumption, although water up to **3000 µS/cm** could be drunk if nothing else was available. Not normally suitable for irrigation, though water up to **6000 µS/cm** can be used on very salt tolerant crops with special management techniques. Over **6000 µS/cm**, occasional emergency irrigation may be possible with care, or if sufficient low salinity water is available, this could be mixed with the high salinity water to obtain an acceptable supply.

When used for drinking water by poultry and pigs, the salinity should be limited to about **6000 µS/cm**. Most other stock can use water up to **10,000 µS/cm**. High magnesium levels can cause stock health problems in this range. Analysis recommended.

Over 10,000 µS/cm

Not suitable for human consumption or irrigation. Not suitable for pigs, poultry or any lactating animals. Beef cattle can use water up to 17,000 µS/cm and adult dry sheep can tolerate 23,000 µS/cm. However it is possible that waters below these EC levels could contain unacceptable concentrations of particular ions. Detailed chemical analysis should therefore be considered before using high salinity water for stock.

Water up to 50,000 µS/cm (the salinity of the sea), can be used to flush toilets provided corrosion in the cistern can be controlled.

NEW SOUTH WALES GOVT. SITE

http://www.dpi.nsw.gov.au/agriculture/resources/soils/salinity/crops/saline-irrigation

Salinity has long been recognized as a problem in many parts of Australia, and many irrigators have to consider using marginal quality water. If you do have to use saline water for irrigation you need to understand how salinity affects a crop. You need to monitor salinity levels constantly to ensure they stay within the acceptable range, and you need to be prepared to accept lower-than-average yields.

How does salt affect the plant?

Plant roots generally take up moisture by a type of osmosis through membranes in root cells. Osmosis is a natural process where water, passing through a semi-permeable membrane, moves from a solution of low levels of dissolved salts to one with a higher salt level. This process allows water to move from a solution of relatively low concentration (the irrigation water) into a solution of relatively high concentration (in the plant root cells) in an attempt to establish equilibrium in the two solutions. This continues until the plant cells become full, or turgid.

Moderately saline water

If the irrigation water is moderately saline, the plant has to work harder to absorb water from the soil. If there is lack of water, the plant soon begins to wilt, and growth is slowed, with reduced yields.

Highly saline water

If highly saline irrigation water is used, the process of osmosis can become reversed. Where the solution outside the plant roots is higher in salt concentration than that of the root cells, water will move from the roots into the surrounding solution. The plant loses moisture, and so suffers stress.

This is why symptoms of high salt damage are similar to those from high moisture stress:

• leaf tip dieback
• margins yellowing, scorched and turning brown or black, followed by
• leaf fall of dead leaves.

If water is sprayed directly on leaves, it can cause salt scorch and leaf damage even at lower salinities. Another danger: specific ion toxicity Irrigation water is only moderately saline, but if it contains high concentrations of specific ions, it can still damage the crop.

• High chloride or sodium ion levels (the most common) cause symptoms similar to high salinity.
• High bicarbonate levels can make calcium and magnesium unavailable to the plant.
• Some effluent waters that may be used for irrigation can have high boron levels.

There will be some variation in how salinity affects the plant, depending on crop, variety, rootstock, leaching ability of the soil and also method of irrigation (spray, drip or furrow). Most crops, including salt-sensitive crops, should accept salinity levels of up to 700 µS/cm without loss of yield. (See How salinity is measured). With salinities over 700 µS/cm, we could expect to see reduced yields from some salt-sensitive plants. The water salinity levels acceptable to each crop (that is, the levels that do not affect crop yields), and levels that will cause about 10% loss of yield. Acceptable salinity levels for horticulture Using the table on fruit crops (Table 2), for example, we see that most grapevines should accept salinity levels of up to 1000 µS/cm without loss of yield. Above this figure, yields generally start to decline, and we could expect up to 10% yield loss at 1700 µS/cm. Acceptable salinity levels for pasture Similarly, using the table on forage crops (Table 4), we would expect lucerne, for example, to accept salinity levels of up to 1300 µS/cm without loss of yield. Above this figure, yields generally start to decline, and there might be up to 10% yield loss at 2200 µS/cm. Soils and salinity High salt levels in soils also reduce yield. High levels of sodium from common salt can also, over time, damage soil structure, causing:

• surface crusting
• reduced infiltration
• restricted subsoil drainage and root development in 'blocky' soils.

Soils with high proportions of sodium are known as sodic soils.

The CSG industry ‘treats its water’ for use. Despite this, the treated CSG water flowed into the Condamine River, still releasing 13 contaminants. Treated water for shale gas would not be any different as the same contaminants are usually present.

WASTE WATER IRRIGATION MANAGEMENT PLANS FOR BEACH ENERGY

I have copies of the 2 documents for the Beach Energy waste-water irrigation plans. Someone else had contacted Beach Energy Ltd. for a copy of these plans. As I understand, conditions were imposed that the plans would only be given out provided there was a meeting with Beach Energy Ltd., and that no one would go to the media with what was in the plans. I will include the documents with this addendum. The waste-water, as I understand, was from the shale gas exploration waste water ponds from Jolly 1 and Bungaloo 1. I believe the readings from the pond analysis water provided by ASL should not be considered safe for spreading on agricultural land, much less “beneficial” with high salt readings, as explained in previous pages, as well as contaminants mentioned including poly nuclear aromatic hydrocarbons and possible contaminants, that have not been tested for. I doubt that the

neighbours on bordering properties were informed prior to 'irrigation' of waste-water on the prime agricultural farmland. This is not acceptable to both neighbours and the wider community.

What surprises me with both documents, is the fact that the word 'shale' is not mentioned. As I understand, Beach Energy Ltd. drilled down into the shale. This should have been mentioned in the waste-water plans.

DOCUMENT FOR "GREYMORE" IRRIGATION WASTE-WATER PLANS

On page 3 under: *OBJECTIVE:*

"This Wastewater Irrigation Management Plan is drawn to demonstrate that the sump waters from Jolly 1 can be irrigated safely and beneficially to pastoral paddocks without harm to those pastures or environment or any person or creature. It records and presents the processes, analyses and methodologies of testing and the application of those waters from Jolly 1 Rig Site to ground and the beneficial advantages of that application."

How can Beach Energy Ltd claim that they can demonstrate that the sump waters from Jolly 1 can be irrigated when there are a huge number of contaminants that have not even been tested for in the waste -water?

The first irrigation site is on a property called "Greymore", on Argyle Road, Penola. "*Greymore is owned by Beach Energy and a paddock of 45.6 hectares has been made available to receive part of the sump liquids. The application area has significant numbers of trees and an estimated 30% of this area may not be useable for liquid application. The identified application paddock is primarily used for beef production, is of a sandy soil structure and has well established pasture."*

The question needs to be asked – **Were the neighbours informed** before this waste-water was irrigated on the property? Why would sodium chloride page 6/43 be considered as nutrients when the salt levels are so high? On page 7/43*"Potassium should not be applied to areas where cattle are lactating, conceiving, birthing or holding young stock."*

On page 8/43 ***"It is recommended that a minimum 7 day withholding period be applied to the paddock after application. This will allow adequate infiltration of the liquid into soil to reduce the risk of animal ingestion. Additionally young stock, conception and lactating stock should be kept clear of the application area for 2 weeks."***

Given that a number of contaminants were not tested for, as listed previously, and the fact that there is a 7 day warning against putting young stock, lactating cows or pregnant cattle o the area, is of great concern. What if the length of time is not long enough, or if there are other contaminants present which could impact animals and pasture (and humans) forever?

On page 9/43, it is stated: "*The depth of the water table was measured at two water bores adjacent to the application paddock and returned depths of 2.7 metres and 3.1 metres. The low volume of applied liquid, the well established plant root zone and the relative soil water holding capacity means this depth is far below any potential impact."* This is of major concern for contamination of the aquifers, with little leeway for impacts of contamination. It must also be taken into account that other waste-water ponds may have even higher amounts of contamination, and radionuclides.

On page 10/43 it is stated "*longest drying time for solids remaining in the sump".* What exactly has been planned for the waste solids? What is planned if unconventional gas is allowed to proceed, if

there are dozens of waste-water ponds containing waste solids?

On page 11/43 in the Application Paddock soil test summary, the aluminium should be less than 9 and yet it is 11.

On page 12/43, a Topcon system is mentioned, which is a water spray guidance system. When compared to other cultivation systems, I understand this system is more complicated. If the power fails, the tracking data goes too.

On page 13/43, "*As part of Beach Energy's commitment to ensuring an improvement in the soil quality and productive capacity of the application area, an agronomic program has been designed to further improve the pastoral soil quality in conjunction with the sump water application".* **I believe this statement is misleading, given the salinity levels and the fact that not all contaminants have been tested for.**

Also it is stated: "*The addition of trace elements to pasture is a standard and common agricultural practice for improvement of production. The application paddock is used for hay making which means that the fodder produced in this paddock will be fortified with these trace elements which will assist with livestock health and can also boost livestock growth rates."* **I believe to say that 'waste water' will improve production when applied to the pasture is rubbish, especially when it is not known what other contaminants are contained in the water which were not tested for**. I understand what has happened around the Hopeland, Chinchilla areas in Queensland, is completely the opposite – deaths of cows and calves that are unexplained and did not occur before coal seam gas production, and includes calves being born blind. I don't see things would be any different in the SE.

Further down on page 13, there is more room for concern. There are four types of treatment routines that have been proposed. An area will be set apart where no irrigation of the waste-water has been applied. Then there are sum waters from a tanker that includes trace elements. Then another area where the sump waters are hand applied. The forth area is for trace elements only. I understand from a colleague in the irrigation industry, that hand application is not easily controlled for spraying evenly, and that there are always some drips at the end of a run. It also states "The control areas and trace element only area will be avoided and physically covered during the application to avoid spray drift and accidental application**." If this waste-water isn't toxic, why does the area need to be avoided during application, and what insurance is there that there won't be any spray drift, even to neighbouring properties?**

On page 14/43, I note that samples were being sent to Perth to the CSBP Laboratories trace element analysis. This is to determine the quality of the soil below and the productive value of the pasture above. What about testing for contamination, especially to see if it has leached into the soil below? There is no mention of this in the report that I am aware of.

Page 15/43 Something is not right. What is on this page does not fit in with the ALS results of the pond water on page 25/43. It states that the ALS environmental tests indicate that all detected levels are well below the threshold of concern within the drilling sump. And yet polynuclear aromatic hydrocarbons and other contaminants are present – there should not be any polynuclear aromatic hydrocarbons at any level, being spread on the land.

There is to be a dilution ratio of 1:444 within the top 10 cm of the surface. I understand that diluting contaminated water does not lessen the risks of contamination, impacting animals and human health. There are 12 metals and metalloids listed on page 15 and a number of contaminants listed on page 16. On page 16, it shows that there is no detection for Benzene and Toluene, but on page 26/43

Benzene is listed as <1 and Toluene <2, showing there is some detection. Given that Benzene is recognized as highly cancerous so for safety reasons there should not be any Benzene present. On page 16, Ethylbenzene and Xylene are listed as not detected. On page 26, Ethylbenze and Xylene are listed as <2. In the ALS results on page 25, Phenol is listed as 18.1, 3-4 Methylphenol at 5.3, Phenanthrene 17.5 and Fluoranthene 9.2.

http://www.cancer.org/cancer/cancercauses/othercarcinogens/intheworkplace/benzene

Hydrocarbons C6-C9 petroleum hydrocarbons are listed as not detected on page 16. On page 26 it is listed as 2700. C10 – C36 is listed on page 16 as 5.01 and listed page 26 as <20. I question the reliability of this document.

On page 18/43, spray drift is mentioned. It states that Animal / Human Inhalation creating irritation and odour impacts are possible. The document states that on a high wind day, no application should be done. It also states that all animals and people should be avoided. Buildings and residents are not to have any spray application near them. The wind direction needs to be monitored for potential drift direction. If the waste-water solution was not toxic and considered safe, then there would be no need for these safety concerns to be issued. As far as pasture damage through excessive salt exposure, causing plant productivity damage or plant scalding, controls listed are to only apply to established pasture, no application to stressed paddocks and to identify appropriate fertility deficiency. **Again I re-iterate, that if these warnings are necessary, then allowing waste-water on the agricultural land should not be allowed.**

Another hazard listed is run off to drains or waterways with potential environmental problems including waterway impacts and water quality, affecting aquatic plants and animals. The controls are as follows: There is to be no application to wet ground or if high rainfall events are predicted. Previous application tracks are to be avoided. Given that the Lower South East in areas has experienced flooding rainfall events during July 2016, this sounds concerning warning bells.

On page 19/43, infiltration to groundwater has the potential of groundwater pollution. It states that if high rainfall events are predicted then the wastewater irrigation should not be applied. Each application paddock is to only have one application from all drilling sources. Again, if the salt levels were not high and there were no contamination problems, then this warning would not be required to be issued. Probably one of the most important hazards identified is soil damage through excessive salt exposure, resulting in loss of farm production. In this case, no application is recommended to stressed paddocks and to only irrigate paddocks identified as low or deficient in potassium or sodium salts. It is said that the consequence is minor. I do not believe this is how the farmers would view this.

On page 20/43, there is a Hazard Report Card Risk Matrix. Under natural Environment, critical ecological or cultural impact, and or regulatory intervention, and reputation through community or media, resulting in critical impact on business reputation or international media exposure, it is estimated that the financial loss would be in excess of $20 million. I did not see any testing for hydrogen sulfide or anaerobic bacteria, and yet these substances are of great concern to the industry and do have ecological impacts. In the following pages it shows the LOR which is the practical limit – as I understand this is the limit the reading should be on a substance for it to be under the guidelines of being safe at that reading or below. Where I have written a substance should be no higher, this is indicating the LOR, which I have not repeated all the way through on the readings, but this is what I mean.

On page 24/43, sulfate turbidimetric as S04 2 – by DA is listed as 2360 mgl. Chloride is listed as 6290

mgl. On page 25/43, the LOR for mercury should be no higher than .0001 mg/l. Yet this has tested at .0010. Under Phenolic Compounds, Phenol should be no higher than 1.0. It is 18.1. Please note there are readings for 2 samples for Jolly 1. I have opted just to list the highest reading. 3- & 4 – methphenol should be no higher than 2. It tested at 5.3. Under Polynuclear Aromatic Hydrocarbons, Phenanthrene should be no higher than 1. It is 17.5. Fluoranthrene should be no highter than 1. It is 9.2. On page 26/43, Pyrene should be no highter than 1. It tested at 12.4. Banz(a)anthracene should be no higher than 1. It tested at 2.9. Chrysene should be no highter than 1. It tested at 4.9. The sum of Polycyclic Aromatic Hydrocarbons should not be above .5, and yet it tested at 53.6. Benzo(a)pyrene TEQ should not be higher than 0.5 and tested at 1.2. Under Total Petroleum Hydrocarbons, C10 - C14 Fraction should not be higher than 50 and tested at 2230. C15 - C28 Fraction should not be higher than 100 and tested at 2520. C29 - C36 Fraction should not be higher than 50 and tested at 350. C10 - C36 Fraction (sum) should not be higher than 50 and it tested at 5010. C10 - C16 Fraction should not be higher than 100 and it tested at 2700. C16 - C34 Fraction should not be higher than 100 and tested at 2200. >C34 - C40 Fraction should not be higher than 100 and tested at 160. C10 - C40 Fraction (sum) should not be higher than 100 and tested at 5010. C10 - C16 Fraction minus Naphthalene should not be higher than 100 and tested at 2700.

On page 27/43, under Phenolic Compound Surrogates, Phenol-d6 should not be higher than .1. It tested at 39.7. 2-Chlorophenol-D4 should not be higher than .1. It tested at 72.4. 2.4.6-Tribromophenol should not be higher than .1. It tested at 105. Under PAR Surrogates, 2-Fluorobiphenyl should not be higher than .1.It tested at 68.8. Anthracene-d10 should not be higher than .1 and tested at 75.0. 4-Terphenyl-d14 should not be higher than .1 and tested at 82.6. Under TPH (V) BTEX, 1.2-Dichloroethane-D4 should not be higher than 1 and tested at 107. Toluene-D8 should not be higher than .1 and tested at 82.8. 4-Bromofluorobenzene should not be higher than .1 and tested at 76.8.

Phenol-d6 is listed with a CAS number 13127-88-3.
2 - Chlorophenol-D4 has a CAS number 93951-73-6.
2.4.6-Tribromophenol has a CAS number 118-79-6.
2-Fluorobiphenyl has a CAS number 321-60-8.
Anthracene-d10 has a CAS number 1719-06-8.
4-Terphenyl-d14 has a CAS number 1718-51-0.
1.2-Dichloroethane-D4 has a CAS number17060-07-0
Toluene-D8 has a CAS number 2037-26-5
4-Bromofluorobenzene has a CAS number 460-00-4

In the chemical handbook http://www.chemicalbook.com/RiskAndSafety.htm#Risk the risks for the 9 listed substances above are the following. (following page)

Indication of Particular Risks

R1: Explosive when dry
2: Risk of explosion by shock, friction, fire or other sources of ignition
3: Extreme risk of explosion by shock, friction, fire or other sources of ignition
4: Forms very sensitive explosive metallic compounds
5: Heating may cause an explosion
6: Explosive with or without contact with air
7: May cause fire
8: Contact with combustible material may cause fire
9: Explosive when mixed with combustible material
10: Flammable
11: Highly Flammable
12: Extremely Flammable
14: Reacts violently with water
15: Contact with water liberates extremely flammable gases
16: Explosive when mixed with oxidizing substances
17: Spontaneously flammable in air
18: In use may form flammable/explosive vapor-air mixture
19: May form explosive peroxides
20: Harmful by inhalation
21: Harmful in contact with skin
22: Harmful if swallowed
23: Toxic by inhalation
24: Toxic in contact with skin
25: Toxic if swallowed
26: Very Toxic by inhalation
27: Very Toxic in contact with skin
28: Very Toxic if swallowed
29: Contact with water liberates toxic gas
30: Can become highly flammable in use
31: Contact with acids liberates toxic gas
32: Contact with acids liberates very toxic gas
33: Danger of cumulative effects
34: Causes burns
35: Causes severe burns
36: Irritating to the eyes
37: Irritating to the respiratory system
38: Irritating to the skin
39: Danger of very serious irreversible effects
40: Limited evidence of a carcinogenic effect
41: Risk of serious damage to eyes
42: May cause sensitization by inhalation
43: May cause sensitization by skin contact
44: Risk of explosion if heated under confinement
45: May cause cancer
46: May cause heritable genetic damage
48: Danger of serious damage to health by prolonged exposure
49: May cause cancer by inhalation
50: Very Toxic to aquatic organisms
51: Toxic to aquatic organisms
52: Harmful to aquatic organisms
53: May cause long-term adverse effects in the aquatic environment
54: Toxic to flora
55: Toxic to fauna
56: Toxic to soil organisms
57: Toxic to bees
58: May cause long-term adverse effects in the environment
59: Dangerous for the ozone layer
60: May impair fertility
61: May cause harm to the unborn child
62: Possible risk of impaired fertility
63: Possible risk of harm to the unborn child
64: May cause harm to breast-fed babies
65: Harmful: May cause lung damage if swallowed
66: Repeated exposure may cause skin dryness or cracking
67: Vapors may cause drowsiness and dizziness
68: Possible risk of irreversible effects

On Page 29/43, the following statement concerned me. *"EPA further advised that because of the difficulty of determining gross alpha and gross beta activities in high TDS waters, determination of the three specific radionuclides (Ra-226, Ra-228 and U-238) would be sufficient."* What else is missing here?

Why are Sawpit 1 and 2 mentioned with samples tested in this report? I understand that the wastewater samples are meant to be from Jolly 1 and Bungaloo 1 drill holes. In my opinion, this looks like "fudging."

WASTE-WATER PLANS FOR IRRIGATION SITE 3 "COOMOOROO"

"Coomooroo" is owned by CG & DC Dean, Millers Lane, Penola.

On page 3/32, one of the purposes of the plan is to demonstrate the 'minimal' risk to the environment, soil and public. I would like to know what the definition of 'minimal' is.

"Coomooroo is owned by George and Denise Dean and two paddocks of 16.6 and 12.9 hectares have been made available to receive part of the sump liquids. The identified application paddock is primarily used for beef and sheep production, is largely composed of sandy soil but also has some small areas of heavier black clays and has well established pasture base. The landscape is relatively flat in topography."

The identified application paddock is primarily used for beef and sheep production and has sandy soil. From what I understand, sandy soil cannot retain liquid at the surface, **so in other words, the irrigation water which contains contaminants as I have already pointed out, would go straight down**

into the soil and contaminate it. I understand there are also small areas of heavier block clays. The landscape is relatively flat. If this practice is allowed to continue in this area, I see no allowances for a 1 in 100 year flood.

On page 4/32 it is stated: *"Talk to the landholder to understand their use of the area and make sure it suits their land use and stock type."* I would like Beach Energy to explain what sort of research the landholders did to be able to be in a position to know if toxic waste-water suits their land use. Common sense would say that no wastewater suits any land use. Were these landowners given the worse case scenarios for other possible contaminants that were not tested for by Beach Energy Ltd? How much information was given to their direct neighbours, and were the neighbours given a say in this practice occurring next door to them? Were the landowners paid off by Beach Energy Ltd? **Again, could this be a case brought against Beach Energy Ltd. for misleading the landowners and lack of due care?**

On page 6/32, the Sump water in Jolly 1 pond measured to be 3 million litres and liquid to be 2 million litres. What happened to the cuttings as the sump had a noticeable volume of cuttings in it, but it is difficult to measure accurately?

"For this exercise the potassium is considered to be the nutrient of highest concern as incorrect application rates can ***lead to a number of agricultural complications*** *(summarised briefly below). In this circumstance sodium and chloride are not considered to be problematic as the area is not adversely affected by saline soils and has high capacity to handle these nutrients."*

On page 7/32, *"The pond contains a visibly large amount of cuttings which make accurate estimation difficult and uncertain. The liquid has a significant salt content."* These statements are of concern. How can wise decisions be made when basic estimation is too hard and there is uncertainty? I have covered more on salt previously in this addendum.

One of the most concerning statements in this document is ***"Potassium should not be applied to areas where cattle are lactating, conceiving, birthing or holding young stock".***

On page 8/32, it is recommended, as in the previous plans I have mentioned before, that a minimum 7 day withholding period be applied to the paddock after application. This will allow adequate filtration of the liquid into soil to reduce the risk of animal ingestion. Additionally, young stock, conception and lactating stock should be kept clear of the application area for 2 weeks.

On page 9/32, the depths of the water table are slightly different – 2.9 metres and 3.6 metres. The low volume of applied liquid, the well established plant root zone and the relative soil water holding capacity means this depth is far below any potential impact**. How can this statement be an absolute, when we know that hydrocarbons had seeped into groundwater 22 m below ground level hydrocarbons from below a decommissioned burn pit, in the Cooper Basin?** Again, what will the implications be, if there is a 1 in 100 year flood in the area, especially if further drill holes are sunk. We must always remember, we cannot control what happens under the ground, including seepage if it occurs into the soil.

On page 10/32, there is already slightly elevated soil potassium. On page 13/32, we discover that *"the application paddock is used for hay making which means that the fodder produced in this paddock will be fortified with these trace elements which will assist with livestock health and can also boost livestock growth rates".* There are two things of concern here. Firstly, the hay is likely to be contaminated, meaning that this will get into the food chain. Secondly, with any contaminants present, it is unlikely that livestock health and growth rates will be assisted or boosted!!!! I would say

the opposite to be true. The rest of the report is similar to the first report I have written up here.

ENVIRONMENTAL ASSESSMENT REPORT

I understand that operators must submit a "site specific Environmental Assessment Report" in accordance with Regulation 20(g), which states:- "an assessment as to whether the relevant activity is covered by an existing statement of environmental objectives under Part 12 of the Act;"

Is this "Site specific Environmental Assessment Report" available for public review? If so, where can it be found? If not, why not?

BEACH ENERGY LTD. ENVIRONMENTAL IMPACT REPORT (EIR) NOVEMBER 2013

This may seem an odd document to include in my addendum. I have not reported on the EIR before. The reason I have included it, is to show further holes in legislation, and also, I believe, generic EIRs should not be acceptable. My concerns are many and varied, and this is only about the exploration process, not even including hydraulic fracture stimulation.

I understand that the exploration carried out by Beach Energy Ltd. was done in accordance with approval processes pursuant to the Petroleum and Geothermal Energy Act 2000. Yet, nothing is mentioned in regard to the possibility of the words hydraulic fracture stimulation or fracking or the word shale shale, or any proper description in this act, as I explained in my submission. Also, the word 'mitigate' is used in the EIR, but there is no mention of 'mitigate' that I can find in the Petroleum and Geothermal Energy Act 2000. Therefore, how could this be prepared under the Petroleum and Geothermal Energy Act 2000?

Exploration for hydrocarbons began in the SE in the 1890's. Robe 1 was drilled in 1915. I have given evidence regarding the aquifer barrier being fractured in the Beachport area allowing salt water into the confined aquifer from the salty unconfined aquifer. On page 6/106, it is stated that the *EIR and resultant Statement of Environmental Objectives (SEO) is 'generic' in nature, covering current and future Beach Energy Ltd. licenses across a relatively broad geographical area, rather than relating to a specific site or sites.*

This is very VERY POOR, given soils can change across the SE, and the depths of the aquifers also vary. It is also stated that there is a general absence of surface water courses, therefore groundwater is, in my opinion, usually the only water that agricultural has to rely on, especially during droughts. The EIR also admits there are sinkholes and caves around the SE, including the World Heritage listed Naracoorte Caves that I previously covered. This report fails to mention how hydraulic fracturing can open up contaminant pathways, or how caves are already 'interconnected', with the possibility of mobilizing CO2, methane or other Volatile Organic Compounds. I reiterate that one of the PELs goes across the corner of this park.

Also on page 6/106, it is stated that: "*This EIR assesses the potential impacts posed by hazards that may result from drilling, completion and initial production testing activities*." In my opinion, and the opinion of professionals in these fields, these are not potential impacts – based on much evidence – THESE IMPACTS WILL HAPPEN, as documented in Australia and overseas. The potential hazards listed in the EIR include: well site, access track and camp site construction and rehabilitation, well control incidents including blowout or kick, use of roads and movement of vehicles and heavy machinery, emissions from drilling activities (air, noise, light), physical presence of drill rig and camp and personnel, and drilling through shallow freshwater aquifers.

Page 7/106 also adds other possibilities, including loss of well integrity (e.g. casing or cement failure), spills or leaks, other downhole issues (e.g. lost circulation, sloughing shales, stuck pipe or drill pipe failure, loss of radioactive source down hole), storage, handling and disposal of waste, fire and unauthorised access by third parties.

There is no mention of the impacts of heavy machinery on the roads, which includes the word "corridor", which is required for pipes or roads that criss-cross the country. There is no mention of the transport corridors, other than a brief mention of a (singular) short access track constructed from the public road to the drill pad. It mentions a 'ring road'. This really is far from the true scenario. There is no mention of who pays for the road deterioration. I understand interstate that the Local Government foots the bills from ratepayer revenue, which I also understand, has risen sharply in areas such as Chinchilla. I would presume this to be the same in South Australia.

On page 7/106, *"The risk assessment contained in this EIR indicates that the level of risk posed by drilling, completion and initial production testing activities is generally low and can be adequately managed to prevent unacceptable environmental impacts."*

I believe this is WRONG CLASSIFCATION, because of the presence of faults, the risk of hydrogen sulfide and anaerobic bacteria, and drilling down 4 km. No one can control what is happening under the ground, regardless of the depth. When I asked the question of how long the life of a well is (even when decommissioned and plugged), at one of the Round Tables, I did not get an answer, because the industry simply don't know. How can you rehabilitate a site – given the different types of layers underground? One can't. It is just a cover up at the surface. To make this claim on the same page "*Aquifers will be protected by casing and cementing of wells."* is ridiculous, for the reasons I have just explained. What happens 50 – 100 years down the track?

The litany of mistruths continues. The word fire is mentioned. Yet there is no law in South Australia, which bans flaring on fire ban days. On page 16/106, the following is stated. *"If the grass is dry or operations are within the fire season, the pad will be surrounded by a 10 m wide ploughed firebreak."* In reality, there was no ploughed firebreak around Jolly 1, it was just mowed, as I observed. I made my thoughts very clear, indicating that this was not good enough, to DSD on this matter, at the time. Impermeable liners are mentioned. I covered what happened to the RAYA pond liners in my submission.

Page 8/106 gives the history of the conventional wells in the SE. Unfortunately, these wells were also drilled through faults. We don't know the impact, as far as I am aware, because there appears to be no baseline studies before these wells were drilled. Once these wells have been decommissioned, what hydrology studies have been done on a regular basis since? I am yet to be provided with evidence (if any) for this. It is interesting that Geltwood 1 is mentioned. The picture of 'leaking' Geltwood 1 was provided in my submission. This well has also never been decommissioned. How many other wells have not been decommissioned in the South East, and for that matter, in South Australia, and adding to that, are in a sorry state? And Beach Energy Ltd, and other petroleum companies expect the South East residents to trust them and think that everything will be honky dory – I don't think so!!!!

On page 9/106 it is interesting to note that the North East corner of the Naracoorte Caves National Park is overlapped by PEL 494, Bool Lagoon Game Reserve, Big Heath National Park and Mary Semour Park are included within the PEL 494 area. Also PEL 186 borders on Little Dip National Park.

Page 10/106 "*This document (and the resultant SEO) is 'generic' in nature, covering drilling activities in current and future Beach licenses across a relatively broad geographical area, rather than relating to a*

specific site or sites, or to specific projects. This approach has been applied in many other EIRs and SEOs that have been developed under the Petroleum and Geothermal Energy Act including previous EIRs and SEOs developed by Origin Energy, Adelaide Energy and DMITRE for exploration in the onshore Otway Basin. As discussed in Section 2.1.4, prior to the commencement of drilling activities, additional site-specific and technical detail for operations at individual well sites must be provided to DMITRE under the activity notification / approval requirements of the Act, including a demonstration that the activities are covered by (and are compliant with) an applicable SEO." Is the additional site-specific and technical details provided to the general public. I am not aware of this. This should not be 'commercial in confidence'.

On page 11/106, it is stated that the Act and Regulations are objective-based rather than prescriptive. This is very concerning and outdated legislation. If something is an objective-based regulatory approach, the industry has to ensure that it manages its activities effectively by complying with performance standards that are cooperatively developed by the licensee, the regulatory authority and the community. From what I understand, prescriptive regulation is where detailed management strategies for particular risks are stipulated in legislation. Somehow the detail in the full picture seems to be missing.

"*A reference in the Act to petroleum or another regulated substance extends to a mixture of substances of which petroleum or other relevant substance is a constituent part. Regulated substances as defined in Part 1 of the Act are: petroleum, hydrogen sulphide, nitrogen, helium, carbon dioxide, any other substance that naturally occurs in association with petroleum; or any substance declared by regulation to be a substance to which the Act applies."* As I understand the word 'regulate' means to control. How can this report state that these substances, that are naturally occurring, can be 'regulated', given that one doesn't know how much will come to the surface, controlled or uncontrolled, and give 100% certainty of where these substances will end up? I won't go through everything pertaining to the law in the EIR here, as I have already given a clear picture in my submission.

On page 12/106, it is mentioned that the cultural values of Aboriginal and other Australians must be taken into account. Dr. Irene Watson, Chairperson, Kungari Aboriginal Cultural Heritage Association, gave clear evidence during her presentation in the South Australian Parliament, and indicated this was not done properly. It is also stated that risks to the health and safety of the public inherent in the regulated activities must be taken into account. If this was the case, based on much credible evidence, the petroleum companies should not be down in the SE in the first place.

As per Regulation 10 of the Petroleum and Geothermal Energy Regulations 2013, the EIR must include a description of the specific features of the environment that can be reasonably expected to be affected by the activities, with particular reference to the physical and biological aspects of the environment and existing land uses. So in other words, the industry and government recognize that the environment **will be affected** by the petroleum activities. There is a list included regarding a description of the reasonably foreseeable events associated with the activity that could pose a threat to the relevant environment. What about the cumulative effects of toxic waste-water if these petroleum activities are permitted to continued to be irrigated on the landscape? Where is the mentioning of the impacts of removal of water, shale or what ever substance coming to the surface and causing a void, creating an unwanted chain of events, such as subsidence, or the mention of the impact on earthquakes.

On page 14/106, the Beach Energy Ltd EIR lists a variety of Acts that are relevant to Petroleum legislation. Yet, there are a number of Acts that have not been included, that are important. These include Lands for Public Purposes Acquisition Act 1914, Incorporation of Compulsory Acquisition and

Land Act 1925, Water Resources Act 1997, Dust Diseases Act 2005, South Australian Public Health Act 2011, Food Act 2001, Animal Welfare Act 1985, and Livestock Act 1997.

The EPBC 1999 Act is mentioned. Bool and Hacks Lagoons, Piccaninnie Ponds Karst wetlands are RAMSAR sites. Yet Beach Energy believes that a requirement for approval under the Act is not lightly to be triggered and yet their licenses surround all these areas, including the Naracoorte Caves UNESCO listed park. Fences do not separate underground aquifers from these areas.

Included on this page is groundwater use for exploration. The rest of the SE has to have water allocations in place, but under the NRM Act, Section 128, groundwater can be taken for use without allocation, in drilling, construction and testing of hydrocarbon exploration wells. Imagine how much groundwater could be used up, looking for 'sweet spots' as defined by Professor Ingraffea during his skype presentation. Page 15/106, low impact skirts around the Development Act, as only activities classified as 'high impact' are required to be assessed under the provisions of the Development Act.

On page 18/106, horizontal drilling is discussed, but this process is not in the Petroleum and Geothermal Energy Act or Regulations. On page 19/106, it is stated that non-toxic to low toxic chemicals are used during testing and drilling. The names of the substances are not disclosed. When this question was asked at one of the Round Tables I attended, the excuse was because of patent rights. Not good enough when people's lives can be at stake. Polymers, e.g. partially-hydrolysed polyacrylamides are listed. Acrylamides are known neurotoxins. Polyacrylamides contain minute residual amounts of acrylamide. Biocides are also listed. Glutaraldenhyde is a biocide. It is a severe eye irritant, causes dermatitis, is classified as harmful in rats. Rats exposed to 20 ppm of this substance resulted in 50% of animals dying in 90 minutes. This substance is considered hazardous and corrosive. It is also known to cause asthma and rhinitis. Tetrakis is another biocide that is toxic to micro-organisms. It has shown mutagenic potential (in Vitro) and cancer potential in rats. No exposure information is available for humans or organisms in the environment, hence no quantitative risk assessment has been made.

It is interesting to note on page 24/106, the following: "*Soils vary from sandy pedal mottled-yellow duplex soils, red weakly structured sandy soils, bleached sands and black organic soils. Wetland areas, such as Bool Lagoon, are black self-mulching cracking clays. The dunal ranges are comprised of a mix of deep sands and the interdunal flats are characterised by either heavier clays that overlie limestone or sands that overlie clay. The swamps are comprised of medium and fine textured saline soils. Along the coast soils are mostly calcareous sand with some small areas of acidic and alkaline peats (SENRCC, 2003).*" **So why is a 'generic' EIR acceptable, with such a range of soils and geology?**

On page 30/106 It is wrongly stated that leakage through the aquitard has been assumed to be generally very low, except in areas where the aquitard is very thin, absent or fractured. *"However, recent work has revealed moderate to good hydraulic connection between the two aquifers and indicated that they are more highly connected than previously assumed."* I have gone into depth regarding this in my submission. The unconfined aquifer depth varies from 2 m to greater than 20 m. This is very shallow, and does not give much leeway for surface chemical and waste water fracking spills.

Also, the Beach Energy Ltd. EIR blames recycling of irrigation drainage water, vegetation clearance or forestry harvesting for the cause of mobilization of salt. Perhaps Beach Energy Ltd. and DSD need to read the Queensland Government commissioned report - 'HEALTHY HEADWATERS – ASSESSING THE SALINITY IMPACTS OF CSG WATER ON LANDSCAPE AND SURFACE STREAMS FINAL REPORT', February 2013, page 11. I understand it is impossible to confidently estimate salt yield due to spatial and temporal variation in water quality in gas fields. It is estimated that the amount of salt produced over

a 30 year period could be up to 1,650,000 tonne per year. If the National Water Commission's estimate of 7500 GL (gigalitre) of coal seam gas water production is used with an average TDS (total dissolved solids) of 3000 mg/L (milligram/litre) the potential salt load brought to the surface would be 22.5 million tonnes over the next 25 years – 900,000 tonnes of salt produced per year. I understand salt mobilization also occurs with shale gas production. **Yet, the Beach Energy Ltd. EIR fails to address this.**

On page 31/106, it is good to note that Beach Energy Ltd. recognizes the extensive and dependent water use in the SE, including for pastures, grapevines, lucerne, forests, irrigation, aquaculture and also domestic supply for towns. They go on to list wood, meat, dairy, cereal crops, wine grapes, horticultural crops, livestock grazing, vegetables, oil seed, fruits, nuts, and fodder crops. They also note that 2,300 farms are n the SE region, and 80,000 hectares are irrigated. The list continues on page 32/106, which includes 3 National Parks, 53 Conservation Parks, 4 Game Reserves. The EIR and Statement of Environmental Objectives does not cover activities in reserves established under the National Parks and Wildlife Act or exploration activities immediately adjacent to a marine park established under the Marine Parks Act 2007. These areas listed in the EIR include the Naracoorte Caves National Park (partially within PEL 495), Woakwine Conservation Park (PEL 186), Big Heath Conservation Park (within PEL 494), Bool Lagoon Game Reserve (within PEL 494), Hacks Lagoon Conservation Park within PEL 494, Mary Seymour Conservation Park (within PEL 494), Glen Roy Conservation Park (within PEL 495), Penola Conservation Park (within PEL 494), Calectasia Conservation Park (within PEL 494), Reedy Creek Conservation Park (within PEL186), and Lake Hawdon South Conservation Park (partially within PEL186).

Lake Hawdon South Conservation Park, Woakwine Conservation Park and Big Heath Conservation Park have some access for petroleum and mining activities. The Upper South East Marine Park is located adjacent to the PEL 186 license area. Again, I reiterate the interconnection with the aquifers to the sea, as the result of tidal effects. I find this appalling, even in a personal way, given that my father, the late Verne McLaren AM, served on the National Parks Commission, and was appointed by the former Premier, Hon. Des Corcoran, with a vision that these areas would be protected for future generations to come, to enjoy, and also for educational purposes. Verne also served under the Hon. Don Hopgood MP, and the Hon. David Wotton MP, while serving on the National Parks Commission.

On page 34/106, there are 25 known Aboriginal sites within the license areas. 21 are classified as archeological, three as scarred trees, and one as a burial site. There may be more additional sites or objects as well.

Page 35/106, the Environmental Impact Assessment is discussed in relation to potential environmental impacts related to drilling, completion and initial production testing activities in the onshore Otway Basin. The document admits there are potential issues with impacts to soil and shallow groundwater mainly arising from well site earthworks, campsite construction and rehabilitation. These potential issues include erosion, inversion, compaction, spills or leaks associated with storage and handling of fuel, oil and chemicals, drilling procedures and initial production testing/ flaring, well control incidents or loss of well integrity, storage, handling and disposal of waste. Again, I have covered these incidents that have already occurred in South Australia, including the SE**. It is interesting to note that AGL pulled out of Gloucester because the waste water irrigation on the land had too much salt and heavy metals in it, and the company that normally dealt with the waste water refused to take anymore, so there was then no place to put the waste water.** Surely this sounds a warning gong as to what is also likely to occur in the SE scenario. No one has 100% foreknowledge of what will be mobilized or come to the surface at different well locations. The EIR also states that "*Any spills will be immediately cleaned up and any contaminated material removed off-site for appropriate treatment or disposal."* As I understand, this is not dealing with the problem,

it is just moving the problem elsewhere.

I was able to demonstrate in Parliament, how quickly limestone soaks up fluid. The EPA also admitted, at a SELGA forum that I was involved with on the panel, large aquifer contaminations cannot be cleaned up. On page 37/106, **another myth is perpetuated.** *"Well control and well integrity risks are managed by a range of measures that are discussed in Section 5.3. The likelihood of impact to surface water from well control or well integrity issues is very low."* I have gone into great detail in my submission regarding well integrity, followed up by Professor Ingraffea's presentation in Parliament via skype, to demonstrate that not all well integrity risks are capable of being managed before damage is done.

On page 36/106, it is stated that drilling sumps are used to contain drilling fluids and cuttings and may collect surface runoff from the well lease, and have the potential to result in localised contamination of soil and shallow groundwater. We are already aware of the Panax Geothermal waste-water pond liners breaking down in less than 4 years. What is also concerning is that the sump contents are generally left to dry out before removal off site for appropriate disposal, again just moving the problem elsewhere.

37/106 it is stated: *"If required (e.g. after heavy rainfall) the sump can be pumped out and the contents disposed at a licensed facility to ensure sufficient capacity is maintained. The risk of flooding is considered in the location and construction of well leases, and if required, additional measures such as a small berm around the sump to prevent floodwater entering the sump may be implemented"*

As I previously covered on page 39, sump water had to be removed from Jolly 1, after a neighbour reported the water near the top of the pond. As I had already challenged Beach Energy Ltd. at Penola regarding the high level of the waste water, they said there would not be a problem, as there **were no down pipes running into the pond,** and yet 2 months later, there had to be an Emergency Authorisation EPA license to move the waste water to Katnook, because of the level of waste-water in the pond, and further forecast heavy rain.

Jolly 1 waste-water holding pond water near surface, April 2014. Photo Anne Daw

As discussed previously, in February 2015, when the EPA was contacted regarding clarification of whether Beach Energy Ltd. had sought and received an amendment to the EPA license 23644, associated with the existing gas production facility at Katnook to include the receipt of fluids from their **other licensed operations in the area,** (the previous emergency authorization as a once off), the EPA said that Beach Energy Ltd. had submitted a development application to the Wattle Range Council, seeking approval for the ability to utilize the Katnook facility on an ongoing basis.

Pages 35 – 43/106 covers a wide range of risks and potential impacts arising from various topics. I won't go into all of the possibilities, as it would sound like a rehash of what I have already presented.

Topics include:
Soil and Shallow Groundwater: Surface Water: Groundwater: Native Vegetation and Fauna: Land Use: Landholders and Local Community: Cultural Heritage: and Economic Impact:

Under the topics are sub-topics that are fairly similar in most cases with a slight variance, and some extra topics under some sub-headings. These include:

Earthworks For Construction And Rehabilitation, Spills Or Leaks, Well Control And Well Integrity, Waste Management, Drilling Through Aquifers, Well Control Incidents, Other Downhole Issues, Well Site, Access Track And Camp Site Construction, Disturbance From Site Activities, Use Of Roads And Movement Of Heavy Vehicles And Machinery, Access To Contaminants (E.G. From Well Control Incidents, Drilling Sump, Spills Or Leaks) And Waste, Fire, And Generation Of Dust And Air Emissions.

The company does acknowledge what can go wrong. Even so, the fact that these possible risks or potential impacts are mentioned in the EIR does nothing to appease community concerns. Nor does it make things right, that because something is mentioned in a report, therefore, it is less likely that negative events may occur. The topic of economics in the EIR, I believe, is hype and spin. It addresses the number of potential economic benefits for landholders, the community and the State, without including the negative impacts, which are the far more likely outcome, such as loss of green and clean image, loss of export markets, lowering of living standards, and various other things I have previously mentioned. As far as compensation, agreements are put into place before activities are taken. There is absolutely no transparency in this, as neighbours are not told about the compensation, nor the amount to be paid, and yet they can be affected in some cases, more than the landowners that have signed an agreement. As I understand, neighbours in the Eastern states cannot get adequate insurance if living near unconventional gas projects, and I would assume this would be the same for the SE of SA.

I am pleased to report that I am one of 3 Australians that have been quoted in a United Nations Report, "A Guide to Rights Based Advocacy, International Human Rights Law and Fracking, which was produced by the Sisters of Mercy (NGO), Mercy International Association: Global Action, enjoying special consultative status with the Economic and Social Council (ECOSOC) of the United Nations. The quote was "*In a submission to the Parliament of South Australia, Natural Resources Committee Inquiry into Unconventional Gas (i.e. fracking) in February 2015, Anne Daw summarized the impact on the community: " Valid community concerns exist in regard to environmental, economic, water security, sustainable food bowl, local, national and international export markets, and tourism. People are concerned with demographic changes, associated strain on community services, loss of lifestyle as they now know it, and insecurity regarding their futures. Impacts on landscape, triggering of earthquakes, seawater intrusion and the fact that the South East is built on limestone with a number of caves, fault lines, sinkholes and subsidence … Limestone subsidence and sinkhole formation are hastened by unconventional gas activities."*

The world is now watching what is happening in respect to unconventional gas in the SE of SA.

In the EIR, drilling through the Gambier Limestone and Dilwyn shallow freshwater aquifers, contamination or salinization of aquifers is mentioned as unlikely. This is ridiculous, given that the aquifer is so close to the surface. There is no mention that I can find of the fact that limestone is brittle, absorbs any liquids easily, or that subsidence is exacerbated by mining, drilling or fracking. For a number of pages, most potential risks or potential impacts, regardless of the type, are listed in further page of the EIR the likelihood as unlikely. I believe, given the evidence around the world, that this is reckless and misleading, given that no 100% guarantee can be given in any area that impacts could be major.

On page 47/106, it is mentioned that as far as air emissions, the reduction in local air quality is considered unlikely. The strong smell of diesel could be smelt easily and strongly from the highway adjacent to Jolly 1. Most locals would not consider this a low risk, having already had a 'nasal taste'. On page 48/106, as far as noise emissions, and disturbance to the local community, this was also considered low. I stayed at the local motel, around 3 km from Jolly 1 and could clearly hear the noise that started in the very early hours of the day. The EIR states that an adequate buffer was to be maintained between the well site and residences. This is total rubbish, there was no buffer present that I observed 10 metres from the waste-water pond, for the drilling of Jolly 1. And these petroleum companies wonder why no one trusts them! It also stated there would a likelihood of unlikely of disturbance to stock. Again total rubbish, the cows, as I previously reported, were adversely affected.

On page 50/106 as far as localized contamination of soil, surface water and groundwater, earthquakes and fault lines fail to get a mention. On page 57/106, under Community Consultation, the community was not satisfied with answers given by Beach Energy Ltd. or government departments. As Professor Ingraffea explained, there are more problems with going deeper. I reiterate, it doesn't matter how many layers of casings and cement, this does not ensure prevention of contamination into aquifers. On this page, is the following question in the first column. Does or has well casing ever failed? Beach Energy Ltd. avoided answering the question honestly, altogether. On page 85, it is quoted that *there is an enviable track record of 50 years of environmentally safe operations.* My submission and this addendum provide evidence to show the opposite to be true. Also on this page, sponsorship programs are mentioned. Most communities view this as a form of bribery, set up to divide the community. Beach Energy Ltd. donated, I understand, $25,000 to the Penola Bowling Club. The effect – division within the community. These type of donations, in many people's opinion, should be made illegal. A number of wells have been drilled since 1866. Where are the reports for ongoing monitoring at all of these wells? Where were the baseline studies? I doubt that both of these questions can be adequately addressed, even if at all. I believe, given the evidence against hydraulic fracture stimulation both in Australia and around the world, the EIR is grossly insufficient and unacceptable.

Having looked also at the Statement of Environmental Objects, (SEO) November 2013, for Beach Energy Ltd., I have nothing to add here as it is fairly repetitive and the EIR is based on the SEO. There is nothing outstanding to add, other than to say that based on both reports, there is nothing that will convince me that any petroleum activities should be allowed on highly valued agricultural land in the SE of SA.

CONCLUSION OF EVIDENCE AGAINST SPRAYING WASTE WATER ON PRIME AGRICULTURAL LAND

There is enough evidence, to show why the waste-water clearly should not have been spread on the agricultural land in the South East. I understand from an irrigator, that even with low levels, e.g. 1900 EC, it is impossible to control the spraying to ensure even distribution. Where there is excess spraying in spots, there is toxicity resulting, and scorching of grasses can be seen. It appears that 'special approval' in this instance, was given for the spraying of the pond waste-water on the land, to get around normal guidelines. All of this is simply not good enough.

NO SAFE METHOD TO DEAL WITH POND WASTE-WATER FROM EXPLORATION OR PRODUCTION PETROLEUM ACTIVITIES IN THE SOUTH EAST

As I have already mentioned what Professor Bill Fisher has said about not drilling near faults or re-injecting near some geological faults, given the geology of the South East injection of waste-water would be a very dangerous practice, given the geology of the SE. In other words, from what I

understand, hydraulic fracture stimulation should not be going ahead in the SE as there is no safe method of disposal of waste-water.

No one has answered the question on how disposal in the South East of SA, of shale gas produced water (concentrated brine, heavy metals, salt, etc. in the water left behind after water treatment) was going to be dealt with, as the result of exploration or during the process of hydraulic fracture stimulation. I understand the answers have been totally inadequate across Australia in relation to waste-water disposal. I also understand that the main reason AGL pulled out of Gloucester in NSW, because the company that was dealing with the Coal Seam Gas waste water refused to take any more of the waste-water.

Because re-injecting waste water near fault lines causes earthquakes, and because the waste water should not be spread on agricultural land in the South East, there is no safe disposal for the waste water, in the South East, and there were the predicted amount of 3446 shale gas wells, with possibly a lot more to find sweet spots as the result of the 'red queen affect', this reason on its own should be enough to ban hydraulic fracture stimulation.

KIMBERLY CLARK INSTALLS INNOVATIVE COGENERATION FACILITY AT MILL

When The Hon. G.A. KANDELAARS asked a question at the SA Parliamentary Inquiry on Hydraulic Fracture Stimulation at Robe, he had impression that Kimberly Clark was dependent on natural gas. I have decided to include what is on the site of Kimberly Clark.

Kimberly Clark in the SE is aiming to reduce it's gas use, as it sees that greenhouse gas reduction is critical to their tissue operations, as well as being important for other sectors due to the rapid rise in energy costs. They are committing to reducing greenhouse gas emissions to protect the precious environment for generations to come. In 2013, they completed the installation of an innovative cogeneration facility at the Millicent Mill. They are now capturing waste heat in the exhaust of the gas turbine, using it as a replacement for natural gas in paper drying and steam production. This has lead to lower energy consumption. Their co-generation facility is expected to provide 100% of the mill's steam, 92% of the mill's total electricity and 85% of drying heat for the line that makes Kleenex, Cottonelle and VIVA products. They have reduced our total carbon emissions by 24% since 2011.

"Now that the cogeneration facility is up and running, it's expected to also: Reduce carbon dioxide emissions by 80,000 tonnes per annum; Produce 20MW, enough to power 36,000 average homes making the mill largely self-sufficient in power; Achieve an energy output efficiency of over 75% for the system in full operation, compared to a typical efficiency of 38%."

http://www.kimberly-clark.com.au/en/sustainability/planet/climate-change-global-warming/reducing-greenhouse-gases/

PETROLEUM AND GEOTHERMAL ENERGY ACT 2000 REPORT 2015

This report has recently been released, and not included in my previous submission. As I was able to establish in my submission, based on the previous years of audit compliances, there remains ongoing issues. According to page 7, "*potential compliance issues (which can include procedural departures from operation plans that, if not rectified, may lead to more serious noncompliance")* in relation to infrastructure, associated facilities, pipelines and well sites. These were observed at 28% (38) of the 135 individual sites. The most prevalent cited issues in 2015 related to waste and wastewater, fencing, weed issues, soil contamination, surface water disturbance, chemicals and oils, and uncontained fuels. It is interesting to note the language in this compliance report. It is stated that

"Eleven environmental improvement notices were issued post inspection to various licensees to notify them of the environmental issues identified that required improvements." As I understand it, this would indicate that there were 11 incidents where compliance was not up to standard – again companies failing to do the right things. This adds further evidence to show that the companies cannot be trusted.

On page 8 there were eleven serious incidents in 2015. These included incidents relating to fuel, oil and produced formation water spills. There is one case still under investigation as I write this addendum, regarding the oil, fuel and produced formation water spills, gas release and security of supply. In the rupture of the Whyte Yarcowie to Port Pirie Pipeline lateral.

Page 25 – 26% of the sites had environmental issues identified. (38 sites in total). There was one notice of non-compliance. There were 2 hydrocarbon spills in the Cooper Basin. Page 27 states that environmental improvement notices were given out. On page 28 there was severe gully erosion on the Santos's Pondrinie to Bookabourdie Gas Trunkline pipeline right of way, described as a potential breach of objective 2 of the SEO.

In the South Australian sector of the Cooper and Eromanga basins, co-produced water is most often disposed of through evaporation and seepage ponds, with a small amount recycled for other purposes. If this is the case, how often are the pond liners changed? As evaporation occurs, what is left becomes more concentrated. What is done with the toxic concentration and any cuttings? I understand GAS scores of –2 and –1 represent unacceptable levels of visible hydrocarbon within the water disposal ponds. In this case the GAS scores of –1 occurred with hydrocarbons in the co-produced water holding ponds due to poor management practices. Again, this illustrates that the petroleum industry cannot be trusted.

On page 29, there were five disposal facility ponds that were unacceptable as there were visible hydrocarbons within the ponds. On page 30 Water retention within borrow pits (a borrow pit is a pit resulting from the excavation of material (usually soil, gravel or sand) for use somewhere else) was a key concern, as increased grazing and predator pressure occurs, using the water for drinking, which impacted on native flora and fauna species.

On page 35 it is stated: "*During 2015, 126 annual reports (for single or multiple licenses) were received by DSD-ERD. Of the annual reports reviewed during 2015, 89 were considered to have met the requirements of regulation 33 of the PGE Act and have been accepted by DSD-ERD (including those accepted after resubmission).* ***A total of 54 resubmission requests were made to licensees with respect to the quality and content of annual reports submitted."***

It is interesting to note that as far as all types of petroleum licenses, and quality of annual reports from the Petroleum Companies, only 26 were acceptable, 42 were required to do a resubmission, another 42 were under review and 6 were not submitted. As far as pipeline licenses, and preliminary survey licenses, 6 were acceptable, 8 had to do a resubmission and 6 were under review. One was not submitted. As far as special facility, 3 reports were acceptable, 4 resubmissions were required, and 3 were under review.

On page 38, regarding a Fit For Purpose report for Beach Energy's South Australian operations, covering wells, pipelines and surface facilities, was reviewed. Further information was requested to clarify and confirm a number of statements and conclusions regarding the adequacy of Beach Energy's risk assessment methodology and integrity management systems. Compliance with relevant technical industry standards and recommended practices is a key consideration of this validation assessment. The assessment identified a number of issues and opportunities for improvement for Beach Energy**. If**

this is the case, and already we are seeing sloppiness on Beach Energy Ltd.'s part, this is of major concern for SE residents.

There are also critical items regarding Santos to satisfactorily demonstrate that the conclusions of the Fit For Purpose report are valid.

Page 39 continues regarding SANTOS as I understand, they need to remove the current corrosion risks associated with:
- stagnant flow conditions caused by inadequately mothballed or suspended flowlines
- above-ground flowlines that require lift and support
- inadequate cathodic protection (install new and reliable cathodic protection systems)
- inadequate coating of buried pipelines (exceeded design life; replace flowlines at risk).

Again, the reasons stack up why the Petroleum industry should not be allowed on high yielding valuable agricultural land in the SE of SA.

On page 41, as far as economics "*As a direct consequence of decreased oil prices, 2015 was a challenging year for the petroleum industry…..Calendar year 2016 is forecast to be another challenging year based on oil prices forecast to remain below US$50 per barrel***" If the audit compliance is stating that 2015 and 2016 are basically not economically sound, why on earth would the South Australian Government think this a viable industry for the SE of SA, given the huge costs of sinking the drill holes in the first place, plus all the risks.** What also is concerning in bad economic times, is if short cuts are being done to cut costs, adding further risks in this industry.

On page 42, regarding decommissioning of the Geodynamics Habanero, there was a compliancy issue. According to the Australasian Corrosion Association Inc., costly and dangerous damage by corrosion impacts bridges, pipelines, buildings, water and wastewater systems plus other infrastructure. **The annual cost of corrosion worldwide is estimated to be 3% of the worlds GDP.**

It is interesting to note that on page 48, carbon capture and storage is mentioned. This was planned for offshore, if the Kingston lignite project had proceeded. This was in an area where there were many fault lines. I covered a little on this in my submission. Carbon, Capture and Storage has very concerning issues. It water gets into the pipeline which contains carbon dioxide, it forms carbonic acid, which eats away the pipe and in turn, dissolves the minerals that are meant to contain it.

http://ion.chem.usu.edu/~sbialkow/Classes/3650/Carbonate/Carbonic%20Acid.html

According to the XX1 World Energy Conference, held in Montreal, on page 13, researchers were surprised when buried CO2 dissolved surrounding minerals that were meant to contain it.

http://www.indiaenergycongress.in/montreal/library/pdf/227.pdf

On page 50 ***"Potential for the exploration and development of gas and gas liquids in unconventional reservoirs in the Otway Basin, in the South East of South Australia, has drawn attention of petroleum license holders and the public in general since Beach Energy announced, and then drilled two exploration wells (Jolly 1 and Bungaloo 1) in 2014. These wells were drilled safely and without incident."*** **This last sentence is rubbish.** As I pointed out in my submission, page 35 - There was a mechanical drill problem, described by locals as 'the drill head getting stuck', which was not disputed when mentioned to Beach Energy Ltd at the SELGA day at Penola, and as a result, a side track around the problem had to be drilled. This occurred at 2,406 metres, and on the drawing showing the intersecting of faults, this appears to be right where the drill intersects a fault. Also, there was the

rotten egg smell coming from the wastewater, and the diesel smell that could be smelt from the highway. Then the holding ponds almost overflowed. To say there was no incident is a lie. How much else are we meant to believe of the audit compliance report, as evidenced here?

"Until such time that it can be demonstrated via well-grounded information and credible scientific evidence that significant risks can be reduced to as low as reasonably practicable while meeting community expectations for net outcomes, no approval to undertake such activities can or will be granted."

This is a very interesting statement. **Does this mean the Department of State Development have put a moratorium on themselves? I do hope so. As it is impossible for them to prove via scientific evidence that the unconventional gas activities in the South East would be without total risk, no approval for such activities should be granted.**

On page 51, conventional gas is mentioned and that "*outcomes have been demonstrably safe and without significant, perceptible, associated negative impacts on the environment, enterprises or the health and safety of people."* Again, evidence in my submission is contrary to this statement. Page 52 "*it was identified that deficiencies existed in a number of incident reports provided by licensees in 2015."*

On page 53 is the following diagram.

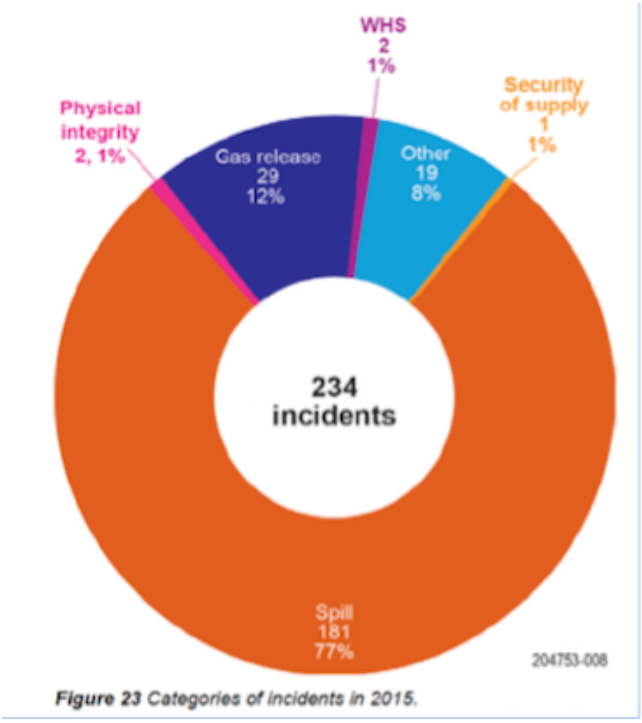


Figure 23 Categories of incidents in 2015.

Diagram from Petroleum and Geothermal Act Audit Compliance Report 2015

It is interesting to note that decrease of incidents is not happening, which is indicative, I believe, that regulation is not working. In **2013**, there were 122 incidents. 81 were spills. 15 were greenhouse gas releases. 4 were physical integrity. 8 were pipeline encroachment problems and 8 work health and safety issues. 2 were security of supply and there were 4 other unnamed incidents. In **2014**, there were 257 incidents. These included 208 spills, 11 gas releases, 2 physical integrity, 6 work health and safety issues, 6 pipeline encroachments and 23 other unnamed incidents.

In 2015, there were 234 incidents. These included 181 surface spills, 29 gas releases, 2 physical integrity, 2 work health and safety incidents, 1 security of supply and 19 other unnamed incidents. Imagine the limestone soaking up all of these spills in the SE!! I was able to show how easily limestone soaks up liquid, at my Parliamentary presentation. **I am not convinced, that as the years progress, incidents are becoming a thing of the past as far as the petroleum industry is concerned.**

On page 54, there was a serious gas release experienced in which the rupture of the Whyte Yarcowie to Port Pirie Pipeline lateral, (near the township of Gladstone in the Mid North of South Australia) on Sunday 12 April 2015, occurred.

The two work, health and safety incidents that were reported occurred due to personnel inadequately following standard work procedures. The 2 physical integrity incidents included defects identified on pipelines. There was also corrosion of pipelines. Page 55, other' incidents included the heritage and off-lease disturbance incidents.

***Figure 24** Comparison of categories of incidents, 2006 to 2015.*

Diagram from Petroleum and Geothermal Act Audit Compliance Report 2015

This is a chart of the comparison of incidents from 2006 unit 2015.

On page 56, there is a graph with substance spills showing a comparison of the number of incidents 2001 – 2015. 2014 and 2015 are not impressive. Even though the spills in 2014 were predominantly low volume spills, when looking at the accumulation effects, this leads to more concerns with the industry. Aging infrastructure in the Cooper and Eromanga basin, as I understand, is the main reason behind the spills. In 2015, the fluid spill incidents is mainly blamed on management practices and aging infrastructure. This places no confidence in the industry getting a foothold on the prime agricultural farmland of the South East of South Australia.

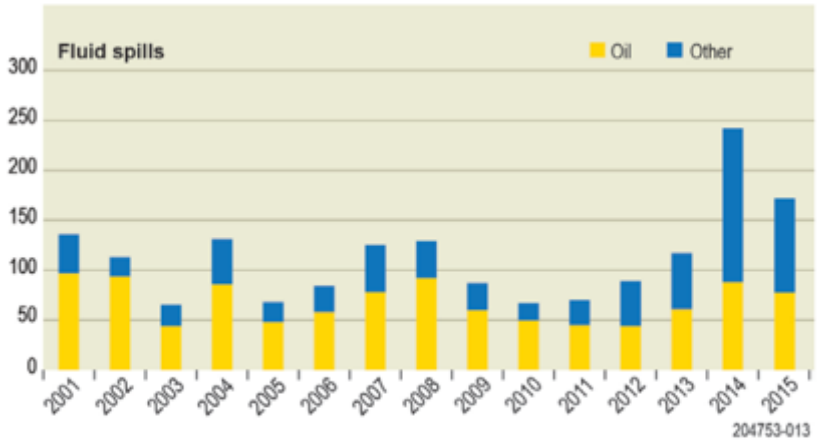


Figure 25 *Annual regulated substance spills by number of incidents, 2001 to 2015.*

Diagram from Petroleum and Geothermal Act Audit Compliance Report 2015

For 2015, the majority of spills related to produced or flowback water or produced oil. As I have clearly demonstrated in my submission, the produced or flowback water is toxic, salty, usually contains heavy metals, volatile organic compounds, NORMS, polynuclear aromatic hydrocarbons, drilling chemicals, etc. And oil is also toxic. Chemical, fuel and sump oil made up the remaining categories of spills. I certainly wouldn't like these incidents happening in my backyard! On page 57, the spills have been summarized in diagrams. There were 173 spills for 2015. 66 were from produced water. 13 were chemical spills, 15 were fuel spills and there were 78 produced oil spills! Not impressive to say the least.

On page 58, it is stated there was a major pipeline leak. History goes back further. In 2001 there was a major spill incident as the result of a pipeline leak. In 2002 there was a leak as the result of a breach in an oil interceptor pond wall.

On page 59, the root causes of incidents for 2015 by analysis were reported as being insufficient 'monitoring/maintenance', and degradation type of failure mechanisms such as corrosion or fatigue associated with ageing infrastructure. This ties in with what was admitted to me at 'fracking school', corrosion being their biggest nightmare. On page 60, there were incidents caused by inadequate work practices and design.

On page 61, there were 11 serious incidents. The licensees were not named. I quote the following.

"In 2015 there were 11 serious incidents reported to DSD-ERD. These incidents consisted of 6 spill events, 4 gas releases and 1 event relating to security of gas supply. See Section 8 for details of this security of gas supply incident that remains under DSD-ERD investigation. The spill events were classified as serious incidents at the time of occurrence due to the potential for contaminants to either enter a water body, including shallow groundwater, or affect the health of native flora and fauna."

What is alarming is that one of the serious incidents was in relation to a gas release in the Otway Basin on 11th November, 2015. What was that all about???? There was the incident at Port Pirie, and also the remaining incidents were in the Cooper Basin. On page 62 there is a title Updates for incidents reported in 2014 and previous years. I have covered some of this in my submission, relating to the 3 ground water contamination sites by SANTOS. 2 of the incidents were blamed on 'outdated practices'. As the result of this, there were further investigations done by DSD into the potential for groundwater impacts at other sites that came into this category. **A staggering further 16 sites were identified in the Cooper Basin where impacts to groundwater have been confirmed by Santos**. I believe that in 20 years time, what is being practiced now in the industry will also be classed as

'outdated'. **Another 3 sites** were not considered to be the result of legacy practices. I did not see anything written in the report to suggest what these other 3 site incidents were related to. I also find it disappointing that most of the offenders for all the incidents I mention in the report, are not revealed.

On page 64, the Whyte Yarcowie to Port Pirie Pipeline lateral ruptured near the township of Gladstone, in the mid north of the state, in April 2015. This is a lateral to the Adelaide Moomba pipeline system. A metallurgical assessment was done, and the conclusion was that the pipeline failed due to a high pH stress corrosion cracking. Supplies were affected to Port Pirie and Whyalla for 8 days. The investigation of the incident is due to be finalized, or may have been finalized already this year (2016).

It is interesting to note that in the DSD Annual Report of the Technical Regulator, Gas 2014,15, for the House of Assembly, dated December 2015, on page 6, the following statement is written. See pdf for REPORT OF THE TECHNICAL REGULATOR - PARLIAMENT OF SOUTH AUSTRALIA.

"It is also noteworthy that the amount of gas consumed directly and in generating electricity is currently trending downwards."

UNITED STATES ENVIRONMENTAL PROTECTION AUTHORITY TAKEN TO TASK FOR DISMISSING EVIDENCE.

The U.S. Environmental Protection Agency Science Advisory Board (SAB) has finalized its review of the EPA's June 2015 draft study of fracking's impacts to drinking water resources. For over a year, A panel of 30 scientists, engineers and industry consultants have been reviewing the details of the 1,000-page draft report, for over a year. *"The panel has taken particular issue with a finding that seemingly came out of left field: the agency's statement that fracking has not led to "widespread systemic impacts" in the U.S."*

It was regarded that the EPA had dismissed fracking impacts stating there were no widespread systemic impacts, without any clear, scientific basis of support. The U.S. Environmental Protection Agency Science Advisory Board has taken the agency to task. Independent peer-reviewed studies and the EPA have identified many examples of contamination, such as spills, well cementing failures below ground, and complications with waste disposal. The EPA found there was around 15 spills every day somewhere in the U.S., yet chose to dismiss those daily incidents as not a sign of "widespread, systemic" problems.

"*Affected individuals, public interests groups, and now the independent EPA Science Advisory Board, comprised of the EPA's own scientists, are calling on the EPA to "clarify" and "quantify" the controversial "widespread, systemic" line, or drop the language altogether. The panelists joined affected individuals and various independent experts who submitted comments in taking issue with how the agency ignored three high-profile contamination cases in its study—notably Dimock, Pennsylvania; Parker County, Texas; and Pavillion, Wyoming. The agency's omissions were contentious in part because in each case, the EPA prematurely abandoned investigations. Now, the EPA SAB has recommended that the agency include detailed summaries of these critical cases."*

As I understand, the EPA chose politics over science. It also mislead the public, and one could say, the petroleum industry itself. The EPA draft report was quoted by industry at presentations for the inquiry, and what the industry has stated is now shown to be unreliable in regard to the EPA report. 51% of Americans, in a March 2016 Gallop Poll, showed they oppose fracking. Only 36% were for fracking. "*A recent peer-reviewed analysis of the science on unconventional oil and gas extraction, of*

more than 680 peer-reviewed studies, found that, "The great majority of science contains findings that indicate concerns for public health, air quality and water quality."

http://www.ecowatch.com/epa-science-advisory-board-fracking-study-water-contamination-1968795058.html

I have included the link if the committee would like to look at the document in its entirety, for the U.S. Environmental Protection Agency Science Advisory Board (SAB), and added some quotes here. There is much detail in the document of what the SAB require the EPA to do.

"Page 2: The SAB recommends that the EPA revise the major statements of findings in the Executive Summary and elsewhere in the final Assessment Report to clearly link these statements to evidence provided in the body of the final Assessment Report. The SAB also recommends that the EPA discuss the significant data limitations and uncertainties, as documented in the body of the draft Assessment Report, when presenting the major findings.

Page 3: These local-level impacts, when they occur, have the potential to be severe, and the final Assessment Report needs to better recognize the importance of local impacts. In this regard, the SAB recommends that the agency should include and critically analyze the status, data on potential releases, and any available findings from the EPA and state investigations conducted in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas, where many members of the public have stated that hydraulic fracturing activities have caused local impacts to drinking water resources.

The SAB is concerned that the EPA had planned to but did not conduct various assessments, field studies, and other research, and the SAB recommends that the EPA delineate these planned activities within the final Assessment Report and discuss why they were not conducted or completed.

For example, the agency should include additional major findings associated with the higher likelihood of impacts to drinking water resources associated with hydraulic fracturing well construction, well integrity, and well injection problems. These findings should discuss factors and effects regarding the severity and frequency of potential impacts from poor cementation techniques, hydraulic fracturing operator error, migration of hydraulic fracturing chemicals from the deep subsurface, and abandoned/orphaned oil and gas wells. The agency should also provide more information regarding the extent or potential extent of the effects of chemical mixing processes from hydraulic fracturing operations on drinking water supplies. The EPA should provide additional detail on the extent and duration of the impacts of spilled liquids and releases of flowback and produced waters when they occur. Furthermore, the agency should also include additional major findings associated with the effects on drinking water resources of large spill events that escape site containment, and sustained, undetected leaks.

Page 1 next section: In general, the SAB finds the EPA's overall approach to assess the potential impacts of hydraulic fracturing water cycle processes involved in oil and gas production on drinking water resources, focusing on the individual stages in the HFWC, to be comprehensive but lacking in several critical areas.

However, the SAB has concerns regarding various aspects of the draft Assessment Report and has recommendations for changes to its text and follow-on activities to address gaps that the SAB has identified.

Page 2: In its draft Assessment Report, the agency sought to draw national-level conclusions regarding the impacts of hydraulic fracturing on drinking water resources. The SAB finds that several major

summary findings do not clearly, concisely, and accurately describe the findings as developed in the chapters of the draft Assessment Report, and that these findings are not adequately supported with data or analysis from within the body of the draft Assessment Report. The SAB finds that these major findings are presented ambiguously within the Executive Summary and appear inconsistent with the observations, data, and levels of uncertainty presented and discussed in the body of the text.

The SAB expresses particular concern regarding the draft Assessment Report's high-level conclusion on page ES-6 that "We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States." The SAB finds that the EPA did not support quantitatively its conclusion about lack of evidence for widespread, systemic impacts of hydraulic fracturing on drinking water resources, and did not clearly describe the system(s) of interest (e.g. groundwater, surface water), the scale of impacts (i.e., local or regional), nor the definitions of "systemic" and "widespread."

I am sure the committee will be able to gather from this information, that what has been perpetrated as the result of the careless quote by the EPA, and quoted by the Petroleum Industry, needs to be ignored.

https://yosemite.epa.gov/sab/sabproduct.nsf/LookupWebReportsLastMonthBOARD/BB6910FEC10C01A18525800C00647104/$File/EPA-SAB-16-005+Unsigned.pdf

SA POWER PRICES: THE ANSWER ISN'T BLOWIN' IN THE WIND - OPINION by Hugh Saddler and Rod Campbell – printed with permission from Rod Campbell.

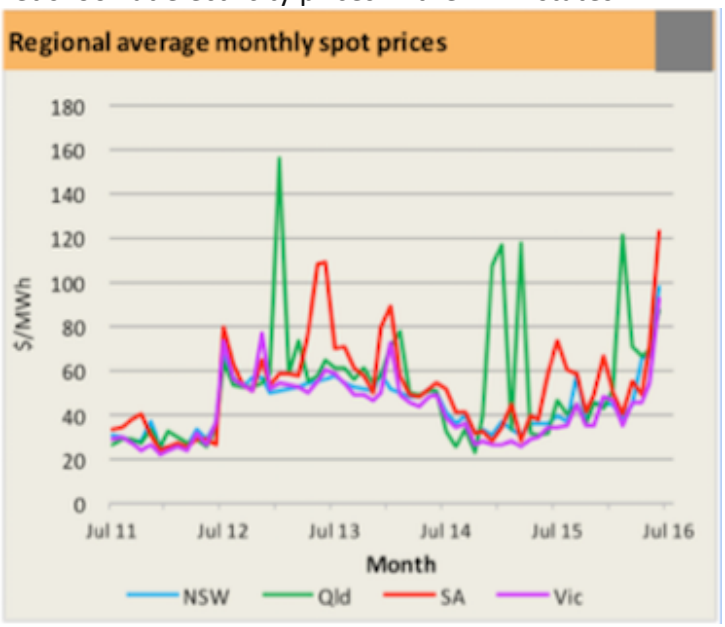
Renewable energy is being unfairly blamed for volatility in the energy market in South Australia, write Hugh Saddler and Rod Campbell. But if wind's not the culprit, what can be done to tackle power prices? An increasing proportion of SA's power comes from wind. This week's wild weather is bringing equally wild claims about South Australian electricity, prices and renewables. And it is just the latest battle in a longer war over changes to how we generate our power.

Remember when Tony Abbott famously said that Whyalla would be "wiped off the map" with a carbon price? It wasn't. But if you've followed reporting of electricity prices in South Australia lately, you could be forgiven for thinking that the entire state was about to fall into the Great Australian Bight. Hardly a week goes by without a headline like *Electric shock: SA business fears being stuck with high costs for years*, in which we learn that "the culprit [is] the Weatherill government's obsession with leading the nation in renewable energy." And statements like this, where we almost lose Whyalla. Again.

"Rising energy prices fuelled by South Australia's ambitious renewable energy target have helped send stricken Whyalla steelmaker Arrium cap in hand to governments seeking $150 million-plus in taxpayer aid." And in case you didn't remember, "South Australia's wind and solar power are among the main culprits." Groups such as the South Australian Council for Social Services are also worried about households' rising power bills.

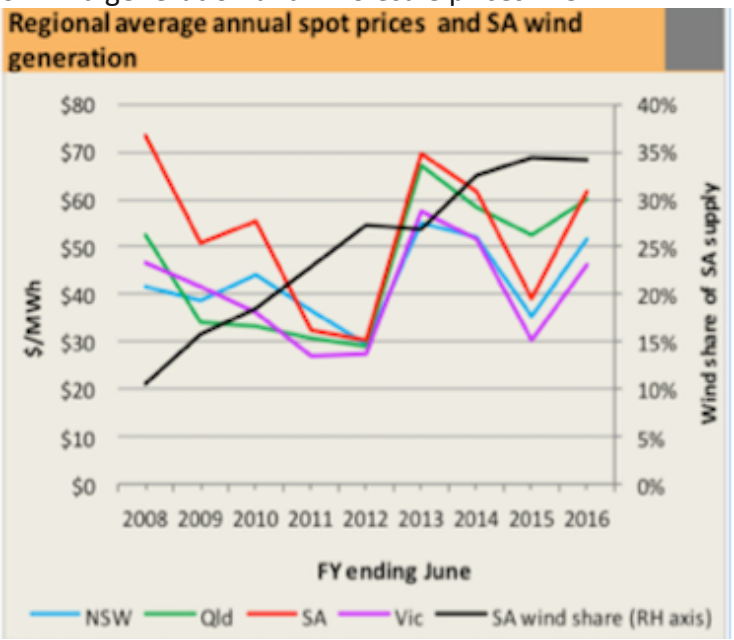
Before we re-start coal mining or go nuclear, let's take a closer look at what's going on. Are electricity prices higher in South Australia? Yes, as they are right across the National Electricity Market (NEM) right now. Are prices higher in SA than other states? Yes, but not by more than the small amount they have been for most of the history of the NEM (and before that, too). And are renewables to blame for either of these effects? No. The real reason that wholesale electricity prices are higher in SA than in the three eastern states is that the cost of conventional generation is higher. This is because SA does not have access to large, low-cost coal resources. SA's coal is low-quality and expensive compared to coal in Victoria, NSW and Queensland.

Let's look at electricity prices in the NEM states:



Source: Cedex July 2016, by pitt&sherry and The Australia Institute

We see that historically, SA prices have been mostly just a bit higher than the other mainland NEM states, particularly NSW and Victoria, while Queensland has also seen several price spikes.
That relationship has not changed. Average spot wholesale prices in each of the four mainland NEM regions (states) during June 2016 were higher than at any time during the carbon price period, with the sole exception of January 2013 in Queensland. So is SA's wind power to blame for the current wholesale market turmoil right across the NEM, including NSW, which has relatively little wind generation, and Queensland, which has none? Of course not. Looking over the whole period since comprehensive reporting of wind generation began, there is in fact no relationship between the share of wind generation and wholesale prices in SA.



Source: Cedex July 2016, by Pitt &Sherry and The Australia Institute

In the graph above, the black line shows a steadily increasing portion of SA power coming from wind. The other lines show the average annual spot price in each state. The average annual price in SA in 2007-08, when wind supplied only about 10 per cent of total demand, was higher than in 2015-16,

when it supplied nearly 35 per cent. So what is driving higher prices in South Australia and the other states? The two most important factors appear to be higher wholesale gas prices, partly caused by the fact that the east of Australia is now linked to Asian gas prices via new gas export terminals at Gladstone in Queensland, and lack of competition between non-wind generators. SA is particularly exposed to both factors. Following the closure of the Northern power station, it has become heavily dependent, during low wind periods, on gas generation, and almost all the gas generation is controlled by the two large "gentailers", AGL and Origin. Analysis of generation and prices in SA during June showed that the price when wind supplied less than 31 per cent of electricity was more than twice as high as when wind supplied more than 31 per cent.

So what can be done about this?

Unfortunately, the gas export genie will not go back into the bottle. There is now no breaking the link between Australian gas prices and world gas prices, ensuring prices will rise. More constructively we can work to make the electricity market more efficient. One change that would help is changing the way electricity prices are set in the NEM. Prices are currently set in half-hour blocks, based on the average of the five-minute intervals in those blocks. If this was changed so that prices were settled every five minutes, it would increase competition, and assist smelters that can manage their power demand as well as battery storage. This change would reduce prices and emissions. This change is currently being considered by the Australian Energy Market Commission. It will be interesting to see if the South Australian businesses, social service organizations and commentators so eager to blame renewables for high prices are prepared to support a change which would increase competition and reduce dependence on gas.

Hugh Saddler is the senior energy analyst at infrastructure consultancy Pitt & Sherry and Rod Campbell is the research director at think-tank The Australia Institute.

http://indaily.com.au/opinion/2016/07/14/sa-power-prices-the-answer-isnt-blowin-in-the-wind/

WORLD'S BIGGEST SOLAR AND BATTERY PROJECT TO BE BUILT IN ROXYBY DOWNS

In an article by Richard Evans, published in the Advertiser on 22nd July 2016, the Lyon Group plans to build the world's biggest solar and battery project in Roxyby Downs, commencing next year. It is planned to have up to 800,000 individual solar panels costing around $300 million, and generating 100 jobs during construction. It is known as the Kingfisher scheme. The project is being promoted as ground breaking, and ushering in greater efficiency and stability for solar power output. When power is required to be topped up, this will be through giant batteries housed in shipping container-sized units alongside the panels. Roxby Downs is recognized as one of the best solar resources in the country. Cheaper energy down the track is expected to be one of the benefits.

Green states: *"Investor pressure and economics are lining up behind solar and storage for Australia." "SA major energy users need an energy supply answer which reduces costs while also providing a good emission outcome. We think Kingfisher is a big part of the energy solution for the state."*

"The combined utility scale, solar and battery technology will allow large users to store solar generated electricity to provide the level of energy security not previously available at no capital cost to the resource company" he said. "*The project is expected to help companies reduce their emission footprint and can reduce costs, while guaranteeing a reliable supply of electricity for industrial users with large swing loads at no capital cost."*

There will be two stages: Stage 1, a 20MW solar PV plus minimum 2MW battery storage with around

160,000 panels is planned for early next year. Stage 2 will see an expansion to 100MW, a 20MW battery and 800,000 panels, with a completion due by late 2018. The 20MW battery to be used in Kingfisher stage 2 is the equivalent of 4000 Tesla home battery storage modules. It is expected that Kingfisher will connect into the National Electricity Market (NEM) grid at Roxby Downs. There is a similar 30 MW project being worked on by the Lyon Group, in Cooktown, Northern Queensland.

http://www.news.com.au/national/south-australia/lyon-group-plans-to-build-the-worlds-biggest-solar-and-battery-project-in-roxby-downs-starting-next-year/news-story/bb7ca285f08c1f09ada69a8b527f1264

ROADS COULD GENERATE SOLAR-POWERED ELECTRICITY

An article in the Sydney Morning Herald by Peter Hannam says that a proposal is underway for roads to generate solar-powered electricity. France-based Colas group has developed this system. The France-based Colas group is the global supplier of bitumen and other surface materials. The company has a promotional video showing the 'Wattway" solar road that uses photovoltaic cells. I have included the link below.

In 2005, Jean-Luc Gautler, a researcher at the Colas group, identified that most road surfaces are clear for 90% of the time. For the past decade, the company has been working with the French National Solar Energy Institute to develop solar panels that are sufficiently resilient and efficient in gathering those rays to warrant the cost of paving roads with them. In 2010, the experimental solar panels provided a good yield. In October 2015, the Colas group rolled out the Wattway product, ahead of the COP 21 summit in Paris. In June this year (2016), the Colas group unveiled trial Wattway sections in France.

The solar tiles are thinner than a dollar coin and measuring 1.26 square metres. Each polycrystalline silicon celled panel is 15 cm side. The panels have a coating of translucent resins and polymers, which protect the fragile photovoltaic cells. Crushed glass adds skid resistance. They can provide as much as 116 watts at peak efficiency. Efficiency is claimed at 15% versus 18% - 19% for conventional photovoltaic panels. It is expected to be cost competitive within a decade. Durability is expected to be between 10 and 20 years, depending on traffic.

The developers are aiming to roll out 1000 kilometres of solar roads within five years and are scouting for 100 test sites around the world. Both Queensland and Adelaide have indicated an interest in participating. Western Sydney is expected to follow. Colas has a subsidiary SAMI Bitumen Technologies company based in Sydney. *"20 square metres of the product laid on existing roads can supply enough electricity for a typical home, and 1 km could support about 5000 people,"* Mr. Retmullah said. The product has been tested to withstand at least 1 million truck tyre passes. It expects the tiles to have the durability of the pavement it covers.

Panels in car parks or lightly used tarmac sites may last as long as 20 years, a similar life to a rooftop system. Home driveways could be another option.

http://www.smh.com.au/environment/climate-change/roads-could-generate-solarpowered-electricity-under-proposal-20160810-gqp1y9.html

VICTORIA BANS UNCONVENTIONAL GAS PERMENANTLY AND EXTENDS THE BAN ON CONVENTIONAL GAS

On 30th August 2016, it was announced that the Victorian Government would be introducing

legislation to permanently ban exploration and development of unconventional gas, including coal seam gas and fracking. There will a moratorium on conventional gas extraction to be extended until 2020 and an inquiry into conventional gas. *'Premier Daniel Andrew said the ban would protect the reputation of Victoria's agriculture sector and alleviate farmers' concerns about environmental and health risks associated with hydraulic fracturing, known as fracking. "We've listened to the community and we're making a decision that puts farmers and our clean, green brand first," he said.'*

The geology aspects and faults are very similar in Victoria to South Australia. I believe that South Australia should follow in Victoria's footsteps and also ban conventional drilling in the South East.

http://www.abc.net.au/news/2016-08-30/victoria-to-ban-csg-fracking-and-unconventional-gas-exploration/7796944

MORE ON THE LAW (NOT IN PREVIOUS SUBMISSION)

HUMAN RIGHTS

The Australian Human Rights Commission Act 1986 needs to be taken into account by the Federal Government. 'No one shall be subjected to torture, or to cruel, inhumane or degrading treatment or punishment. No one shall be subjected without his free consent to medical or scientific experimentation', yet this is exactly how families are feeling in the vicinity of gas and mining operations. Their lives are degraded and they are the guinea pigs without giving permission. At the Federal Level, the Australian Government has an obligation, under international law, to respect, protect and fulfil human rights. The Government must also refrain from action that would breach people's rights.

https://www.humanrights.gov.au/our-work/legal/legislation

LEGISLATION FOR ACROSS AUSTRALIA

I believe that I have presented enough clear, concise, and irrefutable evidence here to show that legislation and regulations are totally inadequate and failing across Australia. Having the EPBC Act 1999, the Biodiversity Act 1993, and the Native Title Act at the Commonwealth level is meant to serve as a stop-gap, but appears ineffective in protecting our environment. I believe other legislation needs to be tightened at State level, and come in to play at a Federal level, to mitigate further unacceptable disasters that have already occurred across Australia.

Australia does not need any more Chinchilla episodes, both from the coal seam gas activities and underground gasification, and any further suicides. What the governments fail to recognise is the emotional toil and stress on many thousands of Australians, who are doing their very best at standing up for our precious land and water. I know I have had enough of this nonsense for 9 years and believe many others feel the same. Most of us don't get paid, and the financial costs are high. The personal sacrifices and man-hours have been enormous, and it would be great if we did not have this cloud over our head, and we could get on and enjoy family life and pleasures, and continue to farm, grow sustainable clean and green food, and enjoy life without the interference of inappropriate gas and mining activities.

http://www.todaytonightadelaide.com.au/stories/fracking-investigation Professor Ingraffea

http://www.todaytonightadelaide.com.au/stories/fracking-debate Anne and Mariann Lloyd Smith

http://www.abc.net.au/landline/content/2014/s3955001.htm Story on SE drill hole subsidence.

THE CLIMATE CHANGE AND GREENHOUSE EMISSIONS REDUCTION ACT 2007

This is an "*Act to provide for measures to address climate change with a view to assisting to achieve a sustainable future for the State; to set targets to achieve a reduction in greenhouse gas emissions within the State; to promote the use of renewable sources of energy; to promote business and community understanding about issues surrounding climate change; to facilitate the early development of policies and programs to address climate change; and for other purposes.*"

The objects of this Act include
(a) to assist in the achievement of ecologically sustainable development in the State by addressing issues associated with climate change and, in particular—
(i) by setting a target (the SA target) to reduce by 31 December 2050 greenhouse gas emissions within the State by at least 60% to an amount that is equal to or less than 40% of 1990 levels as part of a national and international response to climate change; and
(ii) by setting related targets (the renewable electricity targets)—

(b) to promote commitment to action within the State to address climate change through—
(i) the development of specific targets (as appropriate) for various sectors of the State's economy; and
(iii) the development of policies and programs for the reduction of greenhouse gas emissions and for other relevant purposes; and
(c) to encourage energy efficiency and conservation; and
(d) to promote research and development with respect to the development and use of technology to reduce or limit greenhouse gas emissions or to support adaptation to climate change, including by developing ways to remove greenhouse gases from the atmosphere; and
(e) to encourage the commercialisation of renewable energy and of technologies that will reduce or limit greenhouse gas emissions or support adaptation to climate change; and

(g) to encourage and facilitate business and community consultation and early action with respect to issues surrounding climate change; and
(h) to support measures to facilitate adaptation to circumstances that will inevitably be caused by climate change, including by supporting measures that will improve the ability of the community, species and ecosystems to deal with the effects of climate change; and
(i) to provide for reporting on progress being made within the State to meet the SA target, and other specific or interim targets associated with reductions in greenhouse gas emissions, and to meet targets associated with the use of renewable electricity; and
(j) to promote action within South Australia that provides consistency with national and international schemes designed to address climate change, including schemes that relate to emissions trading and emissions reporting: and
(k) to enhance the ability of the State to contribute to, and to respond expeditiously to, national and international developments associated with issues surrounding climate change.

Regarding the development of specific targets (as appropriate) for various sectors of the State's economy, sea level rise should be a main priority, given the figures in the issues paper that are predicted to cost South Australia as the result of sea level rise building and infrastructure impacts. Businesses and communities should be made aware of the impact of fossil fuel usage on climate change and sea level rise predicted to affect South Australia. This Act could be argued that what is expected to be acted upon and enabled, leaves no space for further unconventional gas production in South Australia, including the SE of SA.

The Act is expected to be guided by principals including:
(*a) the use, development and protection of the environment should be managed in a way, and at a*

rate, that will enable people and communities to provide for their economic, social and physical well-being and for their health and safety while—
(i) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations; and
(ii) safeguarding the life-supporting capacity of the environment; and
(iii) avoiding, remedying or mitigating adverse effects of activities on the environment;
(b) proper weight should be given to both long and short term economic, environmental, social and equity considerations in deciding all matters relating to environmental protection, restoration and enhancement;

If the government is serious about this very important Act, then to meet requirements as listed here, this cannot be achieved without the reduction of the fossil fuel industry, and the swap over to renewables, to avoid catastrophies or lessen impacts, including sea level rise.

Under interpretation, greenhouse gas emissions are defined as emissions of carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, sulphur hexafluoride, or any other gas brought within the ambit of this definition by the regulations.

Under Part 2, (7) The Minister must, as soon as practicable after - (b) taking action under subsection (6), prepare a report on the matter and cause a copy. I believe the minister is responsible for taking action to reduce green house gas emissions, therefore reduce the amount of gas being produced, including banning petroleum activities in the SE of SA.

Under Part 3—Administration
Division 1—The Minister 6—Functions of Minister
(1) The functions of the Minister under this Act are amongst other things, to *(c) to develop, adopt or promote policies or programs that are relevant to addressing climate change and the effects of climate change in accordance with the objects of this Act (and taking into account any specific requirements under this Act);*

I believe that the function of the Minister is to reduce the amount of fossil fuels used, and allow no further petroleum activities in the South East of South Australia. Section (g) also states "*to promote the commercialisation of renewable electricity technology and to support initiatives to develop a scheme to promote the generation and use of renewable electricity within the State, including by providing incentives to encourage South Australians to feed electricity generated from renewable sources into electricity grids;"*

In this same section – *"(n) to provide reports and to publish other information associated with climate change or initiatives or activities to address climate change, and to support public education in relation to climate change;"* Therefore the public should be educated on the impacts of fossil fuel use and sea level rise.

This is further backed up by *"(7) (j) information on any relevant rates, trends or impacts associated with climate change, with particular reference to any identified or assessed impacts of climate change on South Australia or any expected future impacts of climate change that have emerged or become increasingly relevant during the reporting period."*

Under the section on the Premier's Climate Change Council, *11—Functions of Council*
(2) The Council has other functions conferred by the Minister.
(3) (iii) costs associated with reducing or limiting climate change or greenhouse gas emissions, or with mitigating the effects of climate change or greenhouse gas emissions; and

(iv) costs associated with failing to take action to address climate change;

Therefore the Minister has an obligation to both the Parliament, and the public to show the costs if fossil fuel use is not reduced, including allowing further production of fossil fuels in the SE of SA, thus enhancing sea level rise.

Under Part 4—Policies, programs and other initiatives
14—Policies
(1) The Minister should seek to develop—
(a) policies that will assist in—
(i) reducing or limiting climate change or greenhouse gas emissions, or mitigation the effects of climate change or greenhouse gas emissions.

So in other words, the Minister has an obligation to curb the use of fossil fuels, knowing full well that fossil fuels are a primary cause of greenhouse gas emissions, thus impacting climate change and sea level rise.

c) policies that otherwise seek to secure the objects of this Act.

In other words, the policy of reducing greenhouse gas emissions must be adhered to, which ties in the Petroleum and Geothermal Energy Act 2000, as far as fossil fuels. Surely, when the world is facing a serious time as far as climate change, the Climate Change and Greenhouse Emissions Reduction Act 2007 MUST override the Petroleum and Geothermal Energy Act 2000, and take priority.

(2) The Minister must, in acting under this section—
(a) seek to achieve consistency with policies adopted by the Government to promote sustainability within the State; and (b) develop a policy or policies that demonstrate the Government's leadership in dealing with climate change through the management and reduction of its own greenhouse gas emissions, and through the development of related reporting mechanisms, in a manner that is consistent with the objects of this
Act;

Sustainability within the state also, I believe, means sustaining our food bowl and water, and sustaining our agriculture and doing what ever is necessary to limit greenhouse gas emissions to help reduce climate change. Sustaining agriculture, also means sustaining agriculture economically.

(f) seek to take into account other relevant frameworks, policies, programs and initiatives.

THE AUSTRALIAN CONSTITUTION

The Constitution is a document that was conceived by Australians, drafted by Australians and approved by Australians. The people of New South Wales, Victoria, South Australia, Queensland and Tasmania created government. They agreed to unite in one indissoluble Federal Commonwealth under the Crown of the United Kingdom of Great Britain and Ireland, and under the Constitution that was established.

https://jade.io/article/188377

According to the High Court of Australia - MASON CJ, BRENNAN, DEANE, DAWSON, TOOHEY, GAUDRON AND McHUGH JJ, In the case of *JOHN ANTHONY RIDGEWAY v. THE QUEEN (1995,) 129 ALR 41, 19 April 1995:*

"Governments are the agents of the people. Since the enactment of the Australia Act 1986 (U.K.), the powers of government in this country are derived from the people who are the ultimate sovereign (243)." Therefore, in my opinion, the government (at any level in Australia) should be acting on the will of the people. From the surveys that have been completed in the SE of SA, so far the findings are that 96% of the people want to live in a gasfield and invasive mining free community. This is the will of the people. Most people would say that this is purely about social license, but when one looks at **this clause in** the case of Ridgeway Versus the Queen, April 1995, and the Australian Constitution, the Government has to rule 'by the will of the people'.

According to Quick and Garron, The Annotated Constitution of the Australian Commonwealth on page 286, *"the truth is the supreme absolute and uncontrollable authority remains with the people."* In other words, those elected to government are the peoples' servants, and cannot rise above that role.

Section 51(xxxi)

"The Parliament shall, subject to this Constitution, have power to make laws with respect to the acquisition of property on just terms from any State or person for any purpose in respect of which the Parliament has power to make laws."

State Parliament approves the petroleum licenses for exploration and production. As I understand, in certain situations, such as under the Biosecurity Act (under review at present), The Environmental Protection Biodiversity and Conservation Act 1999, The Native Title Act 1993 and the Australian Human Rights Commission Act 1986, the Federal Government overrides the State Government. Although the government does not usually acquire properties that are encroached by Petroleum companies, but are responsible for allowing the petroleum companies on the properties (under the name of an allocated license), the farmers and landowners feel that they have 'lost' their properties.

Take for example what I have mentioned earlier in regard to the class action against both Linc Energy and the Qld. Government, because the government gave the go ahead to Linc Energy, they are regarded as implicated. Acquisition means the act of acquiring or gaining possession. Therefore it can be argued that the Petroleum companies have 'gained possession' of someone's land through the government to sink the drill holes and proceed with petroleum activities. If the farmer, landowner or community have objected to this activity, then in Constitutional Terms, I believe that it has not been done on just terms.

It is not just about the property that the farmers and community have owned for maybe generations. It is about risking their potable water, and the fact that contamination in water bodies has already occurred. It is about those aquifers dropping, which has occurred. It is about taking away certainty of a future, and a lifestyle that the farmers and community know and enjoy. It is about taking away community connections. It is about taking away community spirit. It is about taking away hope and justice. It is about taking away basic human rights**. Approving Petroleum licenses on properties where the farmers and community oppose any Petroleum activities can then be argued that it is not 'constitutional' as this has not been done "on just terms".**