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Submission from
Basin Sustainability Alliance

Productivity Commission inquiry into Non-financial barriers to mineral and energy resource exploration

March 2013

The Basin Sustainability Alliance (BSA) wishes to make this submission to the Australian Productivity Commission for consideration as part of its 12-month inquiry into the non-financial barriers to mineral and energy resource exploration. (*Productivity Commission Issues Paper Dec 2012: Minerals and energy Resource Exploration*).

This written submission is provided as a follow-up to the in-person meeting BSA representatives David Hamilton, Lyn Nicolson and Anne Bridle held with Productivity Commission representatives on 27 Feb 2013.

The Basin Sustainability Alliance is a Queensland-based group representing the concerns of landholders and rural communities in relation to the unprecedented scale and pace of development underway in the coal seam gas (CSG) industry in Queensland.

BSA's charter is focused on ensuring the sustainability of land and water resources for future generations - particularly highlighting the risk CSG development poses to the Great Artesian Basin. It also plays role as an advocate for landholders who are facing uncertainty and frustration of CSG development in their communities.

BSA members feel strongly that the Coal Seam Gas industry is steaming ahead in Queensland with an alarming lack of monitoring and research. Under the current systems, there is a real danger that CSG development will impact on health and communities and damage vital natural resources, and food and fibre production for future generations.

More information about BSA and its official charter can be found at: www.notatanycost.com.au.

BSA's key concerns are as follows:

Lack of Regulatory powers – ie. does the Qld Government have the power to act?

In November last year, BSA wrote to Queensland Deputy Premier and Minister for State Development Jeff Seeney to ascertain the capacity of the Government to recondition CSG activities that are deemed too environmentally harmful. BSA sought assurance from Deputy Premier Minister Seeney, that the Government has the power to stop CSG activities in a region if the risks are found to be high. (BSA's letter makes reference to a research paper by Nicola Swayne "Regulating coal seam gas in Queensland: lessons in an adaptive environmental management approach?" attached.)

Minister Seeney replied on 11 March stating that he had referred the letter to the Minister for Environment. The current lack of a response to this question is of concern to BSA.

Our question is - if water or any other environmental related impacts are greater than intended/significant or predictions of impact change for the worse – how does the Queensland Government wind back conditions for projects already approved in order to give assurance that water resources are not severely compromised?

Policy changes enabling industry

BSA is concerned that current legislation and policy is geared towards removing barriers to allow more streamlined approach to mining exploration, when it is our view that there is still currently not enough science and baseline information available to assess the true impacts that the coal seam gas industry will have on the future sustainability of our land and water resources.

Queensland State Government regulation leans towards industry self regulation and an adaptive management regime that BSA considers lacking.

Further, BSA is struggling to see linkages between scientific research currently commissioned or proposed and federal and state planning processes. In the face of uncertainty it is critical that new information/ science infers planning processes to the degree that failure to act may ultimately bear liability to governments.

Lack of communication to those bearing impact

Whilst a number of processes allow for public input into CSG development, the continual flood of environmental authority amendment applications (for CSG development) that we are now seeing in Queensland are beyond community capacity to track the potential and changing impacts and square off that the government has conditioned the impacts adequately. By sheer volume and scale of projects, those ultimately bearing the impacts of development are denied a voice.

Notification processes are lacking, where companies are only obligated to advertise "publicly" (ie. metropolitan newspaper public notice), and not make direct contact with landholders related to their tenure until such time as a CCA process commences..

Sustainability of our Water Resource

Landholders and the many communities that rely on groundwater must not have their access to water compromised. As a long term sustainability principle, no one should have reduced access to quality and quantity of water as a result of CSG activity.

In Queensland, CSG and mining proponents have a right of way to use and interfere with water. In the case of Petroleum holders this right is conferred under s185 of the Petroleum and Gas (Production and Safety) Act 1994. There are significant concerns about this right of way, which include, but are not limited to:

- Agricultural and other use in Queensland is highly regulated through resource operations plans and has been significantly curtailed through irrigation entitlement cutbacks to ensure long term sustainability. Current and proposed CSG development adds a major and unlimited water user to the equation in an already stressed system.
- In Queensland, there are no conditions in the Environmental Authority conditioning of Petroleum tenure holders around impact on groundwater.
- There is concern that the industry may not have the capacity to make good water impacts from CSG extraction, that is, in an already stressed system and with water impact to come from CSG industry development, from where will the water come to make-good impacts to water?
- Whilst the government calls on CSG companies to lodge risk management plans regarding their activities, the government does not have the capability nor resources to assess such reports.
- Whilst drilling data is received by government in a timely manner is not incorporated into the water modelling to predict impacts in a timely fashion, which may reduce capacity in modelling water impacts
- There is a time lag between cause (extraction) and affect (water impact).
- Water quality change is only protected by make-good if there is a decline in water that is associated with water quality decline. Otherwise the pathway for redress is through the a civil suit through EPA by water user.
- CSG Water Management Policy: there has been a change to incorporate beneficial use as first priority versus minimise/limit impact
- Beneficial use options put forward for Condamine Alluvium include substitution of licence entitlement for treated CSG water (virtual reinjection) versus reinjection. There is considerable community angst and scientific uncertainty around which method provides or enhances long term sustainability of the water resource.

Impact on our Land

BSA has serious concerns about the impact of CSG on liveability and viability of existing landholders and rural communities. Concerns include:

- CSG companies are inflexible in infrastructure placement (CSG wells, roads, pipelines and associated infrastructure)
- Petroleum tenure holders have the attitude that they hold a right of way inn their development plans and will therefore come in over the top of a landholder's business
- There are still no answers to the disposal of the hundreds of thousands of tonnes of salt to be produced as a waste product of the petroleum activities
- No evidence that some soils can be rehabilitated to the previous use and suitability class
- Fugitive emission is also a concern – some recent preliminary university studies found very high levels of methane in the atmosphere near CSG mines.

Landholder rights – Power imbalance

At the heart of BSA's concern about the land access framework is the imbalance of power. BSA believes that the current framework does not fully recognise or acknowledge that CSG exploration and production infrastructure and activities are not voluntary for landholders.

Issues include:

- Landholders not compensated for all loss (eg trauma and stress aspects)
- Currently some companies are offering "incentive payments" to bypass legal advice, or too get the landholder "over the line"; eg sign by a certain date.
- CCA unsigned: legals and other costs not recouped, therefore a landholder's financial capacity to protect viability could be eroded through inability to claim costs
- Accounting implications of signing CCAs
- Socio-economic impacts - impact on other businesses (eg staff etc)
- Distance from dwellings

Please refer to BSA's submission the Land Access Review for more details (attached).

Research Gaps

BSA has identified a number of gaps in baseline information and scientific research and is continuing to review its concerns in this area. Please refer to the list of Research Gaps prepared by Ruth Armstrong in late 2012 (attached).

CASE STUDY – A Landholder's experience

By way of example, BSA wishes to present the case study of Cecil Plains farmers Dave and Ruth Armstrong (author of this submission). The following outlines the experience of this farming enterprise in the context of the Productivity Commissions brief.

This case study provides comment on issues surrounding coal seam gas exploration in Queensland. The relevant state legislations pertaining to this industry in Queensland, to which this submission refers are as follows:-

- Queensland Petroleum and Gas (Production and Safety) Act 2004
- Queensland Water Act 2000
- Queensland Environmental Protection Act 1994

Ruth's story:

My husband and I are the owners of the property 'Yanco Farms', located on the Toowoomba-Cecil Plains Road between the North Branch of the Condamine River and Norwin on the Central Open Darling Downs in Queensland. The closest town to our farm, and to this unique inner Downs area is Cecil Plains. Our property in an intensively cultivated, fully integrated irrigation farm that grows sorghum, corn, sunflowers, soybeans, wheat, barley, chickpeas and cotton. Horticultural crops have also been grown on occasion

The central open Darling Downs is a dual crop agricultural ecosystem, capable of producing high quality, high yielding summer and winter crops each year. The combination of a mild climate, fertile, moisture retentive soils and access to water for irrigation produces an agricultural ecosystem that is world renowned.

In about 2008 or 2009, residents in our agricultural community east of Cecil Plains began receiving letters in the mail from Arrow Energy, inviting us to attend information sessions and view poster displays about their operations. Our community was generally aware that Arrow was operating a domestic coal seam gas facility at Grassdale, some 20 kilometres to the north-west (Figure 1). I did not attend any of these meetings personally, and very few members of my community did. At this time we were not aware that Arrow held exploration tenure over our farms and a related level 2 Environmental Authority.

In 2009, Arrow drilled two core holes east of Cecil Plains in the intensively cultivated agricultural region where I farm (Figure 1). The core holes were drilled in the railway reserve on state government crown land, so negotiations did not occur with any local landowner, and the first anyone locally knew what was happening was when the drill rigs showed up. It was at this time that our community became aware that the information sessions that Arrow were holding might not be about their domestic activities at Grassdale, and that they were exploring for coal seam gas in our community.

In March 2010, my husband was contacted by phone by an Arrow land liaison officer, who wanted to meet with us regarding Arrow doing a 6 well pilot project on our farm. We met with him two weeks later in April, where we were presented with a map of the proposed location for the pilot and one page of supporting information. We had a two hour discussion about the proposal. The

supporting documentation identified the tenure area as Authority To Prospect (ATP) 683 and described the reasons for drilling as follows:-

"The successful execution of previous drilling programs in the Bowenville block has proved coal thickness and gas contents. The Carn Brea pilot is the next step in field development planning which will gain the necessary production and operational knowledge to progress the development of the area. The project will extend the 2P reserves in ATP683P and demonstrate well deliverability. It will prove development concepts and also de-risk future development. With the ultimate aim of embarking on full scale field development across the Dalby South Block to help meet the domestic contracts and the need s of LNG trains."

After this meeting, I contacted the Department of Environment and Resource Management (DERM) as it was then called and spoke with the delegate of administering authority for the tenure area. I was informed that Arrow only had a level 2 Environmental Authority (EA) at that time, and that they would need a level 1 EA to conduct the pilot project because of the 40 megalitre holding pond required to store the produced water. The delegate provided me with a copy of the level 2 Environmental Authority.

It was only after this phone conversation, and through my own investigations that I identified the geographical extent of ATP683, understood the difference between an ATP and a Petroleum Lease (PL), researched the difference between a level 2 and a level 1 Environmental Authority, grasped which petroleum activities were permissible under level 2 and level 1 EA's, and did some research on the local geology to discover the presence of the Cecil Plains Syncline and the Horrane Trough, which is highly prospective for coal seam gas.

The delegate informed me that Arrow would need to apply to the department in order to obtain a level 1 EA, and that the application would involve a public submission process prior to grant. If I had not been informed of this, or if Arrow had chosen to contact my husband after the grant of a level 1 EA rather than before, then I am sure that I and anyone else in my community would never have had an opportunity to have any input into the approvals process for Arrow's exploration activities.

Throughout this time, Arrow also had a PL Application for part of ATP683 in with the Department of Natural Resources and Mines (DNRM). Our community was only informed of this development once the approval has been granted.

Currently, Arrow is in the EIS phase of their Surat Gas Project. ATP683 and the converted PL258 form part of this wider project. It is my understanding that projects under an EIS process generally proceed to full development if economic factors allow. In my assessment, if exploration uncovers an economically viable resource, and there are no state or federal matters of environmental significance to contend with, then the project will proceed to full scale development. From the perspective of a landowner in an exploration tenement, the entire process is most unsatisfactory.

There are several significant issues for my agricultural community with respect to large scale coal seam gas development. Firstly, the current land use is intensive. All farming businesses in the local area utilise every acre of the property for agricultural purposes. The uniform distribution of high quality soils means that extensive areas are under cultivation. There are no unutilised parts of the

farm that are available for positioning CSG infrastructure on. CSG development will have a direct impact on agricultural production.

The high clay soils will be rendered unusable if they are contaminated by produced CSG water. These soils will also suffer from compaction from large numbers of light and heavy vehicle movements which will result in a further decline in agricultural productivity.

This agricultural area is supported by a shallow alluvium – the Condamine Alluvium Aquifer (CAA). The CAA has been over exploited in the past, and bore owners have had cutbacks in entitlement in the order of 30%-50% in recent years in order to achieve sustainable extraction limits. The CAA is incised into the Walloon Coal Measures (WCM) (Hillier 2010 – report attached), which is the geological layer targeted for CSG production. In some areas there is little to no separation between the CAA and the WCM, and CSG extraction will cause water to move from the CAA into the WCM, creating further stress on the system.

There are also significant social impacts to consider from CSG development in the area east of Cecil Plains. The area is densely populated for an agricultural region, having been broken into 400 to 600 acre parcels when first developed. The district is also an active floodplain, and was historically flat and treeless. Residents have line of sight for five to ten kilometres over 360 degrees, so a gas field under construction and in production is going to have a significant ~~effect~~ impact on visual amenity.

The notion exists that CSG production, as opposed to open cut mining, can coexist with the current land use because it does not obliterate the current land use from the landscape, and per unit area, has a relatively small footprint in comparison. There is no evidence to support such a notion and there are other factors that will determine whether coexistence is possible. These include the intensity of the current land use, the extent to which the land can be returned to its previous use post development, the level of reliance of the current land users on groundwater and the risk posed to that groundwater, the population density of the community and geographic attributes of the landscape that can expose and screen the development.

Whether communities can coexist with CSG development is therefore not answerable with a single syllable. Rather, the various areas, communities and individual properties targeted for CSG development will have varying capacities to coexist and will sit somewhere on a scale depending on the factors mentioned above. It is unfortunately the case for my community that we sit at the high end of the scale for all of the risks – intensive land use on susceptible soils, groundwater dependent on an aquifer that will be negatively impacted, high population density in a landscape that exposes the development. Coupled with this is the fact that the area also contains a significant gas reserve. Andrew Faulkner, Arrow CEO has stated that somewhere between 25% and 40% of Arrow's gas within the Surat Gas Project area is located in the region above the Horrane Trough, east of Cecil Plains (Pers comm.).

Government and industry will argue that the environmental values mentioned above are afforded protection through the conditions of the tenure area's Environmental Authority. However, I find these conditions to be wanting. Firstly, there are no conditions in an EA which provide protection or limits to harm for land use. This is perhaps understandable given that this issue is outside the

scope of the EP Act. However, social impact assessments in proponent Environmental Impact Statements (EIS) consider agricultural land to be industrial land, and therefore they are regarded as low constraint, low risk areas for development, irrespective of their actual capacity to cope with CSG development.

Environmental Authorities will contain conditions which state that disturbed land must be rehabilitated to the previous use and suitability class. However, even though evidence may suggest that rehabilitation is not possible for certain soil types, the EA conditions do not reflect this distinction and activities are approved over the entire tenure area.

In Queensland, there are no conditions in EA's to limit impacts to groundwater from CSG activities, even though groundwater is recognised as part of the environment in the EP Act and is recognised as having environmental value for agriculture and as drinking water supply in the in the EP (Water) Policy 2009. Section 185 of the Queensland Petroleum and Gas (Production and Safety) Act 2004 states *that "A petroleum tenure holder may…..in the area of tenure (a) take or interfere with the water if taking or interference happens during the course of, or results from, the carrying out of another authorised activity for the tenure; Example 2 underground water necessarily or unavoidably taken during petroleum production.."* Because the P&G Act has this section, the Department of Environment and Heritage Protection (DEHP) do not place any conditions in EA's outlining the level of environmental harm that is acceptable to groundwater, both in terms of quantity and quality impacts.

Contrary to this situation, licenced users of the water must comply with their licencing requirements which generally set a volumetric limit on the amount of water that can be taken over a particular timeframe. In the Condamine Alluvium, licenced bore owners have been subjected to cutbacks in allocations of up to 50%, and to quote from the DNRM Central Condamine Alluvium Groundwater Management Area newsletter of 30th June 2012:-

"The groundwater resources of the CCAGMA continue to function in a "mined" condition with use significantly exceeding recharge and long term available supply. As a non-seasonally responsive aquifer, use in excess of recharge within the CCAGMA has and will continue to result in a progressive depletion of system storage, the key strategic asset of the groundwater system.

The only way this trend can be contained is through further water use reduction within the CCAGMA, hence the creation of the management area."

Bore owners in the scheme have been extremely co-operative with the regulator to achieve this end, and do so willingly in the knowledge that the desired result is a sustainable resource that can be enjoyed indefinitely. There is significant distress from groundwater users, both of the CAA and other aquifers of the Great Artesian Basin (GAB) regarding the petroleum industry's right to unfettered take of these resources, particularly in light of cutbacks that have taken place, moratoriums on further harvesting that are in effect and bore capping and piping schemes that have been undertaken in recent years. Either these groundwater systems are being mined unsustainably or they're not. In any case there cannot possibly be two sets of rules for different users, where the same resource is concerned.

There are conditions in EA's placing noise limits on petroleum activities. However, these noise limits can technically be exceeded until a "valid noise complaint" is made. If no complaint is made, then the petroleum activities continue. If a complaint is made, then the proponent must investigate. If it is found that noise limits have been exceeded then the petroleum tenure holder must come to an agreement with the person making the complaint. Options include erecting barriers, moving the activities further away or paying compensation. If the petroleum activities the subject of the complaint are already constructed, then compensation is the most likely mitigation strategy applied and the exceedence of the noise limits continues.

Once a gas field is established and water drawdown and gas extraction has commenced, it is extremely difficult to "switch it back off" without jeopardising the field's capacity to produce at a later date. Coupled with this is the fact that issuing tenure to a proponent is a more powerful exercise of statutory power than amending that right after it has been issued. There are no statutory public interest criteria by which the relevant Minister can refuse an application for grant of tenure. By departmental practice, it is assumed that development of the gas resource is in the public interest and that environmental considerations can be accommodated through conditioning (Geoff Edwards 2006). As the case study and accompanying information provided above shows, these assumptions are incorrect.

From my own personal experience, if the resource is in sufficient quantities and can be extracted economically, then exploration will transition to development. EA's are not adequate to protect environmental values from acceptable levels of harm, and current land uses, particularly in a rural climate, do not even factor in the equation. Significant amendments to the current regulatory regime are required. These include:-

Resource industry should not be exempt from planning instruments and should fall under the same planning authorities as every other land use;

Resource industry should not be exempt from water resource operation plans;

The State must undertake detailed environmental and social assessments for areas the subject of tenure allocation prior to issue of initial exploration tenure.

There has been a noticeable shift in public sentiment surrounding resource development, particularly where it interfaces with agriculture. While the resource extractive industries are considered a valuable part of our economy and society, it is no longer palatable for development to occur wherever there are resources to be harvested. The wider community now considers that resources development should be strategic and give greater regard to other valuable sectors of our society including agriculture and the environment.

It is indefensible that the resource sector is exempt from water resource plans, whilst other legitimate users of those water resources do so under the authority of a licence with the objective to achieve sustainable use and setting of threshold volumetric limits to water extraction. It does not sit well with water users and the wider community that they must achieve sustainable take of groundwater, whilst there is on the other hand no limit to the quantity or quality impacts that petroleum tenure holders can have on the very same water resources.

If the regulator will not introduce mechanisms to halt resources development once threshold limits of environmental harm have been reached, then it is essential that the State undertake comprehensive social and environmental assessments of the risks from resources development prior to the issuing of the initial exploration tenure. Any time after then is too late, if a region is later deemed to be unsuitable for resource activities, other than for the case where issues of national environmental significance are triggered under the EPBC Act. If an area is subsequently made available for tenure allocation, then comprehensive baseline environmental and social data must be obtained and made publicly available. These baseline environmental assessments would necessarily provide information on issues of national environmental significance as per the Australian EPBC Act. This information would be of benefit to explorers that are considering applying for tenure. Knowing that an area was of environmental significance would be a valuable decision making tool for the application.

Are the processes and conditions placed on exploration activities to access private land and Crown land where mining exploration is permitted, unnecessarily onerous? Are there particular examples of such processes and conditions?

From a land owner perspective, the conditions placed on exploration activities are not onerous. Rather they are completely unsatisfactory. Generally, the realisation that a land owner's land is the subject of exploration rights by a resource company occur when the resource company first contacts the land owner seeking access. The land owner will be at a distinct disadvantage. He will not be familiar with the relevant laws governing the activities. He will not understand the nature of the activities proposing to be undertaken. He will be completely taken by surprise and unprepared for the exploration activities proposed. The laws governing the negotiation between the parties regarding access are distinctly one sided, and the land owner may incur costs that are not necessarily recoverable.

It is essential that at the time of grant of tenure that all land owners within the tenure area are notified of the decision, provided with a map of the tenure area and are provided with information about the activities that have been approved. The land owner will then be in a position to do further research on the proposed activities if he so chooses and be prepared for an initial contact if and when it comes.

How can the mineral and energy exploration sector coexist with other types of land use, such as agriculture? Are the additional processes and conditions placed on exploration activities necessary to ensure agricultural production is protected? Are current government policies and legislative responses based on a robust and transparent account of the costs and benefits of different types of land and aquifer use?

The mineral and energy exploration sector cannot coexist with other types of land use, such as agriculture, without first having identified all of the various forms of agriculture that exist in the tenure area. There may be several different types of agricultural land use occurring in a tenure area and each one will have varying issues regarding the capacity for coexistence. Even though

exploration activities are generally less invasive and impactful than full scale production, they will have an impact, and will impact on different agricultural land uses to varying degrees. After the land uses have been identified, an assessment of the potential impacts of the proposed exploration activities on each form of agriculture must be made. This level of detail will inform the location, timing and type of exploration activities to be undertaken and the ability for the impacts to be successfully mitigated.

Generally, the processes and conditions placed on activities with regard to their impacts on agriculture refer to production activities and not exploration activities. However, there is a need for further conditioning of exploration activities where the current land use will be significantly impacted eg. Seismic activity during crop growing, pilot CSG activity on intensive current land use.

It is my understanding that the current government policies and legislative responses do not in any way account for the costs and benefits of different types of land and aquifer use, particularly in regard to exploration. As previously mentioned, no baseline assessments of any kind are conducted prior to issue of exploration tenure.

Page 22 Environmental Issues

"Non-invasive exploration activities, often conducted at the start of projects, may have little or no environmental impact."

I must disagree with this statement. All exploration has an impact and requires the signing of a Conduct and Compensation Agreement between the land owner / occupier and the tenure holder. This in itself is a major impact, and will cost the land owner time and money. The current status of the Queensland legislation gives an explorer the right to access land, even without an agreement in place. A landowner can only recoup his costs after an agreement has been reached, and the very essence of compensation is that it is payment for losses incurred, and not an additional source of income. So all exploration has an impact, and it is a rare land owner that will negotiate an agreement that makes him better off for the access.

Whilst some exploration activities may be considered non-invasive and have little or no environmental impact in some areas, the same exploration activities would be very invasive and have major environmental impact elsewhere. Seismic activities on an intensive cultivation enterprise will be substantially more impactful than the same activities on an extensive rangeland grazing property. Similarly, a 5 well pilot project on a 40,000 acre broadacre dryland cropping farm is substantially less invasive than the same activity immediately adjacent to a feedlot enterprise. (See photos – figures 2 and 3)

Are the environmental approval processes and requirements of the states and territories commensurate with the environmental risks posed?

As has been previously mentioned in this submission, the state environmental approval process and requirements are woefully inadequate for the protection of environmental values. DEHP in Queensland places no conditions in EA's for the petroleum industry regarding impacts on

groundwater, even though the petroleum activities, especially production activities will have significant, and in some cases, catastrophic impacts on groundwater.

It is apparent that there is a natural progression from exploration to production and very little if no ability to halt the progress to production if the resource satisfies the criteria of the tenure holder. At a federal level, the EPBC Act has some capacity to influence the process, but at a state level, the DEHP, through the EA process, seeks only to place limits on environmental harm where it can, and in some instances, not at all.

Further contact

BSA committee members are happy to be contacted further to discuss the matters raised in this submission. The initial contact point should be the author of this submission Ruth Armstrong as per contact details on cover page.

ATTACHMENTS (included as one PDF attachment in email)

1. BSA letter to Deputy Premier, Minister for State Development Hon. Mr Seeney, RE: Power of Government to cease activities that are deemed environmentally harmful, 27th November 2012

2. Reply from Deputy Premier, Minister for State Development Hon. Mr Seeney, 11TH March.

3. Swayne, Nicola (2012) Regulating coal seam gas in Queensland : lessons in an adaptive environmental management approach? Environmental and Planning Law Journal, 29, pp. 163-185.

4. IS THERE A DROP TO DRINK? An Issues Paper on the Management of Water Co-produced with Coal Seam Gas By Geoff Edwards Principal Policy Officer, Mining and Resource Strategy Queensland Department of Mines and Energy

5. Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River, John Hillier, August 2010

6. BSA LAND ACCESS REVIEW SUBMISSION, 19 December 2011

7. Research Gaps – Ruth Armstrong 2012

8. KMZ file – gas wells (Google Earth)

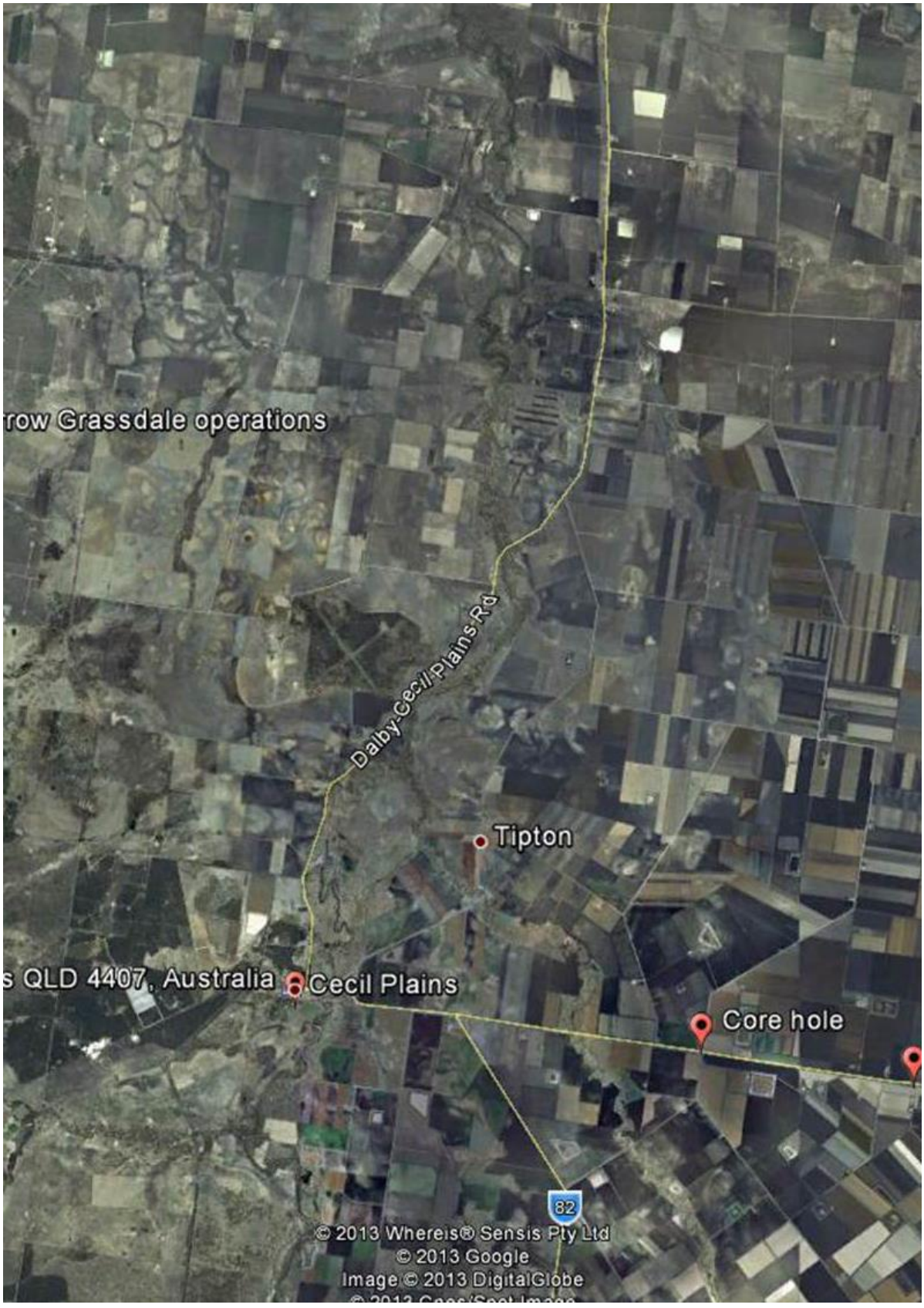
row Grassdale operations
Dalby-Cecil Plains Rd
Tipton
s QLD 4407, Australia
Cecil Plains
Core hole
82
© 2013 Whereis® Sensis Pty Ltd
© 2013 Google
Image © 2013 DigitalGlobe

Figure 1

Figures 2 and 3: Example of a CSG exploration well footprint. This demonstrates their incompatibility with intensive cultivation.

bsa
basin sustainability alliance

27th November 2012

Deputy Premier, Minister for State Development
Hon. Mr Seeney, MP
PO Box 15009
City East Qld 4002

Dear Deputy Premier,

RE: Power of Government to cease activities that are deemed environmentally harmful

We understand that the Queensland Gasfields Commission plans to commission scientific studies to understand the risk to aquifers of CSG development particularly with respect to the Condamine Alluvium. In the event that these studies uncover an unacceptable risk to the aquifers, BSA seeks assurance from you as Deputy Premier and Minister for State Development, that the Government has the power to stop CSG activities in a region if the risks are found to be high.

Whilst we recognise that petroleum tenure holders, Government and communities have different thresholds for what constitutes unacceptable harm or risk, we firstly request clarification on State Government's capacity to act.

Secondly, we seek to understand that if the Government does indeed have the power to act, then how will it decide when to act?

We understood that the whole idea of the Adaptive Management Regime was to enable government to intervene and halt activity where necessary, if risks became unacceptable. This was the basis on which the community assumed Government allowed the industry to continue.

BSA notes however the findings from the recent paper entitled "Regulating Coal Seam Gas in Queensland: Lessons in an Adaptive Environmental Management Approach" by Dr Nicola Swayne (see attached document). She concluded that

> *"A radical paradigm shift in the Queensland regulatory approach would be required for an effective adaptive environmental approach to occur. This would require, among other matters, that the adaptive management approach be integrated into statutory provisions for the approval and management of CSG projects .....a truly adaptive environmental management approach must be able to embrace the hard decisions that go with "learning by doing" including the ultimate decision of ceasing CSG activities in Queensland in the face of significant information gaps and/or an unacceptably high risk of cumulative adverse impacts."*

We seek your reassurance on this point. Is Dr Swayne right on this issue? If so, does the government propose to take such a "radical paradigm shift" in the Queensland regulatory approach so that it can make the ultimate decision of ceasing certain CSG activities in Queensland if faced with significant information gaps and/or an unacceptably high risk of cumulative adverse impacts?

As adaptive management is a centrepiece of the Governments strategy for dealing with CSG impacts, we look forward to your response to the extremely important issue.

Yours sincerely,

David Hamilton
Chairman
Basin Sustainability Alliance
www.notatanycost.com.au

CC:

Minister for Environment and Heritage Protection, Hon Andrew Powell MP

Minister for Natural Resources and Mines Hon Andrew Cripps MP

Queensland Gasfields Commission Chairman Mr John Cotter.

Queensland Government

Office of the Hon Jeff Seeney MP
Deputy Premier
Minister for State Development, Infrastructure and Planning

Our ref: MC13/794
DH060313

11 MAR 2013

Mr David Hamilton
Chairman
Basin Sustainability Alliance
PO Box 180
DALBY QLD 4405

Dear Mr Hamilton

The Honourable Jeff Seeney MP, Deputy Premier, Minister for State Development, Infrastructure and Planning, has asked me to thank you for your letter about the CSG development at Condamine Alluvium.

As this issue falls within the portfolio responsibilities of the Honourable Andrew Powell MP, Minister for Environment and Heritage Protection, I have forwarded a copy of your letter to his office for consideration.

Yours sincerely

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REGULATING COAL SEAM GAS IN QUEENSLAND: LESSONS IN AN ADAPTIVE ENVIRONMENTAL MANAGEMENT APPROACH?

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The current regulatory approach to coal seam gas projects in Queensland is based on the philosophy of adaptive environmental management. This method of "learning by doing" is implemented in Queensland primarily through the imposition of layered monitoring and reporting duties on the coal seam gas operator alongside obligations to compensate and "make good" harm caused. The purpose of this article is to provide a critical review of the Queensland regulatory approach to the approval and minimisation of adverse impacts from coal seam gas activities. Following an overview of the hallmarks of an effective adaptive management approach, this article begins by addressing the mosaic of approval processes and impact assessment regimes that may apply to coal seam gas projects. This includes recent Strategic Cropping Land reforms. This article then turns to consider the preconditions for land access in Queensland and the emerging issues for landholders relating to the negotiation of access and compensation agreements. This article then undertakes a critical review of the environmental duties imposed on coal seam gas operators relating to hydraulic fracturing, well head leaks, groundwater management and the disposal and beneficial use of produced water. Finally, conclusions are drawn regarding the overall effectiveness of the Queensland framework and the lessons that may be drawn from Queensland's adaptive environmental management approach.

INTRODUCTION

Following the comparative success of Coal Seam Gas (CSG) operations in the United States, there has been significant interest in the development of CSG reserves internationally and within Australia to take advantage of the "cleaner-burning fossil fuel that could enhance energy independence, reduce emissions and serve as a bridge fuel to a renewable energy".[1] In

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addition to these benefits, the development of CSG reserves also has the potential to offer job creation and economic benefits.[2] There is significant CSG exploration currently underway in Queensland, in particular from the Bowen and Surat Basins (the latter being part of the Great Artesian Basin). The last 10 years have seen significant growth in the Queensland CSG sector encouraged, in part, by the Queensland Gas Scheme. In May 2011 the Premier of Queensland heralded the new "Gas Age" for Queensland, announcing that the CSG industry would generate $9 billion per annum in exports, more than $6 billion in state revenue and would result in creating over 6000 jobs over the next 25 years.[3]

CSG production involves accessing CSG that is trapped on the surfaces and in the fractures of a coal seam by groundwater pressure. [4] The gas is released by removing the groundwater from the coal seam and pumping it to the surface where it becomes "CSG water".[5] These removed substances are then piped to a compressor station where the CSG water is extracted and removed for treatment.[6] Two of the most significant issues to be addressed in the regulation of CSG are environmental impacts and impacts on local landholders. Environmental issues include the risks from hydraulic fracturing, groundwater contamination concerns and risks associated with the management and disposal of large volumes of produced water from the CSG extraction process.[7] The cumulative effects of multiple CSG projects in particular on surface and groundwater systems "are not well understood".[8] As noted by the National Water Commission (NWC), "if not adequately managed and regulated, [the CSG industry] risks having significant, long-term and adverse impacts on adjacent surface and groundwater systems".[9] Local landholders could also be significantly impacted through disruption of land-use practices, surface impacts (including subsidence), air, water

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[1] Sakmar S, "The Global Shale Gas Initiative: Will the United States Be the Role Model for the Development of Shale Gas Around the World" (2011) 33:2 *Houston Journal of International Law* 370 at 399. See also Clark T, Hynes R and Mariotti P, *Greenhouse Gas Emissions Study of Australian CSG to LNG* (WorleyParsons, April 2011).
[2] Sakmar, n 1 at 399.
[3] Premier and Minister for Reconstruction, The Honourable Anna Bligh, "Premier Heralds New 'Gas Age for Queensland'" (27 May 2011), http://www.cabinet.qld.gov.au/mms/StatementDisplaySingle.aspx?id=74946 viewed 6 March 2012.
[4] Australian Government, "Onshore Co-produced Water: Extent and Management" (National Water Commission, RPS Australia East Pty Ltd, Waterlines Report Series No 54, September 2011) (NWC Co-produced Water Assessment), at 4.
[5] NWC Co-produced Water Assessment, n 4 at 5.
[6] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [6].
[7] Sakmar, n 1 at 399-404.
[8] National Water Commission, "Position Statement: Coal Seam Gas and Water" (December 2010, Australian Government) at 1.
[9] National Water Commission Position Statement, n 8 at 1.

and soil contamination, and other social and economic impacts.[10] As a result of the substantial risk, uncertainty and significance of potential impacts, and the long time periods for both emergence and possible recovery, the NWC has called for "an adaptive and precautionary management approach" to be adopted in relation to CSG projects in Australia.[11]

The Queensland Government has asserted that the Queensland regulatory approach is based on the principles of adaptive environmental management. This approach recognises the uncertainty surrounding the impacts of CSG activities and puts in place a system "to monitor and instigate change where necessary".[12] It is essentially an approach of "learning by doing" which is heavily reliant on the implementation of a systematic approach to continuous monitoring, evaluation and enhancement of the regulatory framework. The purpose of this article is to critically analyse the Queensland regulatory approach to CSG to determine whether it is likely to be effective in addressing the range of impacts associated with CSG projects. This article begins by outlining the key hallmarks of an effective adaptive environmental management approach. It then turns to consider each of the key components of the regulatory framework for CSG projects in Queensland starting with the mosaic of approval processes and impact assessment regimes that may apply. This includes an evaluation of the likely effect of recent Strategic Cropping Land reforms on the approval of projects. This article then turns to a critical review of the preconditions for land access in Queensland and the emerging issues relating to the negotiation of access and compensation agreements for CSG activities on land. The following sections undertake a critical review of the environmental duties imposed on CSG operators in relation to the possible adverse environmental impacts of CSG activities. Provisions relating to the use of hydraulic fracturing are evaluated alongside duties to report the use of fracking and presence of well head leaks. Queensland's approach to the management of groundwater impacts, and its explicit adoption of the principles of adaptive environmental management for this issue, are also evaluated including the "make good" obligations imposed for bore impacts. The article then turns to an assessment of the Queensland provisions for the management of extracted CSG water including the range of approval requirements relating to the beneficial reuse and

[10] National Water Commission Position Statement, n 8 at 1.
[11] National Water Commission Position Statement, n 8 at 1.
[12] Queensland Government, "Adaptive Environmental Management Regime for the Coal Seam Gas Industry" (Department of Environment and Natural Resources, 2011) at 1 (Queensland Adaptive Environmental Management Regime Policy).

third party supply of the CSG water. Finally, this article brings the analysis together to draw conclusions on the likely effectiveness of the Queensland regulatory framework and the lessons, if any, that can be drawn from the use of this adaptive environmental management approach in Queensland.

WHAT ARE THE HALLMARKS OF AN ADAPTIVE ENVIRONMENTAL MANAGEMENT APPROACH?

It has been said that "few concepts in environmental management are both as widely promoted and as widely misunderstood as adaptive management".[13] The core focus of adaptive environmental management is the concept of "learning by doing" and it has traditionally been applied to complex environmental problems where ecological uncertainty is present.[14] Adaptive environmental management does not have a particularly strong track record, mostly owing to it being adopted as an overarching management goal without the establishment of the other essential hallmarks required for an effective adaptive environmental management approach.[15]

Adaptive Management is designed to assist managers to "learn about complex ecological systems by monitoring the results of a suite of management initiatives".[16] Accordingly:

> it is an approach that ensures management not only plans and carries out actions to achieve objectives, but also measures the results so that everyone can see what's working and what's not, and consequently make informed decisions and adjustments to enhance the achievement of objectives and the delivery of desired outcomes.[17]

To be successful, the regulator must be able to process the necessary information and draw meaningful conclusions.[18] It must be clear who decides how and when management practices

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[13] Gregory R, Ohlson D and Arvai J, "Deconstructing Adaptive Management: Criteria for Applications to Environmental Management" (2006) 16(6) *Ecological Applications* 2411 at 2411.
[14] Gregory et al, n 13 at 2412-2413.
[15] Gregory et al, n 13 at 2411.
[16] Gregory et al, n 13 at 2412.
[17] Jones G, "The Adaptive Management System for the Tasmanian Wilderness World Heritage Area – Linking Management Planning with Effectiveness Evaluation" in Allan C and Stankey G (eds), *Adaptive Environmental Management* (Springer, Netherlands, 2009) p 228.
[18] Pahl-Wostl C, "Requirements for Adaptive Water Management" in Pahl-Wostl C, Kabat P and Moltgen J (eds), *Adaptive and Integrated Water Management* (Springer, Dordretch, 2007) p 4 .

will be changed, based on that evidence and why.[19] It will not be successful if used by management agencies as a basis for postponing difficult decisions that need to be made in the face of resource constraints and scientific uncertainty.[20]

It is important to ensure that there is sufficient flexibility and responsiveness within the broader regulatory framework to allow the agency to alter its regulatory approach in response to the information and conclusions established through the adaptive management approach.[21] The absence of this is likely to lead to "costly implementation failures".[22] Examples of successful adaptive management projects to-date have generally relied on the project being small-scale and limiting itself to a single question.[23] Clearly, adaptive environmental management is not a "one size fits all" solution.[24]

A successful adaptive environmental management approach requires significant time and effort, and involves long time frames and high investment of resources to provide the necessary institutional capacity within the managing agency to deliver the adaptive management strategy.[25] It is not a decision-making framework nor does it make the decision making process easier.[26] In fact, "in many cases it can make the decision process harder because it embraces complexity and presents and evaluates alternative options on the assumption that decisions will be made and enacted, rather than ... avoided".[27] However, it does have an important role to play in the decision framework. To enhance the role of adaptive management, the evaluation and learning processes should be formally *integrated* into the management regime.[28] This means that the objectives of the adaptive management framework should be clearly specified in the relevant legislation.[29] Similarly, the formal requirements for evaluation and reporting on the effectiveness of the management approach should be included as part of the legislative framework.[30] This includes clearly defining:

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[19] Pahl-Wostl, n 18, p 4.
[20] Gregory et al, n 13 at 2411.
[21] Gregory et al, n 13 at 2421.
[22] Gregory et al, n 13 at 2423.
[23] Allan C, "Can Adaptive Management Help Us Embrace the Murray-Darling Basin's Wicked Problems" in Pahl-Wostl C, Kabat P, and Moltgen J (eds), *Adaptive and Integrated Water Management* (Springer, Dordretch, 2007) p 69.
[24] Gregory et al, n 13 at 2412.
[25] Jones, n 17, p 251.
[26] Argent R, "Components of Adaptive Management" in Allan C and Stankey G (eds), *Adaptive Environmental Management* (Springer, Netherlands, 2009) p 26.
[27] Argent, n 26, p 26.
[28] Pahl-Wostl, n 18, p 18; Gregory et al, n 13 at 2413.
[29] Jones, n 17, p 256.
[30] Jones, n 17, p 256.

- What are the management objectives and the key desired outcomes for the ecological system?[31]

  This should include both objectives for the system responses and for filling any gaps in information or knowledge about the system.[32] If these objectives cannot be articulated, owing to the absence of critical data or knowledge, then "the adaptive management activity is either delayed while data are gathered or knowledge is generated, or frustrated by an inability to describe the system".[33]
- What are the appropriate strategies and actions to be taken to achieve the objectives and key desired outcomes?[34]

  Where there are information gaps, this may require managers to choose actions which provide the greatest learning about the system rather than taking the traditional approach of choosing those actions which appear likely to cause the least harm.[35]
- What range of potential performance indicators can be used to monitor or measure the effectiveness of the management approach?[36]

  For example, what are the indicators for a change in management approach?
- How will what is learnt be used in deciding what to do?[37]

  For example, how will findings of monitoring and evaluation be reported in a transparent and credible manner?[38] And critically, who will be responsible for adjustments in the management approach in response to the results of the evaluation?[39]

How does the Queensland regulatory model compare to these hallmarks of an effective adaptive environmental management approach? There is a complicated set of legal arrangements in Queensland with seven different pieces of legislation to be applied in conjunction with a series of statutory guidelines and dozens of Queensland Government policy documents. Much of this is the result of 2010 legal reforms which inserted new CSG provisions into existing legislation while also picking up and moving other obligations which now fall under the jurisdiction of different authorities. Many of these changes are the result of

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[31] Jones, n 17, p 237.
[32] Argent, n 26, p 14.
[33] Argent, n 26, p 20.
[34] Jones, n 17, p 237.
[35] Argent, n 26, p 14.
[36] Jones, n 17, p 239.
[37] Argent, n 26, p 14.
[38] Jones, n 13, p 240.
[39] Jones, n 13, p 240.

the Queensland Government enacting an "adaptive environmental management approach" to the approval of CSG activities in Queensland. [40] The adaptive management approach in Queensland is reflected in various policy statements released by the Queensland Department of Environment and Resource Management. Accordingly, the implementation of the adaptive management approach is not integrated into the statutory decision making processes but simply superimposed onto the existing legal duties.

The Queensland approach is said to recognise the uncertain impacts of CSG activities and puts in place a system "to monitor and instigate change where required".[41] The object of this approach is to "ensure regulation responds to what happens on-the-ground and that the environment is protected, even in unforeseen circumstances".[42] The Queensland Government considers that the current model will allow CSG projects to proceed while protecting the environment. However, it is clear that the Queensland regulatory approach is one that is designed to *facilitate* these resource extraction projects while *assuming* the regulatory approach will be able to be changed, to an appropriate level and within a sufficient timeframe, to avoid any adverse environmental impacts. This is a very ambitious undertaking.

RIGHTS TO EXTRACT CSG IN QUEENSLAND

CSG in Queensland is the property of the State and royalties and annual rent are payable for the extraction of CSG.[43] Commercial CSG extraction was previously allowed in Queensland under the terms of the mining lease but this is no longer the case.[44] Now only incidental CSG extraction is permitted under coal or oil shale mining tenements in Queensland.[45] Commercial CSG production requires petroleum tenure under the *Petroleum and Gas (Production and Safety) Act 2004* (Qld)[46] or the *Petroleum Act 1923* (Qld).[47]

The approval process for a petroleum lease includes the usual requirements that apply to petroleum projects including requirements for an approved work program and development

[40] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.
[41] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.
[42] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.
[43] *Petroleum and Gas (Production and Safety) Act 2004* (Qld), s 26 (P&G Act 2004 (Qld)).
[44] *Mineral Resources Act 1989* (Qld), Pt 7AA, Div 8.
[45] *Mineral Resources Act 1989* (Qld), Pt 7AA.
[46] P&G Act 2004 (Qld), s 800.
[47] This article will address the operation of the P&G Act 2004 (Qld) only as this applies to all new applications in Queensland.

plan as well as additional obligations relating specifically to the protection of overlapping tenures in the proposed CSG area.[48] This includes a requirement that the applicant for a petroleum lease submit a CSG Statement that addresses the "CSG assessment criteria" which includes the protection of the legitimate business interest of the existing tenement holders and avoiding impacts on the future development of those resources.[49]

ENVIRONMENTAL APPROVALS FOR CSG PROJECTS

An application for a petroleum authority under the *Petroleum and Gas (Production and Safety) Act 2004* (Qld) will be considered in parallel with an application for the required environmental authority under the *Environment Protection Act 1994* (Qld). An environmental impact statement (EIS) may be carried out voluntarily or where it meets the trigger criteria under the guidelines of the Queensland Department of Environment and Resources Management.[50] In Queensland, the petroleum activity may be classified as a level 1 or level 2 petroleum activity and be either code compliant or non-code compliant.[51] Classification is based on risk of environmental harm. For level 1 activities there are a number of triggers including whether the petroleum activity is likely to have significant impacts on a category A or B environmentally sensitive area or is carried out on a site containing a regulated dam.[52]

For the most part, CSG projects are likely to fall into the category of level 1 petroleum activities particularly if they are large scale involving construction of pipelines. Recent amendments to the *Environment Protection Act 1994* now require all proposed level 1 CSG activities to develop an Environmental Management Plan (EMP) for approval by the regulator.[53] The EMP must address all the environmental values likely to be affected; any potential adverse or beneficial impacts on those values; and the proposed environmental protection commitments for best practice environmental management.[54] The EMP must also

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[48] P&G Act 2004 (Qld), Ch 2, Pt 1 (authorities to prospect), Pt 2 (petroleum leases). The operator may also require licenses for surveys, pipelines and petroleum facilities, Ch 4.
[49] P&G Act (2004) (Qld), Ch 3, Pt 6.
[50] *Environment Protection Act 1994* (Qld), Ch 3 (EP Act 1994 (Qld)). It is the current policy of DERM not to require an EIS for exploration, see Queensland Government, 'Guideline: Deciding the Level of Impact Assessment for the Mining Industry' (Department of Environment and Natural Resources, 2011) at 6. See also Appendix C criteria for EIS trigger (note: this guideline is currently under review by DERM).
[51] EP Act 1994 (Qld), Ch 5A.
[52] Set out in *Environmental Protection Regulation 2008* (Qld), Sch 5.
[53] EP Act 1994 (Qld), s 310D.
[54] For example, impacts of air quality, remnant vegetation and important habitat and nuisance noise impacts. Queensland Government, "Guidelines under Environmental Protection Act 1994: Preparing an Environmental

include a rehabilitation program for the proposed disturbed land and must volunteer a proposed amount of financial assurance for the rehabilitation program.[55] A CSG water management plan is required as part of the EMP.[56] The CSG water management plan must specifically address the:

i. expected quantity of the CSG water, the flow rate and quality;
ii. proposed management of the CSG water including use, treatment, storage and disposal; and
iii. measurable criteria for monitoring and assessing the effectiveness of management including actions to be taken if criteria are not satisfied.[57]

In considering the application, the regulator must have regard to a number of factors including the "Standard Criteria" which is defined to include the principles of ecologically sustainable development (ESD), the public interest, the receiving environment and best practice environmental management.[58] The regulator may impose any conditions on the environmental authority that it considers necessary or desirable and has a set of model conditions that it will apply to CSG projects as it considers appropriate.[59] Financial assurance is required for all level 1 petroleum projects.[60] This is in addition to the security required for the petroleum authority under the petroleum legislation.[61]

Interactions with the Commonwealth EPBC Act

Where there are likely to be impacts on matters of national environmental significance, the approval requirements under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) will also apply. One of the most relevant triggers of matters of national environmental significance is the potential to impact on a listed endangered community including "the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin".[62]

Management Plan for Coal Seam Gas Activities" (Department of Environment and Resource Management) at 3 (Queensland EMP Guidelines).
[55] Queensland EMP Guidelines, n 54 at 3.
[56] Queensland EMP Guidelines, n 54 at 16.
[57] EP Act 1994 (Qld), s 310D.
[58] EP Act 1994 (Qld), s 310N, Dictionary.
[59] Queensland Government, "Guidelines: Model Conditions for Coal Seam Gas Activities" (Department of Environment and Resource Management, March 2011) at 1 (Model Conditions).
[60] EP Act 1994 (Qld), ss 310O, 312O.
[61] P&G Act 2004 (Qld), s 487.
[62] Note: a detailed analysis of the operation of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) is outside the scope of this article.

CSG projects and major coal mines will also be subject to new assessments by an independent expert scientific committee, established under the EPBC Act, which will focus on the long term impacts of CSG projects on underground aquifers and water resources.[63] In addition to promoting research and bioregional assessments, this statutory committee will also provide advice to the State governments as part of the existing State resources licensing processes.[64] Amendments to existing state laws will be required to give legal effect to the advice of the committee.[65] The Federal Government has indicated that there is the possibility of future amendments to the EPBC Act to enable the Commonwealth government to approve CSG projects if the States do not cooperate.[66] Meanwhile the Australian Greens had previously proposed an alternative arrangement to include a new "matter of national environmental significance" in the EPBC Act that would enable the impacts of CSG and other mining projects on Australia's water resources to be considered under the Federal regime.[67]

ENVIRONMENTAL IMPACT ASSESSMENT FOR CSG IN QUEENSLAND

In some cases a CSG project may be designated as a "significant project" under the *State Development and Public Works Act 1974* (Qld) in which case the EIS process will apply under that legislation. It is possible that a CSG project could be considered "state significant" where the scale of the project and its impact on capital investment, employment levels and revenue generation potential are significant to Queensland. If additional operational works are involved then this may also trigger the need for approval under the *Sustainable Planning Act 2009* (Qld). Petroleum and gas projects have otherwise been exempt from the need for development approval under that Act. However, this situation is changing.

The growing momentum behind the development of CSG projects in Queensland has led to increased tension between competing land uses by the agricultural and resources sectors and

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[63] Wilson L, "Expert Panel to Judge Project Proposals", *The Australian* (22 November 2011), http://www.theaustralian.com.au/national-affairs/expert-panel-to-judge-project-proposals/story-fn59niix-1226201823472 viewed 6 March 2012.
[64] Wilson, n 63.
[65] Wilson, n 63.
[66] Packham B, "Gillard to apply Water Test For Future Coal Seam Gas Projects", *The Australian* (21 November 2011), http://www.theaustralian.com.au/business/mining-energy/super-next-front-in-mine-tax-war/story-e6frg9df-1226201684195 viewed 6 March 2012.
[67] Waters L, "Media Release: Greens Welcome Independent Breakthrough on Coal Seam Gas" (The Greens Party, 21 November 2011), http://greens.org.au/content/greens-welcome-independent%E2%80%99s-breakthrough-coal-seam-gas viewed 6 March 2012.

has raised serious concerns regarding Australia's long-term food security. As noted by the Queensland Government, "strategic cropping land (SCL) is a finite resource that must be protected into the future to ensure it is conserved for growing food and fibre crops, which support economic growth for Queensland's regional communities".[68] In an attempt to balance the competing tensions between the agricultural, resource and development industries, the Queensland Government passed the *Strategic Cropping Land Act 2011* (Qld) (SCL scheme). The objectives of the SCL scheme are to: Protect land that is highly suitable for cropping; manage the impacts of development on that land; and preserve the productive capacity of that land for future generations.[69] These scheme objectives will be achieved through a number of provisions.[70]

The SCL scheme will begin by identifying areas where land that is likely to be highly suitable for cropping may exist. There are two strategic cropping protection areas that have been identified, in central Queensland in the Emerald and Springsure area and in southern Queensland in the Darling Downs, South Burnett, Lockyer Valley and Scenic Rim area which are considered to be "under intense and imminent development pressure".[71] The protection areas cover approximately 4.78 million hectares while the management area covers a further 37.2 million hectares across Queensland.[72] The SCL scheme also contains provisions for deciding whether or not specific land is highly suitable for cropping (SCL). Any project proponent and/or any persons holding a legal interest in the land may seek confirmation of that land parcel as SCL based on an on-ground assessment against eight scientific criteria addressing (only) the soil characteristics of the land.[73] Following the validation decision, the land will be recorded in the decision register as SCL on non-SCL land.[74]

The SCL scheme establishes a number of principles to protect land that is SCL or potential SCL and to manage the impacts of development on it. These are:

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[68] Queensland Government, "Strategic Cropping Land Bill 2011: Explanatory Notes" at 10 (SCL Explanatory Notes).
[69] *Strategic Cropping Land Act 2011* (Qld) (commenced 30 January 2012), s 3 (SCL Act 2011 (Qld)).
[70] SCL Act 2011 (Qld), s 4.
[71] Queensland Government, 'Strategic Cropping Land Policy – Strategic Cropping Protection Areas and Strategic Cropping Management Areas' (Department of Environment and Natural Resources, 2011) at 1.
[72] SCL Explanatory Notes, n 68 at 2.
[73] SCL Explanatory Notes, n 68 at 3; SCL Act 2011 (Qld), Ch 2.
[74] SCL Act 2011 (Qld), s 40.

Protection: the protection principle is to protect SCL and that, except in exceptional circumstances, doing so takes precedence over all development interests.

Avoidance: the avoidance principle is that if it is reasonably practicable to do so, development must avoid SCL.

Minimisation: the minimisation principles are that development must:

- wherever possible, minimise its impacts on SCL; and
- if the impacts of development on SCL are temporary, fully restore the SCL to its pre-development condition.

Mitigation: the mitigation principles are that:

- for identified permanently impacted land—
  - mitigation requirement can only be relied on if the impacts of the development can not otherwise be reasonably avoided or minimised; and
  - if the mitigation requirement can be relied on, mitigation measures must have a value at least equal to the loss of the land's productive capacity as cropping land;
- mitigation measures must have a positive and enduring effect on the future productivity of cropping in the State.
- the SCL Act requires that mitigation measures are in place before the carrying out of the development.

Productivity: the productivity principle is that SCL must be conserved for the future productivity of cropping in the State.[75]

The SCL scheme makes it an offence to carry out development on potential SCL land that will have a permanent or temporary impact on the land without authorisation under a development approval or resource authority.[76] The SCL scheme requires assessment of the development and this assessment process will tie in with the existing assessment processes under the *Sustainable Planning Act 2009, Environmental Protection Act 1994* and resource

[75] SCL Act 2011 (Qld), s 11.
[76] SCL Act 2011 (Qld), ss 76-79. Other than in an emergency situation.

legislation.[77] A SCL State Planning Policy has been passed for the operation of the planning and development assessment process under the *Sustainable Planning Act 2009*.[78]

A key component of the SCL scheme is whether the activity is likely to have a permanent impact on the land. "Permanent impact" is defined in the SCL scheme to occur where the carrying out impedes the land from being cropped[79] for at least 50 years or where the land cannot be restored to its pre-development condition.[80] The impediment to cropping may be physical or legal, such as restrictive covenants over the land. [81] The *Strategic Cropping Land Act 2011* (Qld) (SCL Act) notes that this could include the cumulative effect of drilling and wells for resources development.[82] However, it is not clear how a landholder would be in a position to prove that the future cumulative impacts of these CSG wells and infrastructure will lead to permanent impacts on the cropping productivity of the land. This is particularly problematic given the emphasis of the SCL scheme on soil characterization and cropping impacts rather than on the full suite of impacts caused by CSG projects including groundwater impacts. In any event, the Queensland Government has already released a Standard Conditions Code for those resources activities that "have a temporary impact and pose a relatively low risk of impacting on SCL" land and has specifically included access tracks, underground pipes and CSG wells in the list of activities that have a temporary impact.[83] A simplified compliance framework will apply for those activities that are authorised under the Code and a full development assessment will not be required.

The presence of "permanent impacts" would not, in itself, lead to the refusal of the CSG project. To the extent the land is in a protection area and the impacts are permanent, the SCL scheme prevents the development other than in "exceptional circumstances".[84] The *exceptional circumstances criteria* are that there must be no alternative site for the

[77] SCL Explanatory Notes, n 68 at 3; SCL Act 2011 (Qld), Chs 2, 3.
[78] Queensland Government, "State Planning Policy 1/12: Protection of Queensland's Strategic Cropping Land" (SPP 1/12, commenced 30 January 2012).
[79] Cropping is defined to include: (a) the yield of any form of cultivated crop for any purpose, including, for example, for food, as fibre, for fodder or medicinal purposes; (b) the growing of trees to produce, or as a component for food, fibre or a medicinal product; and (c) harvesting a timber plantation, SCL Act 2011 (Qld), Sch.
[80] SCL Act 2011 (Qld), s 14. Open-cut mining and storing hazardous mine wastes, including tailings dams, overburden or waste rock dumps are also identified as causing permanent impacts.
[81] SCL Act 2011 (Qld), s 14.
[82] SCL Act 2011 (Qld), s 14.
[83] Queensland Government, "Strategic Cropping Land Standard Conditions Code for Resource Activities" (Department of Environment and Resource Management, Version 1, January 2012), at 3; SCL Act 2011 (Qld), s 81; Strategic Cropping Land Regulation 2011 (Qld) s 8.
[84] SCL Act 2011 (Qld), Ch 4; major renewable energy projects have been prescribed as development in "exceptional circumstances" under the Strategic Cropping Land Regulation 2011 (Qld) s 9.

development to be carried out; and there will be a significant community benefit in carrying out the development on the land.[85] Although the SCL Act notes that the presence of a significant community benefit cannot be decided *solely* on the royalties to be paid to the State from the project, the wording of the scheme provides a sufficiently broad discretion to enable the "significant" social and economic benefits for Queensland of these resources projects to override the possible risk of loss of cropping productivity.[86] As a result, it seems likely that the result will be the conditional approval of these resources developments.

Mitigation measures are required to be undertaken for the land if the development is found to fall within the exceptional circumstances.[87] Mitigation measures are also required if the land is in the management area and will have permanent impacts.[88] Those mitigation measures may be achieved through the entering into of a mitigation deed with the Queensland Government or by payments into a mitigation fund for the calculated "mitigation value" of the land.[89] The SCL Act states that those mitigation measures must aim to increase the productivity of cropping in Queensland, have a public benefit, and aim to provide an enduring effect.[90] However, no further explanation of the practical implementation of these concepts is currently contained in the SCL scheme.

The SCL scheme is clearly in its infancy with decision-making thresholds left to be determined. While the SCL scheme does draw attention to the significance of protecting agricultural areas from the adverse effects of certain resources projects in Queensland, it is very clear that this scheme will not act as an outright prohibition on these projects.. Instead, this scheme is designed to simply add an additional layer of impact assessment onto existing approval requirements and to enable additional conditions of approval to be imposed including direct mitigation measures, payments to mitigation funds and the provision of financial assurances. While these may go some way to minimise the likely impacts from some resources projects, they will not protect the productivity of Queensland's "finite" and

[85] SCL Act 2011 (Qld), ss 117, 118, 127, 128.
[86] SCL Act 2011 (Qld), s 128(2).
[87] SCL Act 2011 (Qld), Ch 5.
[88] SCL Act 2011 (Qld), Ch 5.
[89] SCL Act 2011 (Qld), ss 131, 138. This value will be a rate per hectare prescribed in the regulations, s 132; Strategic Cropping Land Regulation 2011 (Qld) s 10.
[90] SCL Act 2011 (Qld), s 135. Failure to comply with the SCL Act may result in the making of stop work notices and restoration notices against the resource developer, SCL Act 2011 (Qld), Ch 6.

"irreplaceable" soil resources as asserted by the Government and they will certainly not protect the land from CSG projects in Queensland.[91]

ACCESS TO LAND FOR CSG OPERATORS IN QUEENSLAND

Preconditions for land access and the Land Access Code

The petroleum legislation imposes a duty on the holder of a petroleum authority to ensure that it carries out its authorised activities in a way that "does not unreasonably interfere with anyone else carrying out a lawful activity".[92] This could include other authority holders in the area as well as local landholders that may be carrying out sensitive land-use practices. The Land Court may declare that a particular activity interferes with the carrying out of lawful activities and may order modifications or reductions in the activity to remove the interference.[93] In reality, the mere presence of these CSG projects on local land will cause disruptions to the landholder including as a result of the location of infrastructure on the land including drill sites, well heads, gathering lines, compressor stations, fluid storage and treatment facilities, and access roads. These, in conjunction with noise impacts and impacts on visual amenity will affect practices on the land such as locations of stock, pasture and crops.

In an attempt to appease some of the community resistance to the resources sector, the Queensland Government introduced a uniform *Land Access Code* which came into effect in October 2010 and applies to all major resources projects including mining, petroleum, geothermal and greenhouse gas storage.[94] The stated intention of the code is to balance the interests of the agricultural and resources sectors including through best practice guidelines for good relations and good faith between operators and the owners/occupiers of private land.[95]

The Land Access Code contains a number of mandatory conditions that are imposed on all authorities regarding conduct on private land including in relation to the:

- Use of existing access points, roads and tracks;
- Minimisation of disturbance on livestock and property;

[91] SCL Explanatory Notes, n 68 at 14, 33.
[92] P&G Act 2004 (Qld), s 804.
[93] P&G Act 2004 (Qld), s 537DB(2)(d).
[94] P&G Act 2004 (Qld), s 24.
[95] Queensland Government, "Land Access Code" (Department of Employment, Economic Development and Innovation, November 2010), Pt 2 (Land Access Code).

- Obligation to prevent spread of pests; and
- Use of gates, grids and fences.[96]

Under Queensland petroleum legislation, the CSG operator is required to provide at least 10 business days written notice before entering the land to undertake either preliminary or advanced activities.[97] There are a number of exemptions to this general requirement including where entry is necessary to preserve life or property or because of an emergency or where the owner has chosen to sign a waiver for the notice of entry requirement.[98] Once the entry notice, or waiver of entry notice, has been given, this is taken to apply to any new owners and occupiers of the land throughout the duration of the notice.[99]

A failure to properly notify may lead to actions against the operator. For example, in 2009 the O'Connors sought an injunction against Arrow Energy restraining the construction of a treated water pipeline on the Daandine Homestead property, west of Dalby, for the management of CSG water from the CSG operations.[100] The applicants asserted that the water treatment pipeline was not authorised because it was not an "incidental activity" for the purpose of the lease.[101] The Court noted that the water management plan for the CSG water was "the only way the treated water can be beneficially used" and held that these were authorised activities.[102] However, Arrow Energy had also failed to disclose in its notice of entry that it would be installing a treated water pipeline on the O'Connor property. The notice referred only to "water pipelines" and the Court construed this as relating to untreated water pipelines only.[103] As a consequence the Court noted that:

> it follows that the applicants are entitled to declarations as to the unlawfulness of the respondent's entry on their land to construct the treated water pipeline. They are also entitled to an order restraining the respondent from further construction of the treated water pipeline unless and until a valid entry notice is served.[104]

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[96] P&G Act 2004 (Qld), s 555; Land Access Code, n 95, Pt 3.
[97] P&G Act 2004 (Qld), s 495.
[98] P&G Act 2004 (Qld), s 497.
[99] P&G Act 2004 (Qld), s 512.
[100] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432.
[101] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [32].
[102] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [36].
[103] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [42].
[104] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [49].

The Court stopped short of issuing a mandatory injunction for the removal of the treated water pipeline noting that the remedy lacked practical utility given that Arrow would be entitled to return and reconstruct the pipeline upon serving a valid notice of entry.[105] Instead, the Court considered that an award for damages would be adequate compensation for the applicants.[106] In total, there were five breaches of the land access laws that occurred on the O'Connor property between 2 June 2008 and 23 January 2010. [107] Four of those breaches related to conducting activities on private land without proper authority while the fifth related to the unlawful construction of a pipeline.[108] The total penalty payable for these offences was the relatively paltry sum of $40,000.[109]

Negotiation of Conduct and Compensation Agreements

Strong resistance to CSG projects has led to public protests and calls to "shut the gates" against CSG activities. However, such actions are not permitted under the Queensland legislation and it is an offence for a landholder to obstruct a CSG operator from accessing their land if it has otherwise met all of the requirements of the legislation.[110] Nevertheless, at least one group of farmers in the Darling Downs is attempting to lock out mining companies while also seeking to challenge the environmental approval of a CSG project by Arrow Energy on the basis that the project could lead to permanent groundwater impacts that may not be capable of mitigation.[111] Each owner and occupier of the land is entitled to reasonable compensation for the impacts caused by CSG activities on their land.[112] The legislation requires that a *Conduct and Compensation Agreement* be negotiated between the parties before a CSG operator may enter the land to undertake activities likely to have a significant impact on the landholders land use (known as advanced activities).[113] Standard form

[105] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432 at [50]
[106] *O'Connor and O'Connor v Arrow (daandine) Pty Ltd* [2009] QSC 432.
[107] Minister for Employment, Skills and Mining, The Honourable Stirling Hinchliffe, "CSG company fined $40,000 for land conduct breaches" (Ministerial Media Statement, 20 June 2011), www.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=75340 viewed 6 March 2012.
[108] Hinchliffe, n 107.
[109] Hinchliffe, n 107.
[110] Queensland Government "Tips for landholders negotiating agreements with resource companies" (Department of Employment, Economic Development and Innovation, November 2010) at 1 (Queensland Government Negotiating Tips).
[111] This challenge is supported by the National Farmers Federation. See Lloyd G, "Fertile Grounds for Coal-Seam Test Case", *The Australian* (21 May 2011), http://www.theaustralian.com.au/national-affairs/fertile-grounds-for-coal-seam-test-case/story-fn59niix-1226059965718 viewed 6 March 2012.
[112] P&G Act 2004 (Qld), s 532.
[113] P&G Act 2004 (Qld), s 500.

agreements have been developed by the Queensland Government, in conjunction with resources explorers, producers and landholder groups, to address land access and compensation issues.[114] These are intended to be used as a starting point between the parties and may be modified by agreement. These standard form agreements include a deferral agreement where the compensation agreement is entered into after entry.[115] It should be noted that the requirement to agree to compensation prior to access is not absolute and this has the potential to weaken the bargaining position of the landholder.

The CSG operator is also able to access private land *outside* of the petroleum authority area. It may cross the land if it is reasonably necessary to access the area of the petroleum authority and may carry out activities on the land that are reasonably necessary to allow the crossing.[116] Unless it is an emergency situation, the operator must have obtained the agreement to the access, orally or in writing.[117] If the impact of access will not be permanent then agreement from the occupier will suffice but where the exercise of access rights is likely to have a permanent impact on the land – such as the construction of a road – agreement is required from both the owner and occupier of the land.[118]

An owner or occupier of the land cannot unreasonably refuse to make an access agreement, they may request only that the agreement be subject to reasonable and relevant conditions.[119] In considering the reasonableness of access, the following must be considered:

- The nature and extent of any impact the exercise of the access rights will have on the land and the owner or occupier's use and enjoyment of it; and
- How, when and where and the period during which the holder proposes to exercise the access rights.[120]

The minimum negotiating period for these agreements is generally 20 business days.[121] If, at the end of the minimum negotiation period, the parties have not entered into an agreement,

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[114] See Queensland Government, "Landholder Information" (Department of Mining and Safety, 2011) for links to the standard form agreements, http://mines.industry.qld.gov.au/mining/landholder-information.htm viewed 6 March 2012.
[115] P&G Act 2004 (Qld), s 500B.
[116] P&G Act 2004 (Qld), s 502. This includes rights to carry out required rehabilitation and environmental management works under the EP Act 1994 (Qld), P&G Act 2004 (Qld), s 513A.
[117] P&G Act 2004 (Qld), s 503.
[118] P&G Act 2004 (Qld), s 503. *Permanent impact* on the land, is defined as meaning "a continuing effect on the land or its use or a permanent or long-term adverse effect on its current lawful use by an occupier of the land".
[119] P&G Act 2004 (Qld), s 504.
[120] P&G Act 2004 (Qld), s 505(3).
[121] P&G Act 2004 (Qld), s 536A.

then either party may ask for an authorised officer to call a conference or call for the alternative dispute resolution process to be commenced to negotiate an agreement.[122] If that process is unsuccessful then an application may be made to the Land Court of Queensland to determine the compensation liability and any conditions to be imposed on access.[123] If the parties fail to agree within the minimum negotiating period then the matter will be referred to the Land Court which will determine the appropriate conditions to be imposed on access to the land.[124]

Under the legislation, the CSG operator is liable to compensate each owner or occupier of the land for any "compensatable effect" that is caused by the authorised activities on the land including:

- Deprivation of possession of its surface;
- Diminution of its value;
- Diminution of the use made or that may be made of the land or any improvement on it;
- Severance of any part of the land from other parts of the land or from other land owned; and
- Any cost, damage or loss arising from the carrying out of activities under the petroleum authority on the land.[125]

Previously compensation under the *Mineral Resources Act 1989* (Qld) did not extend to the owner or occupier's valuation and legal costs.[126] Now owners and occupiers are able to claim the "accounting, legal or valuation costs the claimant necessarily and reasonably incurs to negotiate or prepare the agreement".[127] The Queensland Government recommends that landholders seek independent legal advice in negotiating these agreements and in Queensland legal aid is made available to all landholders without means testing.[128]

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[122] P&G Act 2004 (Qld), s 537A. See also Ch 10, Pt 1AA for the procedures applying to conferences.
[123] P&G Act 2004 (Qld), ss 537B, 537D, 537DB, 537DC. In determining the conditions of access the Land Court must have regard to the criteria set out in s 505.
[124] If the holder asks the owner or occupier to make an access agreement, and the owner or occupier has not made the agreement within 20 business days, then the owner or occupier is taken to have refused to agree, P&G Act 2004 (Qld), s 504.
[125] P&G Act 2004 (Qld), s 532.
[126] See *Australian Diatomaceous Earth Pty Ltd v Marsterson* [2004] QLRT 49.
[127] P&G Act 2004 (Qld), s 532(4)(b).
[128] Queensland Government Negotiating Tips, n 110 at 3.

There are a number of difficulties associated with the negotiation of these compensation agreements by landholders. To begin with, the definition of "occupier" specified in the *Petroleum and Gas (Production and Safety) Act 2004* (Qld) (P&G Act) is relatively narrowly including only those persons who:

(i) under an Act, or, for freehold land, a lease registered under the *Land Title Act 1994* (Qld), have a right to occupy the place; or

(ii) have been given a right to occupy the place by an occupier under subparagraph (i).[129]

Problematically, because of the absence of a "right to occupy" not all persons financially affected by the use of the land for CSG operations in Queensland will have a right to negotiate compensation for the use of the land.[130]

The compensation agreements generally provide a fixed sum for compensation based on the number of wells to be drilled on the land rather than being based on any diminution of property value.[131] This is a stark contrast to the position in the United States where landholders own the underground resources and can receive up to US$25,000 per acre or 25% royalty from the use of their land for CSG activities.[132] Under the standard form agreements in Queensland, the agreed amount is provided as *full and final* compensation for those authorised activities and infrastructure set out in the agreement.[133] Those authorised activities and infrastructure are generally defined in broad terms to provide the most flexibility of access and use to the CSG operator. There are no review provisions contained in the standard agreements. However, the access agreement may be varied by application to the Land Court.[134] In particular, where the landholder can demonstrate that there has been a material change in circumstances, the level of compensation may be reviewed by the Land Court.[135]

The compensation and access agreement is a significant document and will bind the parties to it and each of their personal representatives, successors in title and assigns.[136] Consequently,

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[129] P&G Act 2004 (Qld), Sch 2.
[130] For example, share farmers and other rights holders.
[131] Queensland Government Negotiating Tips, n 110 at 5.
[132] Sakmar, n 1, p 396.
[133] Queensland Government, *Standard Conduct and Compensation Agreement* (version 27 August 2010) Sch 3, http://mines.industry.qld.gov.au/mining/landholder-information.htm viewed 6 March 2012.
[134] P&G Act 2004 (Qld), s 509.
[135] P&G Act 2004 (Qld), s 537C.
[136] P&G Act 2004 (Qld), ss 507, 537E.

the rights of access and use agreed in the standard form agreement will bind future owners and occupiers of the land. Because of this, it is critical that the landholder fully understands the nature of the agreement and the scope of compensation arrangements and access conditions that can be requested in the agreement to address the possible concerns of both current and future owners and occupiers.[137] However, it takes time for landholders to develop a working knowledge of the CSG laws and their rights to compensation.[138] This learning curve has been hampered by the obligations of confidentiality which are currently required as standard conditions in these compensation agreements.[139] As a result, landholders are unable to disclose the terms of their negotiated agreements with other landholders or other government agencies.[140] Concerningly, although these agreements will bind future purchasers they are not noted or identified on the land title and there is currently no public register which is able to be searched by potential purchasers of the land as part of their due diligence processes.

ENVIRONMENTAL DUTIES OF CSG OPERATORS AND THE USE OF HYDRAULIC FRACTURING

Once the activities on the land have been completed, the CSG operator must report to the owner and occupier regarding the nature of the activities that have been carried out on the land.[141] One of the most contentious activities in CSG extraction is the use of hydraulic fracturing (or fracking) to extract the CSG resource. Fracking involves stimulating the CSG well by pumping a fluid (comprised of water, sand and chemical lubricants) under pressure to open up cracks and fracture the coal seam to increase gas production from the coal seam.[142] There are many concerns regarding the fracking process including the use of chemical additives in the fracking fluid. It has been warned that fracking will "alter the structural

[137] Under the P&G Act 2004 (Qld), the owner or occupier is not civilly liable to anyone else for a claim based in tort for damages relating to the carrying out of an authorised activity under the petroleum authority, s 563A. However, anecdotal evidence suggests that only limited indemnities for direct damage are being included in the standard agreements.
[138] Gray S, "Coal Seam Gas Laws 'Disadvantage' Landowners", *Sydney Morning Herald* (3 March 2011), http://news.smh.com.au/breaking-news-national/coal-seam-laws-disadvantage-landowners-20110303-1bfr6.html viewed 6 March 2012.
[139] Queensland Government, n 133 at cl 20.
[140] Burgess S and Tapim F, "CSG Inquiry Continues in Brisbane", *ABC News* (20 July 2011), http://www.abc.net.au/news/2011-07-20/csg-inquiry-continues-in-brisbane/2802118 viewed 6 March 2012.
[141] P&G Act 2004 (Qld), s 513.
[142] Queensland Government, "Hydraulic Fracturing (fraccing) in CSG Wells" (Department of Environment and Natural Resources, 11 March 2011) at 1.

integrity of the target coal seam aquifers" and that "the potential for fraccing activities to impact on the structural integrity of other aquifers and aquitards, and on existing groundwater flow processes, can never be completely eliminated".[143] There is also the likelihood that subsurface subsidence and surface deformation will occur.[144] This can "alter overland flow paths initiating new erosion features in susceptible areas."[145]

The Queensland Government has reported that between 10% and 40% of all Queensland wells will be fracked by the CSG industry.[146] The environmental protection legislation in Queensland imposes specific obligations on the CSG operator to notify the regulator and each owner and occupier 10 business days before commencing hydraulic fracturing activities and within 10 business days of completion of fracking.[147] Amendments have also been passed to retrospectively impose a statutory condition on all environmental authorities to prohibit the use of BTEX stimulation fluids, that is, fluids containing petroleum hydrocarbons that contain benzene, ethylbenzene, toluene, or xylene[148] above the maximum concentrations prescribed by s 81B of the *Environmental Protection Regulation 2008* (Qld).[149] The presence of naturally occurring BTEX has meant that an absolute ban could not be applied. Instead, the prescribed limits are Benzene, 1 part per billion (ppb); Toluene, 180 ppb; Ethylbenzene, 80 ppb; m-Xylene, 75 ppb; o-Xylene, 350 ppb; p-Xylene, 200 ppb.[150]

The completion notice to be submitted by the CSG operator must contain details of the composition of the hydraulic fracturing fluid pumped into the petroleum well.[151] The CSG operator must also report to the regulator within two months on the specific details of the fracking activity, and whether it resulted in geological connections between geological intervals, such as break-through between formations, and:

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[143] Geoscience Australia and Habermehl M, "Summary of Advice in Relation to the Potential Impacts of Coal Seam Gas Extraction in the Surat and Bowen Basins, Queensland: Phase One Report Summary for the Australian Government Department of Sustainability, Environment, Water, Population and Environment" (29 September 2010) at 4.
[144] Geoscience Australia and Habermehl, n 143 at 5.
[145] Moran C and Vink S, "Assessment of Impacts of the Proposed Coal Seam Gas Operations on Surface and Groundwater Systems in the Murray-Darling Basin" (University of Queensland, November 2010) at 4.
[146] Queensland Government, n 142 at 1.
[147] *Petroleum Gas (Petroleum Safety) Regulations 2004* (Qld) (P&G Safety Regulations), ss 30A, 35, 35A.
[148] Or chemicals that produce, or are likely to produce, benzene, ethylbenzene, toluene or xylene as the chemical breaks down in the environment.
[149] EP Act 1994 (Qld), s 312W, this came into force on 29 July 2011.
[150] Queensland Government, "Faccing and BTEX" (Department of Environment and Resource Management, 2011), http://www.derm.qld.gov.au/factsheets/pdf/csg/csg8.pdf viewed 6 March 2012 These BTEX standards were based on the Australian Drinking Water Guidelines (ADWG) and the Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality.
[151] P&G Safety Regulations, s 35A.

any other details about the hydraulic fracturing activities that would assist a person in making a future assessment of the impact of the hydraulic fracturing activities on the coal seam and any increased risk to safe and efficient mining of coal.[152]

Under the *Environment Protection Act 1994*, there is a duty to notify where serious or material environmental harm is caused or threatened by an act or omission and recent statutory amendments have increased the applicable penalties for non-compliance.[153] A new provision has also been passed which imposes a duty to notify where, while carrying out a CSG project, a person becomes aware that:

- The activity has, or is reasonably likely to, negatively affect the water quality of an aquifer; and/or
- The activity has caused the connection of two or more aquifers.[154]

Under the new provisions, employees must notify their employer within 24 hours or, if they cannot be reasonably contacted, they must provide written advice to the regulator.[155] In addition, as soon as is reasonably practicable, the employer must then provide written notice of the event, its nature and the circumstances in which it happened to *any occupier* and/or *any registered owner* of the affected land.[156]

Duty of CSG operators to report well head leaks

Under the Queensland petroleum legislation, the CSG operator is also required to report to the Queensland Petroleum and Gas Inspectorate if particular "incidents" occur during its CSG operations.[157] An incident in Dalby, Queensland in May 2011 highlighted deficiencies regarding the timeliness of reporting of leaks. The circumstances involved a well-head leak where CSG and water spilled onto a farming property over a period of time.[158] One of the many concerns relating to the event was the operator's failure to notify both the Government and the landholder about the existence of the leak on the property in a timely manner. In

[152] P&G Safety Regulations, s 46A.
[153] EP Act 1994 (Qld), s 320.
[154] EP Act 1994 (Qld), new s 320A; *Natural Resources and Other Legislation Amendment Act 2010* (No 2) (Qld).
[155] EP Act 1994 (Qld), new s 320B.
[156] EP Act 1994 (Qld), new ss 320C, 320D, 320E.
[157] P&G Act 2004 (Qld), s 706; P&G Safety Regulations, s 11 and Sch 2.
[158] Burgess, S "Farmer Waits for Gas Leak Impact", *ABC News Online* (24 May 2011), http://www.abc.net.au/news/2011-05-24/farmer-waits-for-gas-leak-impact/2728256 viewed 6 March 2012.

response, the Queensland Government introduced a new *Code of Practice for CSG Well Head Emissions Detection and Reporting*.[159] The Government also introduced new reporting requirements for all unplanned fuel gas leaks in relation to CSG well heads and imposed a new limit of 10% lower flammable limit (LFL) for all reportable leaks and a requirement that reports be provided to the regulator within 24 hours.[160]

GROUNDWATER MANAGEMENT OBLIGATIONS IN QUEENSLAND

One of the most significant and contentious issues in the regulation of CSG projects is the potential adverse cumulative impacts from the approval of multiple CSG projects on the Surat and Bowen Basins.[161] The impacts of groundwater extraction could include significant impacts "on aquifer interaction (eg water flow, cross contamination), vertical recharge, structural integrity and artesian pressure".[162] Current impact assessment of projects is based primarily on groundwater modelling of predicted impacts. However, as noted:

> the information provided in the assessed EIS documents is not fully adequate for understanding the likely impacts of widespread CSG development across the Surat and Bowen Basins; nor will any level of information or modelling that can be provided by individual proponents... a regional-scale, multilayer groundwater flow model which incorporates data from both private and public sector sources is necessary… however... no matter how thorough a model or detailed the underlying data, any modelled outcomes will be accompanied by high inherent uncertainties until sufficient CSG production data is available to calibrate the groundwater model.[163]

As a result, it was recommended to the government that a "regional scale, multi-state and multi-layer model of the cumulative effects of multiple developments" be used to "set the parameters for an adaptive management framework".[164] In the meantime, a precautionary approach to approving CSG projects was emphasised across Australia.[165] The Queensland Government identified two particular areas where an adaptive environmental management approach could be reflected in statutory amendments. The first relates to the impacts to the

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[159] Queensland Government, "Code of Practice for CSG Well Head Emissions Detection and Reporting" (Department of Employment, Economic Development and Innovation Petroleum and Gas Inspectorate, 2011).
[160] Queensland Government, n 159 at 5. Leaks of 10% LFL must be reported in writing to the Petroleum and Gas Inspectorate within 24 hours. Leaks at 100% LFL or above must be notified immediately by telephone, at 9.
[161] Geoscience Australia and Habermehl, n 143 at 1.
[162] Geoscience Australia and Habermehl, n 143 at 2.
[163] Geoscience Australia and Habermehl, n 143 at 1.
[164] Geoscience Australia and Habermehl, n 143 at 7.
[165] Geoscience Australia and Habermehl, n 143 at 7.

environment from the generation and management of CSG water. In this case, monitoring, evaluation and reporting obligations are placed on the CSG operator who must evaluate the effectiveness and appropriateness of the management of CSG water and if inappropriate, outline what future actions will be taken to ensure appropriate management of the CSG water.[166] If necessary, the conditions of the CSG authority may be amended by the regulator to reflect these changes in management approach by the operator. The second area relates to the management of impacts to existing bores and springs. Dewatering as a result of aquifer drawdown from CSG extraction processes could result in impacts on individual bore holders within the area.[167] As a result, in Queensland trigger thresholds are now included in the legislation for groundwater level drawdown in bores and springs.[168] Accordingly, the Queensland approach to groundwater regulation purports to apply the principles of adaptive environmental management through a combination of monitoring, assessment, reporting and management of impacts.

As a result of 2010 amendments, management of underground water now falls under the *Water Act 2000* (Qld), rather than the petroleum legislation, and under the jurisdiction of the Queensland Water Commission (QWC). It is an offence under the *Water Act 2000* to take or interfere with water without an approval. However, the *Petroleum and Gas (Petroleum Safety) Act 2004* (Qld) authorises the taking or interference of underground water in the carrying out of authorised activities.[169] Operators must otherwise comply with provisions of the *Water Act 2000*.[170]

In Queensland, the *Water Act 2000* requires CSG operators to use *all best efforts* to acquire all information regarding relevant bores in the area.[171] Prior to the commencement of petroleum production, the CSG operator must prepare a baseline assessment plan for all identified bores to be approved by QWC.[172] Where there are multiple tenure holders, such as the Surat Basin, this will be a declared cumulative management area and QWC will be responsible for ongoing monitoring of impacts on the catchment and for preparation and

[166] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.
[167] Moran and Vink, n 145 at 4.
[168] Queensland Adaptive Environmental Management Regime Policy, n 12 at 2.
[169] P&G Act 2004 (Qld), s 185.
[170] P&G Act 2004 (Qld), s 189.
[171] *Water Act 2000* (Qld), s 367.
[172] *Water Act 2000* (Qld), s 397.

submission of underground water impact reports to the Chief Executive.[173] An underground water impact report must be supplied to the QWC by the CSG operator within 14 months of the grant of the petroleum tenure with a report required every three years thereafter.[174] That report must contain measures for an ongoing water monitoring strategy to be approved by QWC.[175] Consultation on the report must take place before it is submitted to QWC for approval.[176] These obligations to report, along with other underground water obligations, will continue beyond the life of the petroleum tenure.[177]

The adaptive management approach to groundwater in Queensland relies on ongoing monitoring and reporting by the CSG operator as well as being dependent on the presence of suitable expertise within the Queensland regulatory authority to enable the appropriate evaluation and response to the emerging modelling and data. While the raw data is currently being collected and reported within Queensland, it is less clear how the Government intends to determine whether, and to what extent, the existing regulatory approach requires adjustment in response to this information. This is a clear weakness in the Queensland regulatory response.

The cumulative effects of CSG projects across regional basins are currently unknown and warnings have been given that this could result in a significant reduction in recharge flows and basin pressures.[178] As noted, the *Water Act 2000* contains trigger thresholds for the impacts of CSG operations on groundwater drawdown in bores and springs. These are a 5 metre drop for consolidated aquifers and a 2 metre drop for shallow alluvial aquifers.[179] Once triggered, QWC can direct the CSG operator to undertake a bore assessment using *industry best practice*.[180] A water bore is considered to have an impaired capacity if there is a decline in the water level of the acquirer or the bore can no longer provide a *reasonable quantity and quality* of water for its authorised use or purpose.[181] Provided that it is established that the

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[173] *Water Act 2000* (Qld), ss 365, 370. The report is due within 14 months of an area being declared a cumulative management area.
[174] *Water Act 2000* (Qld), s 370. QWC may require changes to the report if it believes there have been material changes in the information or predictions contained in the report, s 392.
[175] *Water Act 2000* (Qld), s 376. It is an offence to fail to comply with the approved report, s 390.
[176] *Water Act 2000* (Qld), s 381.
[177] *Water Act 2000* (Qld), s 439. The act provides rights of entry to allow this occur after the end of the petroleum tenures, s 441.
[178] Geoscience Australia and Habermehl, n 143 at 4.
[179] *Water Act 2000* (Qld), s 362.
[180] *Water Act 2000* (Qld), ss 402, 411.
[181] Queensland Government, "Coal Seam Gas- Bore Assessments" (Department of Environment and Resource Management, April 2011) at 1; *Water Act 2000* (Qld), s 421.

CSG activities *contributed to a material impact* on bore water supply, the CSG operator must negotiate with the bore owner to "make good" the impaired capacity of the bore.[182] Negotiated restoration measures to "make good" could include:

- Restoration of the water supply – for example deepening the bore, improving pressure at bore head, installing a new pump or drilling a new bore;
- Providing an alternate water supply; or
- Compensation to the bore owner for the loss of supply.[183]

The parties will enter into a "make good agreement" which will be binding on the CSG operator and the water bore owner. It will also be binding on all future successors in title.[184] However, an application may be made to the Land Court for amendment to address a material change in circumstances; address a make good measure for the bore that is not effective; or to provide for another effective and more efficient make good measure for the bore.[185] Any decision of the Court will also bind all future successors in title.[186]

The CSG operator is required to use its best endeavours to obtain this negotiated agreement.[187] If the parties fail to reach agreement then either party can seek alternative dispute resolution.[188] If unsuccessful, the Land Court can determine the terms of the make good agreement including the levels of compensation for:

- Diminution of the value of the land on which the bore is located;
- The use of water which the owner would have made from the water of the bore; or
- Any cost or loss suffered as a result of the impaired capacity of the water bore.[189]

The Court will take into account the make good measures in calculating the level of compensation.[190]

Keeping in mind that the Queensland approach is based on the principles of adaptive environmental management, it is significant that the Queensland Government has left the obligation to require specific remediation of groundwater in the hands of the landholders

[182] *Water Act 2000* (Qld), s 409.
[183] Queensland Government, "Aquifer Impacts and 'Make Good' Arrangements" (Department of Environment and Resource Management, February 2011); *Water Act 2000* (Qld), s 421.
[184] *Water Act 2000* (Qld), s 422.
[185] *Water Act 2000* (Qld), ss 434-436.
[186] *Water Act 2000* (Qld), s 437.
[187] *Water Act 2000* (Qld), s 406.
[188] *Water Act 2000* (Qld), ss 425, 426.
[189] *Water Act 2000* (Qld), s 436.
[190] *Water Act 2000* (Qld), s 436.

(who will not have the cumulative data and knowledge of the QWC) rather than in the hands of the regulators. The Queensland Government is not responsible for directing the CSG operator to take steps to "make good" the damage and if the landholder chooses compensation over remediation then the groundwater resource could remain permanently effected. The use of these "make good" obligations also appears to assume that the majority of impacts on the groundwater system will be able to be mitigated or reversed. However, contamination of water supply or joining of aquifers is not generally a reversible event. In such circumstances, the land could be permanently deprived of its water source leading, one would assume, to very significant amounts of compensation for loss of supply and loss of livelihood across the life of the property. But what if the company has become insolvent or no longer exists at this point? Will the security held by the regulator be sufficient to address these almost indeterminate make good obligations across the tenure area? Equally concerning is how responsibility for causation is to be allocated where there will be multiple CSG operators contributing to the cumulative impacts emerging over time across a region. The NWC has made it clear that the long term impacts on aquifer pressures and levels may not be adequately protected by these current "make good arrangements".[191] Accordingly, it seems clear that further reforms will need to be considered by the Queensland Government if it is to respond to the emerging information regarding the groundwater impacts and follow a *true* adaptive environmental management approach.

PRODUCTION AND MANAGEMENT OF CSG WATER IN QUEENSLAND

Another key issue in the Queensland regulatory approach are the requirements imposed for the management of CSG water produced from CSG operations. The development of CSG reserves generally produces large volumes of co-produced water that is typically of poor quality, containing high sodium and chlorine concentrations and other impurities.[192] There are significant environmental issues surrounding the quantity, quality and management of the associated water from CSG production.[193] It is estimated that CSG production generates almost 35% more associated water per unit of energy than conventional petroleum

[191] National Water Commission Position Statement, n 8 at 3.
[192] NWC Co-produced Water Assessment, n 4 at 1; Taulis M, "Australia and New Zealand CBNG development and environmental implications" in Reddy, KJ (ed), *Coalbed Natural Gas: Energy and Environment* (Nova Science Publishers, 2010) p 415.
[193] NWC Co-produced Water Assessment, n 4 at 6.

production.[194] The NWC estimates that the amount of water produced during the oil and gas extraction process in those areas will be more than 300 giga litres per year over the next 25-35 years with 97% of that extraction coming from the growing number of coal seam gas activities.[195] To put this number in context, in 2010 it was estimated that 33 giga litres per year were produced from the oil and gas extraction process.[196] The majority of the CSG water (approximately 96%) would take place in Queensland with approximately 70% of this water expected to be generated in the Surat Basin and the remainder in the Bowen Basin.[197]

If inappropriately managed, CSG water can "almost irreversibly damage soils, riparian vegetation and fish communities throughout the lifespan of the… projects".[198] There are a number of possible management options for the CSG water, including supply for urban and industrial use, storage and aquifer reinjection, and agricultural use including stock watering and irrigation uses.[199] Most of these options will require treatment prior to use or disposal in order to meet applicable water quality standards.[200] However, treatment may not be economically feasible leading to consideration of other disposal options such as deep injection, direct discharge to land surface or a surface water body or impoundment in an evaporation or filtration pond.[201]

Options such as aquifer recharge or environmental releases are not commonly used in Australia.[202] The NWC has noted that environmental water releases should be subject to practical limitations.[203] It also noted that aquifer recharge, that is, returning CSG water to the geological formation, is technically feasible and is the option favoured in many areas of North America but that "further assessment of whether aquifer recharge could be an important management option to minimise effects on groundwater levels and pressures is required".[204]

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[194] NWC Co-produced Water Assessment, n 4 at 11.
[195] NWC Co-produced Water Assessment, n 4 at viii. "The potential quantity of water generated in Qld over the next 25 years from CSG production for LNG and domestic industries is 3775 GL for a low development scenario to 7650 GL for a probable development scenario", at 14.
[196] NWC Co-produced Water Assessment, n 4 at viii.
[197] NWC Co-produced Water Assessment, n4 at 1, 14, 16.
[198] Taulis, n 192, p 421.
[199] NWC Co-produced Water Assessment, n 4 at viii.
[200] NWC Co-produced Water Assessment, n 4 at viii.
[201] NWC Co-produced Water Assessment, n 4 at 18
[202] NWC Co-produced Water Assessment, n 4 at 21.
[203] NWC Co-produced Water Assessment, n 4 at ix.
[204] NWC Co-produced Water Assessment, n 4 at ix.

Interestingly, the NWC has identified a number of key constraints to CSG water management in Queensland including the "restrictions to management options imposed by legislation".[205] For example, CSG evaporation dams were previously the most common tool for managing associated water in Queensland. Under recent amendments to the *Environmental Protection Act 1994* a CSG evaporation dam cannot be proposed to manage the CSG water unless:

- the CSG environmental management plan includes an evaluation of the best practice environmental management for CSG water and alternative ways for managing the water; and
- the evaluation shows there is no feasible alternative to a CSG evaporation dam.[206]

The Queensland Government's policy preference in relation to the management of the CSG water is:

i. injection into a natural underground reservoir or untreated use (for livestock watering, industrial uses, domestic uses or augmentation of water storage dams);
ii. treatment and use using desalination, chemical treatment or filtration; and
iii. direct supply via pipeline to a water supply dam.[207]

Disposal to surface water and to land are not the preferred options of the Queensland regulator.[208]

The waste by-products from the treatment of CSG water are brine and solid salt residue and the disposal options for these by-products create their own environmental concerns. One option is to dispose of the salt residue to a purpose built licensed regulated waste disposal facility. In this case, the Queensland regulator requires that the facility be located on freehold land owned by the CSG operator and fully contained.[209] The treatment facility will be listed as a "contaminated site" and the petroleum tenure holder will be required to remediate the site prior to the surrender of the petroleum tenure.[210]

CSG water is an unwanted by-product of CSG production and, as such, falls within the definition of waste under the *Environmental Protection Act 1994*.[211] Given this, the CSG

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[205] NWC Co-produced Water Assessment, n 4 at 26.
[206] EP Act 1994 (Qld), s 310D.
[207] Queensland EMP Guidelines, n 54 at 16-20.
[208] Queensland EMP Guidelines, n 54 at 23-24.
[209] Queensland Government, "Salt and Brine Management in Coal Seam Gas Production" (Department of Environment and Resource Management, March 2011) at 1.
[210] EP Act 1994 (Qld), Ch 7, Pt 8.
[211] EP Act 1994 (Qld), s 13.

operator must comply with the waste management hierarchy under the *Environmental Protection (Waste Management) Policy 2000* (Qld). Management of the CSG water as waste is an environmentally relevant activity requiring additional approval under the *Environmental Protection Act 1994*.[212] Alternatively, the regulator may approve the CSG water to be used as a resource, rather than a waste, if it has a beneficial use other than disposal.[213]

CSG water must be managed in accordance with the approved CSG Water Management Plan for the project.[214] CSG operators must ensure that all CSG water is contained, is not released to land or waters and is only used for purposes specifically authorised under the *Environmental Protection Act 1994* and *Petroleum and Gas (Petroleum Safety) Act 2004* or under a resource for beneficial use issued under the *Environmental Protection Act 1994*.[215] The standard conditions of approval state that any CSG waters released to the environment must not have any properties or any contaminants in such concentrations that are capable of *causing environmental harm*.[216] Consequently, releases to the environment that do cause harm to the values of the receiving environment would be likely to be unlawful under the *Environmental Protection Act 1994*.

Beneficial Use of CSG Water

Under the *Petroleum and Gas (Petroleum Safety) Act 2004*, the CSG operator is permitted to allow an owner or occupier of land in the area of the tenure or adjoining it to use the extracted CSG water for limited domestic irrigation[217] or stockwater purposes.[218] Under the conditions of the environmental authority, CSG water to be used for domestic or stock purposes must comply with the water standards contained in the *ANZECC 2000 Water Quality Guidelines*.[219] Any uses beyond this require additional approvals.[220] The suitability of the CSG water for domestic irrigation depends on the quality of the water produced by the CSG project. CSG water can contain high levels of sodium, chlorine, boron and zinc all of

[212] EP Act 1994 (Qld), Ch 4.
[213] EP Act 1994 (Qld), s 13(4).
[214] Model Conditions, n 59, G7.
[215] Model Conditions, n 59, G8.
[216] Model Conditions, n 59, G10.
[217] That is, less than 0.25 hectares.
[218] P&G Act 2004 (Qld), s 186; Queensland Government, 'Guidelines: Approval of Coal Seam Gas Water for Beneficial Use' (Department of Environment and Natural Resources, March 2010) at 2.
[219] Model Conditions, n 59, G9.
[220] *Environmental Protection (Waste Management) Regulation* 2000 (Qld), s 66B.

which pose a toxicity hazard for plants and vegetation and could significantly impact crop yields.[221]

If the CSG operator obtains approval for general or specific beneficial use then this could approve uses for irrigation and livestock watering as well as for other environmentally relevant activities including coal washing, dust suppression and industrial use.[222] Treated and untreated CSG water is often used for petroleum site operations including drilling, hydraulic fracturing, dust suppression and hydrostatic pipeline testing.[223] Other innovations include use for steaming and cooling in power stations and for coal washing. The NWC has noted that "urban and industrial water supply would be ideally suited for CSG water reuse, however relatively constant flows at a particular location are required that may not be available from CSG operations".[224] More unusual are the uses of untreated and treated co-produced water for agriculture and forestry projects – to-date both Santos and Origin Energy have piloted the use of treated CSG water to irrigate large-scale forestry projects in the Bowen Basin.[225]

It should be noted that approval under the Queensland provisions is for beneficial use only and this is not intended to act as a "disposal option" for the CSG operator. If the regulator considers that the rate of consumption is excessive, or there is over-application of the water for the beneficial use, then there will be a breach of the conditions of approval.[226] Furthermore, if the application of the CSG water in itself causes environmental harm then the CSG operator, and the user of the beneficial resource, may also be liable for the offence of causing unlawful environmental harm under the Queensland *Environmental Protection Act 1994*.[227]

Supply of CSG Water

There are a number of additional requirements that will be imposed if the operator wishes to supply CSG water to a third party in Queensland. This supply will require a water licence under the *Water Act 2000*.[228] If the CSG operator owns water supply infrastructure, such as

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[221] Taulis, n 192, pp 415, 411.
[222] Queensland Government, n 218 at 5.
[223] NWC Co-produced Water Assessment, n 4 at 20.
[224] NWC Co-produced Water Assessment, n 4 at viii.
[225] NWC Co-produced Water Assessment, n 4 at 21.
[226] *Environmental Protection (Waste Management) Regulation 2000* (Qld), ss 66M, 66N; Queensland Government, n 218 at 8.
[227] This would include consideration of whether the operator had complied with the general environmental duty to take all reasonable and practicable measures to avoid or minimise environmental harm, EP Act 1994 (Qld), s 319.
[228] *Water Act 2000* (Qld), Ch 2, Pt 6.

pumps, ponds and pipelines, and intends to charge for the supply of water, then they must also be a registered service provider and must comply with their obligations under the *Water Supply (Safety and Reliability Act) 2008* (Qld).[229] In particular, if the CSG water augments the supply of drinking water, either directly or indirectly, then this will require an approved associated recycled water management plan.[230] Post-supply obligations may also apply to this CSG recycled water scheme.[231]

It is important to note that this supplied CSG water is only a temporary resource. [232] These CSG reserves will have a limited lifespan of perhaps 5-20 years per well and the volume of water produced by each well will decline over its lifetime.[233] Accordingly, the supply of treated CSG water is not a permanent substitute for other forms of water supply in Queensland "limiting the longer-term usefulness of this co-produced water for beneficial ecological or consumptive uses".[234] This limitation is particularly concerning when we consider that this supply may be relied upon as a "make good" provision for local landholders where access to water from bores and other sources has been permanently damaged by CSG production. Clearly, this option will provide only a temporary reprieve from any loss of groundwater supply.

THE QUEENSLAND REGULATORY APPROACH: LESSONS FOR ADAPTIVE ENVIRONMENT MANAGEMENT

The Queensland regulatory framework presents as a complex legal web which, ultimately, is designed to allow CSG projects to proceed in Queensland subject to requirements for monitoring, reporting and adjustment of industry practices as new information emerges. The Queensland Government has acknowledged that its understanding of CSG impacts on hydrological process needs to be improved as a fundamental precondition to addressing the impacts of CSG development in Queensland.[235] However, only time will tell whether the current adaptive approach will be able to protect the Queensland environment from what the Queensland Government acknowledges are the "unknown and unintended impacts" of CSG

[229] *Water Supply (Safety and Reliability Act) 2008* (Qld), s 20, Pt 9A.
[230] *Water Supply (Safety and Reliability Act) 2008* (Qld), Ch 3. Exemptions to this requirement will apply where the supply has no materially impact on the drinking water supply of a drinking water service, s 319.
[231] *Water Supply (Safety and Reliability Act) 2008* (Qld), s 329H.
[232] NWC Co-produced Water Assessment, n 4 at 21.
[233] NWC Co-produced Water Assessment, n 4 at 17.
[234] NWC Co-produced Water Assessment, n 4 at 21.
[235] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.

production.[236] It is clear that the Queensland approach does not exhibit all the necessary hallmarks of a *true* adaptive environmental management approach. The use of adaptive environmental management principles in the Queensland regulatory approach is essentially limited to the management of impacts on groundwater and water bores from CSG activities. Overall objectives and key performance indicators are critical prerequisites for an effective adaptive management approach and are missing from the Queensland response. Similarly, any parameters for the evaluation and adjustment of the current Queensland regulatory framework have not been released into the public domain. The Queensland approach is further weakened by the failure to integrate the principles of adaptive environmental management into the Queensland legal framework leaving a potentially fatal disconnect between the decision-making and approval processes under the legislation and the broad adaptive management principles located within the Queensland Government's policy documentation.

Adaptive management, if properly implemented, does have the potential to provide significant assistance in dealing with the complexity and uncertainty surrounding the introduction of CSG activities to Queensland. However, the Queensland approach to adaptive management, in its current manifestation without clear objectives, performance indicators or criteria for evaluation or response, is unlikely to be successful. A radical paradigm shift in the Queensland regulatory approach would be required for an effective adaptive environmental approach to occur. This would require, among other matters, that the adaptive management approach be integrated into statutory provisions for the approval and management of CSG projects. It would require the creation of an appropriate decision-making framework against which the Queensland regulatory approach could be tested and amended. And it would require that the statutory regime be designed with sufficient flexibility to enable changes to be made to the regulatory framework in response to the improved knowledge and understanding of the impacts of these CSG projects. Most significantly, a truly adaptive environmental management approach must be able to embrace the hard decisions that go with "learning by doing" including the ultimate decision of ceasing CSG activities in Queensland in the face of significant information gaps and/or an unacceptably high risk of cumulative adverse impacts.

[236] Queensland Adaptive Environmental Management Regime Policy, n 12 at 1.

IS THERE A DROP TO DRINK?

An Issues Paper on the Management of Water Co-produced with Coal Seam Gas

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PART I – INTRODUCTION

Overview

Coal seam gas is a mixture of hydrocarbons found in coal seams. Due to the highly fractured nature of coal seams and the phenomenon of adsorption, coal is capable of holding large volumes of gas. The gas is held in the coal by overlying impervious layers of rock and because of burial pressure, the gas starts to flow when the impervious layers are breached and the accompanying water is released. Generally, the more water that is extracted, the more gas a well will yield, with production of gas increasing as production of water decreases.

Substantial quantities of groundwater, known as *associated water*, are pumped out to enable gas to be extracted from coal seams in, especially, the Surat Basin. Current legislation vests entitlement to the water (for purposes consistent with a petroleum activity) in the gas companies. An environmental authority issued by the EPA specifies the requirements for environmental management and disposal. The companies may sell the water to a third party, but it then enters the water licensing regime and is subject to the *Water Act 2000*. Development approval under IPA may also then be required for the third-party activity.

Companies have obtained permission from the EPA to dispose of the water mainly in large evaporation basins, though some are negotiating with landholders to desalinate it for rural use. One company in the Dawson catchment has permission to discharge to the watercourse.

Although the life of individual wells is only 10-30 years, it is expected that gas will be extracted from the Surat Basin overall for 50 years or more. Some thousands of wells will be drilled, up to 120 or even more for a single tenement. Typically, wells will be spaced 1.5 km apart or closer, connected by pipes and tracks. Importantly, there is insufficient field history within Australia to make confident predictions of the likely life or performance of wells.

Many of the waters contain sodium and bicarbonate salts and are unsuitable or only marginally suitable for irrigation or drinking. However, quality is variable and some waters are quite fresh. For example, the salinity in the Fairview/Spring Gully field reportedly varies from "almost zero" (probably several hundred ppm) in the north to about 6000 ppm in the south. These figures should be compared with the quality of water from most of the aquifers in Queensland's Great Artesian Basin, containing between 500 and 1,000 ppm total dissolved solids. Although no environmental approvals are required to use water of this standard, the operator is still required to observe the statutory requirement not to cause environmental harm.

The salts break down the structure of irrigated soils and also potentially add to the salt load of inland streams. Desalination is technically feasible but expensive and leaves an even more highly concentrated (though lower volume) residue. A small reverse osmosis plant to desalinate this waste water has been contracted to augment Dalby's town supply but the $10 million cost requires subsidies: one third of the total will be from the Australian Government, two-thirds from the Queensland Government, Dalby Council and Arrow Energy.

The water management regime that has been established is built on four principles:

- gas producers are entitled to take the associated water as of right;
- the companies accept an obligation to monitor the consequences of this take;
- the companies have an obligation to make good any loss suffered by established users;
- environmental authorities are required for these activities and these may be conditioned.

Purpose of this Paper

This paper investigates the management of water that is produced when gas is extracted from coal seams, in Queensland's Surat Basin in particular. The purpose is to serve as a background paper to identify the issues which this industry presents to governments and to place those issues in context and perspective. Eventually, it should be useful to inform:

- policy formulation by the Queensland Government;
- investment decisions by petroleum and gas companies; and
- planning and investment by local governments and water service providers.

This policy analysis was initiated because regional staff of the former Department of Natural Resources, Mines and Water were fielding questions from various stakeholders (e.g. irrigators' associations, landcare groups, NRM bodies and individuals) wanting some assurance that the Department is monitoring the potential impact of CSG operations on existing water bores and also the potential leakage from evaporation ponds. There is also substantial community concern not to waste a potentially valuable resource.

The coal seam gas industry is an important rapidly developing energy resource for Queensland, as recognised by the Premier's attendance at key events, such as the opening of the Spring Gully and Braemar gas-fired projects. But no strategy for reconciling the concerns identified above with the Government's desire to develop the coal seam gas industry yet exists.

Subjects covered

In particular, this paper:

- references some factual information about the industry;
- reviews the procedures involved in granting environmental and other permits for extracting coal seam gas and associated water and how they interact with each other;
- explores whether the statutory regimes adequately protect the public interest and the interests of those with acknowledged rights over resources, particularly groundwater;
- presents some findings resulting from the analysis, leading to:

- issues requiring policy attention; and
- specific actions which the three main departments (EPA, NRW and DME) should take.

Definitions

ATP = Authority to Prospect

CSG = coal seam gas, coal seam methane, coal bed methane (US)

DA = Development Approval

DME = Dept Mines & Energy

EA = Environmental Authority

EMP = Environmental Management Plan

EPA = Environmental Protection Agency

EP Act = *Environmental Protection Act 1994*

EP Reg = *Environmental Protection Regulation* 1998

EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Clth)

ERA = Environmentally Relevant Activity

IDAS = Integrated Development Assessment System

IPA – *Integrated Planning Act 1997*

LPro = *Land Protection (Pests and Stock Routes) Act 2000*

LWMP = Land and Water Management Plan

ML = megalitre (of water)

MR Act = *Mineral Resources Act 1989*

NRW = Dept Natural Resources and Water; NRMW = former Dept of Natural Resources, Mines and Water

P Act = *Petroleum Act 1923*

PAG Act = *Petroleum and Gas (Production and Safety) Act 2003*

PAG Reg = *Petroleum and Gas (Production and Safety) Regulation 2004*

PL = Petroleum Lease

PPL = Petroleum Pipeline Licence

ppm TDS = parts per million total dissolved solids (seawater is c.35,000 ppm; 500 ppm the upper limit for drinking water and 1000 ppm the upper limit for potable human consumption, 5000 for cattle but lower limits may be appropriate depending on composition, duration of exposure, climatic conditions and other factors)

RPP = Riverine protection permit

State Works Act = *State Development and Public Works Organisation Act 1971*

W Act = *Water Act 2000*

WCM = Walloon Coal Measures

W Reg. = *Water Regulation 2002*

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The input of members of the interdepartmental reference panel is appreciated. I am also grateful for good faith input from a large number of knowledgeable people inside and outside the Government.

Circumstances conspired to cut short by more than two weeks the amount of time available to complete the report.

The analysis is grounded in investigation undertaken primarily in regard to the Surat Basin. Although it is not specifically limited to that area, its findings will not necessarily be applicable to operations in different coal measures and different regions. For example, salinity is not such a concern in the Bowen Basin as in the Surat Basin. The volumes of associated water are lower and there has been a longer association with the coal industry. Also, there are other water-related difficulties in the Bowen Basin: for example, the long lengths of levee banks proposed in the flood plains of major rivers; the proposal by Xstrata to long-wall a 6m coal seam underneath a healthy groundwater field which will

no doubt thereby be dispersed; and the large size of open coal pits exposed to air.

The paper does not assess whether there is a need for additional staff or budget.

Consultation with Stakeholders

The analysis has benefited from selective non-public consultation with landholders' representatives, the gas companies, the Australian Coal Seam Gas Council and APPEA, local governments, the University of Queensland's Centre for Water in the Minerals Industry, State departments and various others.

Two relevant reference panels: an interdepartmental one and the quarterly meeting with the Australian Coal Seam Gas Council, met during the period of analysis.

Although some of the main emerging findings have been discussed with the spokespeople for the industry and would not be a surprise to them, the text as such has not been passed in front of the industry.

Finding: A version of this text, edited to remove some of the more internally-focused criticisms of government authorities, should be made available for managed consultation with representatives of the industry. This is to firstly, validate factual information; secondly, confirm the perspective adopted and the key findings; and thirdly to demonstrate good faith in what is a genuinely shared set of challenges.

Literature Search

There is a rich geological and engineering literature from the USA where coal seam gas has been extracted since the 1980s. While this offers a relevant guide to technical considerations, it is of little relevance to Queensland's statutory regimes and policy which are the main focus of this paper. Also, each field is geologically idiosyncratic.

A 2004 consultants' report by Parsons Brinckerhoff co-sponsored by this Department and industry offers a useful overview of the issues. However, the report by itself is an inadequate foundation for policy formulation, for three main reasons:

- the range of sources on which it has relied is narrow and for many subjects is confined to a single US reference;

- many references are cited or quoted without evaluation and without much context. This gives a cut and paste presentation which detracts from confidence in its depth and scholarship;

- throughout the report, there are references along the following lines "the proposed new petroleum and gas legislation will ensure that monitoring and environmental control are adequate". A consulting company is not a position to make optimistic judgements about how well a regime is administered before it even exists.

The Parsons Brinckerhoff report has not yet been endorsed by the Government and does not represent Government policy. This paper is the next successor to it and has the benefit of the industry's experience over another two years.

Market Considerations

This paper is focused on the management of associated *water*, so the production and marketing of *gas* are outside the scope. However, some comments on the commercial forces driving the industry and the likely trends are necessary to place the production of water in context.

First, the significance of the CSG industry to Queensland's economy is difficult to exaggerate. As industry personality Richard Cottee (QGC) has declaimed, CSG has "moved from the esoteric to essential in a very short time". As global prices for petroleum rise in the wake of peaking production of oil, the existence of a convenient portable fuel such as CSG in large quantities can only grow. Queensland is fortunate to have such a valuable gas resource, which is

remarkable on an international stage. It behoves the Government to ensure that it is managed and husbanded for the long-term benefit of this State.

On the other hand, the predictions by some of the industry's more outspoken enthusiasts of unlimited growth will certainly not come to pass. Even though gas is more greenhouse friendly than coal as a source of electricity/energy, it is substantially less greenhouse friendly than energy conservation. The world is facing severe economic and societal disruption on account of climate change and it is quite certain that there will be major shifts in policy in the forthcoming years. As I write this text, Victoria is grappling with the worst bushfire conditions in memory, *six weeks earlier* than they would normally have been expected even in a dry year. Bushfire and dwindling water supplies will focus governments' attention mightily on the consequences of continuing to consume fossil fuels of whatever kind.

Third, the Government's policy directive that 13% of Queensland's electricity is to be met from non-coal sources has switched on demand for gas. No decision better demonstrates the truth that markets do not enjoy an autonomous existence: they are facilitated by government policy (along with the rules of property, contract and corporations); and they can be shaped by changing the statutory and policy context.

Fourth, the deliberate fostering of a competitive market has had the intended outcome of establishing CSG as a significant player on the Australian energy scene. Indeed, one informant noted that "This industry is about Queensland's cornering the national energy market". However, a competitive market in gas has a number of logical consequences, perhaps unintended, which are manifestly or potentially against the public interest:

- gas, coal and renewables companies are competitors and cannot be expected to cooperate; so macro-energy policy is hobbled;
- keen competition between these sectors will tend to under-price each resource, encouraging waste; policy should instead be aimed at conserving the unique and irreplaceable resources;
- a low price for gas tends to make a transition to renewable sources difficult or to require inefficient subsidies and other governmental interventions; the simplest way to encourage energy conservation is to use the power of the market by pricing the non-sustainable sources to be more expensive;
- a low price for gas places downward pressure on the willingness of companies to spend money on environmental protection and community

development; it also tends to favour low-overhead companies lacking a long-term horizon;

- a low price for gas makes beneficial use of the water more problematic as there may be insufficient profit to allow the gas producers the flexibility to innovate; or, in economic language, fierce competition discourages a producer from internalising the true cost of the operation but instead encourages producers to externalise as much expense as possible onto the public purse;

- gas and electricity are both sectors of interest to the emerging infrastructure funds, which are often highly geared and are keen to promote new projects that have a guaranteed income stream. This motive will tend to encourage over-production;

- on the other hand, if the competition becomes really keen, companies may find that it is scarcely worth bringing new gas projects online; again, macro-energy policy becomes distorted by the market.

One departmental insider observed that the circle in which he moves is populated with people with ideas about the next power station, and how to get it up and running before the competition. In a pro-growth atmosphere of this kind, considerations of resource efficiency, environmental sustainability, macroeconomic policy, land-use planning and community development fall by the wayside all remain simply fortuitous side-effects.

If it can be shown that the price of gas is too low to support safe and beneficial disposal, the Government would be challenged to find a way of increasing it without confronting other strands of policy and without gifting a windfall profit to the companies. This paper is not the place to explore how that might be achieved. Suffice to say that the competitive gas market is anti-conducive to market-based solutions to the benign disposal of associated water. Gas producers under conditions of low gas price will turn to governments or user industries to subsidise the cost of disposing of the water that is an inevitable externality from their operations. A low gas price is the corollary of resistance by industry to having higher standards imposed by regulation. Under fierce competition, environmental and social responsibility will require greater effort by ethical company people who will be disadvantaged in the marketplace.

Finding: It is offensive to economic theory to allow the consumers of a resource to purchase at a price below the true cost of provision. This amounts to a subsidy to the consumers from the landholders and others who suffer the adverse consequences. This is what will happen if the full cost of benign disposal of associated water is not borne by the companies profiting from the sale of gas. The market will not internalise these costs unaided.

Finding: That DME re-think its policy stance of support for an independent gas market and lead a Cabinet submission positioning the CSG industry in Queensland's energy future, taking into account the changes in external conditions (such as peak oil and climate change) since the 2000 policy.

Finding: That the submission present a strategy for adjusting the bounds of the gas market so that companies can internalise the cost of benign disposal without threatening their viability.

The Nunan Summary

Lawyer and member of the Australian Coal Seam Gas Council, Tony Nunan, has summarised (2006) the legislative framework of the gas and water regime.

"Queensland's new petroleum regime, in the form of the *Petroleum and Gas (Production and Safety) Act 2004* (PAG Act) and the *Petroleum and Other Legislation Amendment Act 2004,* was long anticipated and was introduced to provide certainty and stability to enable the development of Queensland's significant coal seam gas and coal resources.

Since the new petroleum regime's commencement the CSG industry has continued to expand due to new drilling technologies, greater market opportunities and the encouragement of government through the Queensland 13% gas scheme. The new petroleum regime is a significant upgrade from the former *Petroleum Act 1923* (P Act) which did not contemplate the overlap between coal and petroleum tenure which is inherent in the coal seam gas industry. …

CSG is extracted by removing water from a coal seam. The removal of the water reduces the pressure in the coal seam and allows the CSG to be released... While no two wells or coal seams behave identically, an average CSG well in the Surat Basin can extract between 140,000 and 470,000 litres of water per day during dewatering [50-170 ML p.a.] and an average CSG well in the Bowen Basin can extract between 80,000 and 160,000 litres a day.

With the rapid expansion in the total number of CSG wells drilled from 72 in 2000-2001 to 167 in 2004-2005 there has also been a large increase in the amount of water that is extracted. …

Water extracted during the course of extracting CSG (or another authorised activity for the tenure) is referred to as "associated water" under the P&G Act. A petroleum tenure holder that is desirous of on-supplying associated water must comply with the provisions of each of the P&G Act, the *Environmental Protection Act* 1994 and the *Water Act 2000*.

Unlike water extracted by a landowner via a water bore, associated water is considered to be a regulated waste for the purposes of the EP Act. The storage, treatment, processing or disposal of a regulated waste is an "environmentally relevant activity", which requires the person proposing to undertake the activity (the petroleum tenure holder) to apply for and be granted an environmental authority that authorises the activity. The holder of a petroleum tenure that extracts water from a coal seam is required to obtain

an environmental authority to allow the holder to dispose of or on-supply the associated water. …

"Regulated waste" is defined very broadly under the EP Act and effectively means any non-domestic by-product of another activity (or material surplus to another activity) which has one of the properties set out in schedule 7 of the *Environmental Protection Regulation 1998* (which includes chlorates. arsenic, boron and acid or alkaline solutions) and whether or not the material has value. The EPA and NRMW have taken the view that water extracted from coal seams during the extraction of CSG is considered a regulated waste. S.426(1) EP Act states that a person must not carry out a petroleum activity that is a level 1 environmentally relevant activity unless the person holds, or is acting under an environmental authority (petroleum activities) for the petroleum activity. …The disposal of a regulated waste is a level 1 activity under part 75b, schedule 1 of the EP Reg).

The PAG Act and the amendments to the Water Act have established a detailed and comprehensive regime that regulates the on-supply of water from petroleum tenure and imposes obligations on petroleum tenure holders to monitor and make good any impacts that the extraction of water has on underground water reservoirs within the area of the tenure.

The PAG Act grants the holder of petroleum tenure the right to extract associated water providing the extraction happens during the course of or results from the carrying out of an authorised activity for the tenure. The PAG Act prohibits a petroleum tenure holder from drilling a water bore which is not for the purposes of an authorised activity. Once the water is extracted, the holder may use the water for the holder's authorised activities or on-supply the associated water to the owner or occupier of land within the area of the tenure or land that adjoins land in the area of the tenure provided the owner of the joining land is the same owner of the land within the area of the tenure. However, the associated water on-supplied can only be used by the owner or occupier of the land for stock or domestic purposes.

The Water Act was amended with the introduction of the PAG Act to enable a petroleum tenure holder to apply for a water licence to on-supply associated water for all other purposes that are not expressly authorised under the PAG Act.

Probably the most notable amendment to the Water Act was the inclusion of a regime which acknowledges that the extraction of associated water may impact on land owners' ability to extract water from the same aquifer. The Water Act places conditions on a water licence granted to a petroleum tenure holder requiring the tenure holder to supply stated volumes of water to persons who have applied for, but have been refused, a water licence to take underground water because of the petroleum tenure holder's activities (known as the priority group).

Once the water licence is granted, the petroleum tenure holder can on-supply the water but must not charge a fee to the recipient of the water unless the petroleum tenure holder is registered as a water service provider under s.370 of the Water Act.

In addition to the Water Act acknowledging that persons within the area of an aquifer where petroleum activities are taking place may be refused water as a result of the petroleum activities, the PAG Act places a general obligation on petroleum tenure holders to ensure that they:

- undertake restoration measures to restore the supply of water to the owner of the bore; or
- compensate the owner of the bore for being affected by the dewatering.

This "make good" obligation as it is referred to in the PAG Act is not restricted to the area of the petroleum tenure or the property on which the petroleum activities are being undertaken. The make good obligation includes the extent of the underground aquifer that the petroleum tenure holder is dewatering. Any bores that have been unduly affected as a result of these activities must be made good by the petroleum tenure holder.

A bore is considered to be unduly affected if the drop in the level of water in the bore because of the exercise of the water rights for a petroleum tenure is more than a trigger threshold for the aquifer set by the Chief Executive of…NRMW [now NRW].

The aquifer from which a petroleum tenure holder is dewatering may be a significantly large area. The broad obligation to make good affected bores places a significant burden on the petroleum tenure holder to identify and monitor bores within the aquifer that may be affected by the petroleum tenure holder's activities.

In order to ascertain if bores within the aquifer will be unduly affected the petroleum tenure holder may request that the Chief Executive of NRMW set a trigger threshold for the aquifer from which they are dewatering. This trigger threshold will be the water level drop in the aquifer that the Chief Executive considers will be a level that causes a significant reduction in the maximum pumping rate for the bores in the area affected.

In fixing the trigger level, the Chief Executive must consider the permeability and geology of the aquifers and the water levels in the aquifers. The petroleum tenure holder must be given a reasonable opportunity to make submissions about the trigger threshold proposed by the Chief Executive.

The PAG Act does not provide any detail on how the Chief Executive will obtain the information necessary to determine the trigger level, nor how the Chief Executive will determine the nature and extent of the aquifer. However, the Chief Executive may ask the petroleum tenure holder to give the Chief

Executive documents or information the Chief Executive reasonably requires to fix the trigger threshold.

If the trigger threshold is reached and the landholder is no longer able to use the bore for the purpose or to the potential that it was used prior to CSG extraction, then the petroleum tenure holder must "make good" the bore.

The new petroleum regime gives the petroleum tenure holder two options to make good a bore which has been unduly affected by the petroleum activities.

First, the petroleum tenure holder may undertake restoration measures to ensure that the bore will no longer have an impaired capacity. This may be done by deepening the bore or by providing the landowner with an alternative and equivalent supply of water. Second, the petroleum tenure holder may pay reasonable compensation for the loss of value of the owner's land on which the bore is located; the loss of use the owner has made, or may make, of water from the existing bore; or any cost or loss the owner suffers that is caused by the impaired capacity of the bore.

The inclusion of the make good obligation places significant scientific and factual obligations on the Chief Executive in order to determine trigger thresholds for aquifers. Such a requirement is burdensome on the Chief Executive and NRMW as it is required to set a trigger threshold for every aquifer from which a petroleum tenure holder is extracting water. While there is no specific obligation on the Chief Executive to prepare a trigger threshold for each aquifer, every petroleum tenure holder must prepare and lodge an underground water impact report which states the trigger threshold determined by the Chief Executive for aquifers in the area affected by the activities of the petroleum tenure holder. The only way a petroleum tenure holder can obtain this information is by requesting the Chief Executive to set a trigger level for the aquifer.

A petroleum tenure holder must lodge an underground water impact report for the aquifer from which they are dewatering by the date by which the petroleum tenure holder is first required to lodge a royalty return for petroleum production on their lease or in the case of an ATP, 20 business days after the end of the first year of petroleum testing. The report must detail:

- the trigger threshold (determined by the Chief Executive) for aquifers in the area affected by the dewatering;
- an underground water flow model;
- the area of aquifers predicted to be affected;
- the bores within the area that may be affected;
- an estimate of when each bore will become affected;
- details of a monitoring program; and
- other information and matters prescribed under regulation.

The petroleum tenure holder is then required to monitor the aquifer and

review the predicted effect that their activities will have on the underground water impact report to demonstrate that the report continues to be appropriate.

While the new CSG regime has introduced novel and burdensome provisions regarding the production of water from CSG wells, we are yet to see how these provisions will be implemented in practice. With the continued expansion of the CSG industry and the greater impacts that petroleum production may have on underground water aquifers it is likely that these provisions will place significant long term monitoring obligations on both the petroleum tenure holder and the Chief Executive."

PART II – TECHNICAL EXPLANATION

Overview

Coal methane has long been a hazard in coal mining but has been recognised as a resource for only 20 years. Not all and on some accounts not many seams are suitable for this kind of production. Moura was the first field in Queensland, Peat Scotia the first in the north-eastern Bowen Basin and Fairview the first field in the main Bowen Basin – Fairview commenced production in 1998. The local industry spent 20 years before it developed techniques suitable for extracting the resource in Queensland. Even then, the fields are so different from conventional gas fields that predictions as to volumes of water and gas likely to be produced have been astray, in some cases by tens of percent.

Gas is retained in coal seams in several ways: adsorbed in micropores (most); trapped in matrix pores; free in cleats (macropores) and fractures; free in openly connected pore space of a porous substrate (such as a sandstone); or dissolved in groundwater.

Adsorption is a physical process by which separate molecules of gas lodge in the crystalline structure of a substrate, in this case carbon and other compounds. The process is dependent on the ability of the gas to diffuse through the compound and is greatly enhanced by fracture systems that provide a greater surface area for easy access. Cleats are fractures and increase the surface area of coal accessible for adsorption. Solubility of methane is not high so not much is dissolved.

The cleats in coal are typically much closer together than fractures in other rocks meaning that any gas that can move through the cleats has access to a greater area of the rock; however it is the high propensity for coal to adsorb methane and other gases that really makes the difference. There could be an equal area in a porous fine-grained sandstone but the silica hardly adsorbs any gas so the quantity of gas would depend on the pore space, pressure and presence of other fluids, especially water (and carbon dioxide). The likelihood of connections between a coal seam and an artesian aquifer depends on larger scale geological features such as the stratigraphic sequence (eg. aquicludes) and faulting and folding.

Gas desorbs, diffuses through the matrix and flows from natural fractures. The

moisture content has a marked effect on the adsorption capacity.

The Basins, the Coal Measures, the Waters and the Producing Companies

Loosely, the stratigraphy of the subject areas in the Surat Basin runs as follows:

- local aquifers and seepage zones: less than about 10 m to the surface;
- Condamine Valley aquifers, e.g. the Condamine Alluvium;
- Walloon Coal Measures, themselves consisting of several strata;
- deeper Great Artesian Basin (GAB) aquifers.

Walloon Coal Measures are an aquifer of the GAB and supply numerous artesian bores. They occur between the Gubberamunda Sandstone/Kumbarilla Beds (and further west the Hooray Sandstone) above and the Hutton Sandstone and the Precipice Sandstone below. When subcropping they are overlain in part by Condamine Alluvium. They are geologically and hydro-geologically part of the GAB.

Depths of the measures depend on folding and faulting. Typically, gas wells target the Walloon Coal Measures at a depth of 200-1000 m. The depth of a well varies from field to field and is dependent on the nature of the coal stratigraphy and the zones targeted by the company. The different companies have indicated different depths for their operations. At Spring Gully, Origin CSG extracts CSG from a depth of 600m. QGC in the Walloon area starts at 300 m: three to five seams are tapped for gas. Coals shallower than that tend to be under-saturated; deeper coals are too “tight” so 200 to 700 is the target range. These wells are substantially more shallow than in conventional gas fields.

Origin is involved in three current operations, two in the Bowen: Peat near Wandoan (produces negligible water so need not be further considered) and Spring Gully; as well as a pilot at Talinga and Orana in the Walloon area of the Surat Basin.

Santos runs two operations in the Bowen Basin: Scotia (producing negligible water); and Fairview. It has another operation near Roma just commencing.

Arrow is producing from Kogan North, Daandine and Tipton West. There is a small production from Moranbah in the Bowen Basin.

QGC has operations in the Surat Basin at Berwyndale (Windibri) south-east of Chinchilla. It has test facilities at Argyle (Wambo Downs South) and Lauren nearby.

It is thought that much of the water being produced is 25-75,000 years old. Although for the better known GAB aquifers, age and origin are understood (within ranges), for the water in coal seams, overall, it is uncertain how old is this water, its origin and how rapidly it moves, what kinds of processes are occurring and whether water is seeping between aquifers. These parameters are researchable.

The Production Process

The footprint of each well is about 8 m by 20 m. Wells are connected to a central compressor on the field by pipelines that are generally laid on the land surface or buried to shallow depths. Exploration in this industry is intensive, conducted on a 1 km grid, and requiring extraction of large volumes of water (and hence construction of evaporation ponds) even to prove the resource.

Typically the company may pump for six months before gas is produced. Some wells must be de-watered for 12-18 months before usable quantities of gas emerge; some produce gas after couple of months. Wells are predicted to last 10-30 years, with an estimated 30-50 years being the lifespan for each field.

Each well costs slightly more than $1 million compared with $2.5-3 m for a deeper conventional field. The plant required for extraction is rather basic.

On exiting the surface and the field separator, the water then requires power to pump it beyond the plant.

Gas Production

Current total demand for gas in Queensland is 120 petajoules p.a., equivalent to 30 years' supply from the Walloons. The State is producing 170 PJ of which 70 PJ is produced from coal seams. Fifty PJ are sold interstate. Proven and probable reserves in the Surat Basin are some 3000 PJ. Walloon coal measures have officially reported reserves of 1064 petajoules, Bowen Basin 2626. Origin alone has committed to produce at least 450 PJ of gas under long-term contract.

The industry estimates that there may be more than 15,000 PJ of recoverable coal seam gas reserves in Queensland alone, enough to supply the gas needs of the eastern States for 20 years at current rates of consumption. Spring Gully and Fairview alone can supply the Queensland market for 40 years.

The industry has invested $0.5 bn in developing the fields which now supply 50% of Queensland's gas.

CSG gas is greenhouse friendly (as far as gas can be) with low sulphur and nitrogen oxides, 95-98%+ methane. Surat Basin gas has good prospects for conversion to diesel.

Water Production

Spring Gully produces approximately 3-4ML per day of water, Talinga pilot project about 1-2 ML per day. At Spring Gully, production of water from individual wells is declining by 20% per annum. The amount of water produced is unrelated to the final volume of gas produced. Successful reverse osmosis trials have been conducted at both Spring Gully and Talinga.

Fairview is producing up to 5ML per day (2001). Water is used for stock and domestic supply, discharged to the Dawson River system (licence issued by the previous Department of Mines and Energy, now overseen by EPA), run through a reverse osmosis unit, reinjected to a fractured clay basement or used around the plant. Santos expects Fairview to expand to about five times its present size, producing perhaps 16 ML (100,000 barrels) of water per day.

Arrow is producing 2.86 ML per day from Kogan North, 2 from Daandine and 3.5 from Tipton West. There is a small production from Moranbah in the Bowen Basin.

An earlier estimate is that QGC was expecting to produce 1 ML per day (350 ML p.a.) for 35 years but this is probably now too low.

Arrow is supplying Peabody's Wilkie Creek mine with up to 3 ML per day. It has signed a contract to supply Dalby Town Council with a guaranteed 2.65 ML per day with options up to 5 ML per day, over 15 years; on a "best endeavours" basis.

The total production from all the fields itemised above sums to up to 20 ML per day or 7000 megalitres p.a. How significant is this? This question can be viewed relative to either extraction of groundwater or of disposal.

Looking first at extraction, 7000 ML/yr from an aquifer such as the Walloons is significant, given that 35,000 ML/yr has already been allocated and capped at that level. It represents an increase in water diversions of 20%. There would be no way a cotton farm could get a water licence to support this level of extraction from the Walloon Coal Measures. A cotton irrigator could not access 50 ML/day from this aquifer within a 500 ha property without locally dewatering the aquifer. But, assuming that they could get a water licence, it would effectively rule out any other non-stock or domestic bore for a distance greater than 100 km. This is based on the bore separation distance criteria for the Walloon Coal measures in the Great Artesian Basin Resource Operations Plan, which is to commence in late February 2007.

Referring to disposal, 7000 ML/yr is not large considering the total quantities consumed by for example the irrigation industry. The water demand by a single 500 ha cotton farm could be as much as 50 ML per day during summer for a growing season of 100 days (5000 ML p.a.). However, the total demand would normally not come from just one source. The scale of the disposal "problem" should be seen in context: the volumes are not insignificant on a local scale, but in terms of Queensland's water shortage, they are very small.

Water Quality

At Spring Gully, the water is typically 5-7000 ppm. At Talinga, commonly 2-3000 ppm.

Fairview has dissolved salt values varying from a few hundred to 6000 ppm

(most being at the lower end, regarded as brackish). There are no evaporation ponds at Fairview.

During discussions between departments and the industry, Arrow has mentioned that they are currently supplying feedlots with better quality water than their alternative supplies (but this seems to be illegally).

QGC claims that its water is 2000-3000 ppm. It is irrigating 40 acres of barley at 3000 ppm. This does not fit the purposes authorised under the P&G Act. National water quality guidelines do not recommend irrigation at levels above 1500 ppm TDS for poorly drained soils and then only for appropriate species of plants. Water above 3500 ppm should not be used for any form of irrigation.

Quality in a given aquifer does seem to remain fairly stable as it depletes. However, water composition varies greatly from field to field and has a major impact on the options practicable for treatment. Samples assayed at 4500-6000 ppm dissolved salts have had a sodium content of 1840-3461, chloride 2060 ppm, calcium only 5. The sodium absorption radio is one of the most pernicious parameters: it can be as high as 600. This water will can destroy the structure of friable soils.

Typical alkalinity is pH 7.6-8.9. It is not biologically inert, but has a rather diverse bacterial flora.

There are possibly some toxic materials in some waters, including fluorides and strontium as well as some hydrocarbons (10-11 ppm has been mentioned but industry representatives question this and state that generally, if there are trace levels of hydrocarbons, they are negligible). Some of the lower seams are contaminated with difficult substances. A hint can be given by the reported composition of a surface pond at the Kogan Creek Power Station: arsenic, lead, selenium, iron and acidity are present as is typical of an open cut coalmine. (It is not clear whether the associated water would be free of contaminants of this kind because it is sourced from anaerobic strata).

Industry has claimed that any substantial hydrocarbon residue would be a disaster for the reverse osmosis technology and in any case, benzene and other hydrocarbons are completely unacceptable in water destined for town supply.

PART III – SOME KEY ISSUES

(Other than Statutes and Information as Discussed Separately Below)

The lack of widespread agitation in the media is not necessarily a good indicator of the depth of feeling in the community. The perception that there is a genuine concern by the community about the extraction of water by the coal seam gas industry in the western Darling Downs passed a quick 'cabbie test': on 6 December two out of two cabbies interrogated in Toowoomba left this author in no doubt about the depth of their feeling – and their knowledge. A term used: "plundering our resource" conveys the flavour of their views. How valid are views of this kind and can they be readily assuaged?

Landholders and the community are primarily concerned about the effects of this industry on:

- groundwater resources, especially existing bores;
- farming operations, especially cropping paddocks requiring long machinery runs;
- contamination of the surface through saline water and large permanent evaporation ponds (One informant: "It is almost morally reprehensible to discharge unusable water into the community");
- the waste of a precious resource (One informant: " Deliberately evaporating water in this day and age is a crime").

However, these do not exhaust the sum of the concerns of the State departments who are charged with protecting the undivided public interest. This section introduces some of the issues that have come to light.

The Effects of Gas Production on the Coal Resource

Mostly, the implications of gas extraction for coal extraction are outside the scope of this paper. However, a couple of aspects are water-related.

Condition of coal resource after extraction of gas

Realistically, it is unlikely that coal will ever be recovered from the deep but thin seams used for gas production. Greenhouse considerations alone will militate against this. However, a prudent government would ensure that as many options as possible are kept alive for the future. Even 30 cm thick bands can be mined and burnt in a local power station as that use may not require washing. Dewatering of the coal beds *may* compromise the prospect of later mining them for their coal content (advices on this matter have been mixed).

Where there is any prospect that the coal may be mined later, the water should be regarded as a resource to be co-extracted, as it useable for washing coal and for mining operations.

Finding: That the gas producing companies, the State departments and the regional NRM body cooperate to produce strategic plans at a district scale for the development of the CSG industry and that these plans deal with the question of future extraction of coals.

A special case is presented by Linc Energy which has commenced a project south of Chinchilla upon underground coal gasification. The intention is to convert some of Queensland's "stranded" coal deposits into fuels. The technique of in situ gasification requires setting fire to coal seams underground.

There are several negatives associated with this process. First, the strategy of setting fire to coal seams is regarded sceptically by geologists. There are many places worldwide where fires in coal seams have burnt uncontrollably for years and even decades. To this author, it is difficult to conceive of any circumstances in which the practice of igniting a fire underground can be regarded as prudent.

Second, the Linc project, authorised under the MR Act, is incompatible with the CSG industry.

Third, the process of burning coal under anoxic conditions can produce phenols, benzene and other unpleasant combustion products. Linc is promoting the fact that the diesel fuel it will produce will be cleaner (specifically in sulphur) than conventional refinery diesel, but this advantage says nothing about the cleanliness of the process underground. This study has not had time to explore whether such products are likely to contaminate aquifers tapped by landholders or by CSG-producing companies in the locality. If there is any risk of this happening, it would be better to compulsorily acquire Linc's lease and close the operation down immediately.

Finding: That DME investigate the risk of contaminating aquifers with poisonous combustion products during underground coal gasification; and if the risk is significant, that it retrieve the mineral development licence, regardless of cost.

Capacity to pause

Industry has confirmed that once a field is established, it is very difficult to switch it off or to pause or close it down without seriously compromising its ability to produce gas later. Apparently re-watering of the seams is not easily reversible.

This feature of the production process is problematic if negative consequences for a local aquifer are demonstrated. This feature coupled with the economic investment the company has made will motivate it to resist fiercely a pause or close down.

Finding: The apparent inability of gas producers to pause a project once pumping has commenced places a heavy burden upon industry and DME to be absolutely confident that the consequences can be managed satisfactorily before launching a new project.

The Effects of Gas Production on Groundwater

Generally speaking, in the Surat Basin the CSG industry is being established in groundwater and surface water catchments that are already stressed. A feature of the PAG Act regime is acceptance that aquifers will be dewatered, but this acceptance is conditional on compensation of the affected water users. Aquifers are not made good, but water bore users are.

Connectivity between the coal seam aquifers and the Condamine aquifers

Connectivity with the overlying aquifers particularly freshwater production aquifers such as the Condamine Alluvium and sandstones is one of the four major concerns to landholders. It is also very much on the industry's agenda: connectivity was the focus of negotiations when the new petroleum legislation was being drafted; and was the basis of the monitoring and reporting regime.

The hydrological evidence suggests that the surface aquifers in the Condamine

valley are more likely to be affected by leakage from the evaporation ponds above than by direct extraction of water from the Walloon Coal Measures below.

Though not proven, there is evidence suggesting that there is a connection between the WCM and Condamine Alluvium in the vicinity of Dalby. The evidence includes:

- inferred groundwater flow direction within the WCM is toward the centre of the Condamine valley, based on contours from monitoring bores;
- measured groundwater heads in the Walloons are greater than in the Alluvium;
- dramatic increase in salinity within alluvium to the west of Dalby could suggest an inflow of saltier Walloons water.

Some WCM gas fields such as, reportedly, Arrow's Tipton field, are quite close to the alluvium-based aquifers above, while other fields are quite isolated.

Finding: That potential connectivity be monitored short-term through the water impact reporting regime and long-term through the preparation of strategic water management plans for each field.

Connectivity between the Great Artesian Basin and the coal seam aquifers

Consultants Parsons Brinckerhoff stated "Based on geological information and inferred groundwater information… the Walloon Coal Measures …are not considered to be hydraulically connected to the Great Artesian Basin" but heavily qualified this conclusion, even calling it an "assumption" reached without "detailed, site-specific groundwater assessment".

It is more than an assumption, it also muddies the analytical and metaphorical water significantly. Hydrologists regard the Walloons as part of the GAB and they are shown as such on geological maps and in the GAB Water Resource Plan. There are artesian bores within the Walloons. Perhaps the consultants were saying that the coal seams within the Walloons are not hydraulically connected to the rest of the WCM aquifers, or the Hutton sandstone or the Kumbarilla beds.

Some industry figures have presented two pieces of evidence to indicate that the WCM aquifers are isolated. First, where there are major geological faults, the gas may have slipped out anyway. Second, if there is a significant fault or connectivity between the WCM and other known aquifers, it will not be possible

to de-water the field and so this risk will become fairly obvious fairly quickly. Significant faults would be a major concern for the companies.

However, departmental hydrologists regard both arguments as simplistic. The view that the presence of the gas implies there is no connection with other aquifers is fallacious. First, gas adsorbs to the coal. So even if water can move, gas doesn't necessarily move with it. But even if one assumes (wrongly) that gas moves as one with the groundwater, its presence does not prove a lack of connection with other aquifers. It could simply be that there has not been a suitable pressure gradient to make the groundwater move. This situation can dramatically change with dewatering, as anybody involved with mine pit or tunnel dewatering will attest. With the large induced pressure gradients induced by dewatering, hydraulic connections with other seemingly isolated aquifers can easily appear, resulting in cost blow outs, and sometimes in abandonment of a mine or tunnel. In other words, the reduction of pressure in the aquifer because of dewatering could induce a noticeable hydraulic connection in places where it was not noticeable previously. This is often seen in alluvial aquifers such as in the Murray Darling Basin, where depressurisation in a good aquifer can induce flows of very salty water into the good aquifer from or through overlying aquitards (clays) – which would normally have been considered relatively impermeable. Water flows through a porous medium according to Darcy's Law – and the significant criteria are the properties of the aquifer and the pressure gradient.

Of most importance for our current purpose is the pressure gradient between two points. Groundwater can be induced to flow over a distance greatly separated from the local extraction. Relative pressures between aquifers can be reversed, and where the relative difference in pressures is increased, it can become a noticeable flow where it previously was a virtually non-existent trickle. Hence, gas could be contained locally within the coal seam, and not have moved over a long period; however once pumps are started up, water can be induced to flow in directions and ways that it never has previously.

The information available to this analyst is simply not adequate to form a judgement on the likely risk of compromising the significant regional aquifers of the Great Artesian Basin. The water impact report and monitoring regime within the PAG Act recognises this reality. No one can realistically know in advance what will happen, and what hydraulic connections with other aquifers will appear once the coal seams are dewatered. However, it is reasonable to regard the Parsons Brinckerhoff conclusion as simply "spin".

Finding: That potential connectivity be monitored short-term through the water impact reporting regime and long-term through the preparation of strategic water

management plans for each field.

Finding: That funds be provided to commission studies by geologists of known and suspected faults with a view to plotting their potential effects on the relevant aquifers. (This should be funded by DME if it is arranged as part of foundation geoscience mapping; or by the companies if it is a preliminary to gaining approvals. Monitoring to verify the predictions should be by the companies).

Leakage between aquifers via bores

Double-slotted monitoring bores can cause leakage between aquifers. Bores are often simply capped at completion and not fully plugged, placing fresh aquifers at risk. There are no accepted and consistent standards for abandonment of bores. Schedule 3 of the PAG Reg deals with this, and there is a decommissioning standard for licensed water bore drillers (*Minimum Construction Requirements for Water Bores in Australia*, 2nd edition 2003). However there is a lack of consistency between these documents, and in any case regulatory supervision of this activity is weak.

It is unclear who is responsible to fix any leakage between a salty layer and a fresh layer (and whether post facto repair is even possible) once the gas producing company completes its occupation. It is unclear whether the risk posed by the CSG industry is any greater than that posed by the operation of ground water bores generally, which now outnumber CSG bores by approximately an order of magnitude, although the ratio is shifting.

The information available to this analyst is not adequate to form a judgement on the likely risk of mixing waters.

Finding: That DME prepare a best practice manual for the sinking, operation and decommissioning of CSG wells and link adherence with this manual to one or other of the statutory regimes by conditioning permits.

The practicability and the consequences of re-injection

There is currently minimal information regarding the feasibility and cost of re-injecting the associated water after extraction back into the same coal beds or neighbouring beds. It is understood that Santos is successfully reinjecting at Fairview South, but they are fortunate to have a suitable fractured base stratum beneath their wells. At Surat that option has been described by some informants as unavailable as it is not practicable to reach below the GAB but by

another informant in these terms: "The geological sequence is probably very similar. The difference is that the operator at Surat hasn't tried to find a suitable stratum". Aquifers suitable for re-injection are rare and dispersed. To be able to reinject while being confident that the water is not simply disappearing into some other potable aquifer, there must be a unique set of geological circumstances. The process is most common in alluvial sands and limestone: there is little experience in Australia with fractured rock aquifers. (There is considerable experience in the USA with injecting wastes but success has been mixed: there have been some disasters resulting in extensive contamination of aquifers).

In short, the seams available for re-injection aren't necessarily suitable. The deep ones are commonly suitable but they are hard to reach. Pressures required are very great and the operation is expensive. Pores can become clogged with for example biological precipitates triggered by iron bacteria. Certainly, pulling water out of coal seams is much easier than injecting it back in.

Normally, a field would not be available for re-injection for 20-25 years. It is not possible to consider re-injection on a well-by-well basis: the whole field must be considered.

Re-injection should occur only into an aquifer of equal or lesser quality and into a geologically isolated zone. Not all aquifers are saline. In Surat , there is no aquifer that is saline enough. In the Surat Basin, the permeable aquifers other than the coals tend to be fresh GAB aquifers into which re-injection would be inappropriate.

There is always a risk that a company will nominate an aquifer which they claim is isolated and not of social, environmental or economic importance only to find out later that it is connected to other useable systems. However, if the re-injection is restricted to systems of equal or poorer quality it is unlikely to have an adverse impact.

Finding: Gas producers should be encouraged to re-inject associated water into isolated aquifers of equal or lower quality but the authorities should not assume that this technique will be a commonly available solution.

The Effects of Gas Production on the Land Surface

Debate over the effects of the disposing of associated water has to date focused on the *concentration* of salts in the water. However, a process that brings any water of other than perfect purity to the surface is depositing *additional* salts into the landscape. In the Surat Basin, all significant watercourses are already stressed. Further, any watercourse that drains to the Murray River is adding to what is now recognised as being an intolerable problem downstream. Concentration is irrelevant.

There are issues other than disposal of salts to watercourses and a few are presented here.

The intensity of the gas infrastructure

Laser levelling for cropping operations nowadays means that long runs are required by grain and cotton farmers to operate machinery; and controlled traffic techniques require runs to be on established configurations. A network of even small obstacles in a paddock may make cultivation impracticable, indefinitely, and the loss of production maybe far greater than the value of the land itself and greater than the value of enhanced farm infrastructure, such as new roads and waters and fences.

Compensation is determined by the Land & Resources Tribunal which is not constituted to bring traditional valuation methods into the deliberations (as is the Land Court). In recent decisions subject to the Mineral Resources Act, the Tribunal has effectively rejected claims for injurious affection on the balance of land not physically disturbed. It is highly likely that this “black letter law” approach to compensation will be extended into claims under the PAG Act making it impossible for landholders to be compensated for the loss of value on a “before and after” basis which is a traditional method of valuation.

QGC has publicly announced its intention to increase well spacing from 750 m to 1 km which will cause a reduction of 40% in the number of wells. Such intentions are to be applauded. Even at 1 km, however, the network of well heads is a severe constraint upon farming operations.

Companies must “make good” the detriment to other established users, but there is no known way of restoring contaminated evaporation ponds, and pipelines are a long-term constraint upon property management. Also, one cannot be sure from the literature how each water will react with surrounding soils.

Finding: That the appropriateness of the compensation regime as overseen by the Land & Resources Tribunal be subject of a focused review involving the Valuation directorate.

Finding: That the CSG industry be encouraged to develop low-impact techniques such as burying facilities and wider spacing of wells and compressors as best practice.

Evaporation ponds

Disposal of associated waters through evaporation in surface tanks is not favoured by EPA or any non-government stakeholders. However, in the absence of demonstrably practicable alternatives, several have been approved. Origin has constructed one of 53 ha and 1000 ML capacity with an average depth of 1.7 m; QGC's at Berwyndale is even larger.

Some ponds are unlined whereas some are lined with clays and compacted, say to 98% with 2% or less moisture. Origin reported that it laid down 300 mm of compacted clay, with the compaction process supervised by a qualified geotechnical consultant.

Some evaporation ponds by Santos under the former regulatory regime administered by the Department of Natural Resources and Mines were allegedly not compacted to adequate specifications and are now leaking. Some have inadequate free board and have been overtopped. A contractor claimed that it is widely known in earthmoving circles that two Santos ponds were poorly constructed. Anecdotal evidence suggests that the water level in the unlined evaporation pond at QGC's Wambo Downs South pilot plant is dropping faster than evaporation alone would explain, indicating that water is headed for the Condamine River. The large pond at Berwyndale within 500 m of the Condamine River is reportedly unlined and has not been compacted and expert advice is that it is certain to leak. If these allegations are true, then the statutory regime has failed.

Design, construction, operation, maintenance and decommissioning of evaporation ponds must comply with the EPA Code of Environmental Compliance for Regulated Dams (draft at the date of writing). "Referable dams" (W Act) are a subset of the total number.

There is of course a wide variety of soils at the gas production sites and not all are suitable for evaporation ponds. There is still a lack of understanding in the

relevant circles about precisely how each clay soil type will behave under a potentially heavy salt load. Although usually sodium in a clay increases water holding capacity, in certain circumstances it can decrease. On sloping sites it is more likely that there will be seepage.

Virtually all experts consulted were sceptical that evaporation ponds can in practice be constructed to be sufficiently impervious to prevent leakage into the soils or groundwater. NRW is not confident that technical knowledge is enough to set robust conditions for construction of ponds, even if they are clay lined. Unless there are inspectors on the spot watching that ponds are built to professional design, they will not necessarily be done properly. One small mistake that wouldn't be easily be detected can cause a dam to leak. One engineer said that the chances of being able to construct a secure naturally lined dam on that scale are virtually nil. It just doesn't happen, even if laboratory tests are positive. Dalby Town Council originally relied upon a clay lining for its evaporation ponds, but after observation bores exposed leakage, it is now moving to line with high density polyethylene.

Plastic black clays do not necessarily seal off even if kept continuously wet. They crack because they are unconsolidated. The local black clays in the Dalby area need special techniques by a sheep's foot roller or vibrating flat roller to compact: track rolling with a bulldozer is not sufficient. Compaction is a specialised task: compacting clays in a 115 ha dam to a non-leaky standard is very different from the task of compacting certified road base in constructing traditional roads. However, with a full-scale mining boom in progress, clients must take the contractors that they can find.

Sealing must be near-perfect to be acceptable. Even a very low percentage seepage, over years, will generate sufficient significant escape of salt into the landscape.

Capping and sealing ponds after they have served their purpose is also going to be a challenge. Fifteen years ago, it was common practice to cover polluted tailings with a low-permeability clay. In various climates, these often broke down through cracking and erosion. It is now standard practice to cover a low permeability layer with a porous layer which captures rain and supports vegetation which in turn transpires a good deal of the moisture produced. It is not clear how practicable treatment to this extent will be for ponds of more than a hundred hectares.

The question arises as to who will be accountable for maintenance of a de-commissioned pond in perpetuity. Legally, the landholder will remain

responsible once the petroleum lease is relinquished, but the average landholder would have neither the engineering expertise nor the disposable cash to remediate large ponds if significant defects arise. The gas company will be anxious to depart from the scene as quickly as possible and is likely to restructure its liabilities away rather than accept responsibility. Corporations law requires that companies be concerned pre-eminently for the interests of the shareholders, leaving only the State to accept responsibility for the public interest and remediating any oversights of its departments at the time that the relevant leases were issued. The statutory obligation to make adequate provision for future liabilities may not cover work beyond those conditioned on the leases.

EPA considers the disposal of co-produced water into evaporation ponds as one of the least preferred options.

Finding: It is not possible to construct evaporation ponds with a sufficient degree of confidence that they will not leak unacceptably. After decommissioning, there is no known way of rendering evaporation ponds harmless and the current regime leaves the long-term responsibility with the landholder who most often will not have the capacity to remedy defects. Evaporation ponds are an unsatisfactory method of disposal.

Basin Salinity Management Strategy

Under the Murray Darling Basin Salinity Management Strategy, Queensland is accountable for any approved actions, made after January 2000, that increase stream salinity. Approved actions are those approved, permitted or licensed under a Queensland Act or Regulation. Examples of approved actions that may increase salinity risk include clearing of remnant native vegetation under the *Vegetation Management Act 1999*, discharge of saline waters under the *Environment Protection Policy (Water)*, and development permits under the *Integrated Planning Act 1997* for activities that increase salinity.

If 7,000 ML of water is produced annually, this could result in an additional 15,000 to 50,000 tons of salt in the Condamine catchment per year. Over the life of coal seam gas projects in the catchment, up to 1,500,000 tons of salt could be imported into the catchment, though as the industry expands, this will be an under-estimate. (Of course, traditional bores are having a comparable effect).

As the extraction of coal seam gas is an approved action, the State of Queensland will be accountable for this salt. It is unknown if bonds or royalties earned by the Department of Mines and Energy as a result of developing coal

seam gas at this time (and presumably remitted to the Consolidated Revenue) will offset any penalties imposed on the Department of Natural Resources and Water under the Strategy, or what administrative mechanism will be available to reconcile the accounts.

NRW in November 2006 embarked on a new project to examine the risk of salinity arising from coal seam gas evaporation ponds in the Condamine-Balonne catchment. This project has been launched to enable the Department to satisfy its requirements under the Murray Darling Basin Agreement to run five-year audits of salinity. The project is intended to run till April 2007.

The Condamine Alliance also has an end-of-valley target for salinity on which it is contractually required to report.

Under a separate regulation, if produced water is to be released to an aquatic environment, the Environmental Values and Water Quality Objectives for the aquatic environment must be protected. The EVs and WQOs must be determined and compliance monitored in accordance with the *Queensland Water Quality Guidelines 2006* and the EPA Procedural Guide - *Licensing Discharges to Aquatic Environments*.

Finding: The Queensland Government will be called to account nationally for the total load of salt that leaves its borders in the Murray Darling system.

The Effects of Gas Production on Groundwater-dependent Ecosystems

It is not known whether any groundwater-dependent ecosystems are associated with the Walloon Coal Measures, although this does not mean that they are unimportant.

There are no established methods of dealing with possible effects on these ecosystems although conditions could be placed on the petroleum tenure. This could not easily be done retrospectively.

Beneficial Disposal of Saline Water

The gas-producing companies are concerned that a failure to apply this water to beneficial uses will make them the subject of adverse reaction from the community. Companies would prefer to find beneficial uses rather than constructing and maintaining large areas of evaporation basins. The evidence as to relative costs is contested but it seems that the financial benefit from not constructing evaporation ponds would be a strong, if not complete, offset against the cost of treatment to beneficial standards.

Arguably, more significant than the cost is the loss of reputation in the eyes of the community. Landowners have expressed resentment at the large quantities of water that the companies are allowed to pump out while their own supplies are limited by drought and regulation.

One landholders' consultant argued that the industry is on the way to wasting 100,000 ML of water or as much as NRW has laboured long to save through the entire bore-capping program in the Great Artesian Basin. This figure is conflating one-off extractions with annual sustainable extractions. Savings via the GABSI program are of this magnitude – about 140,000 ML/yr – but are ongoing, and would need to be compared with the annual CSG extractions (at a minimum) – of 7-15,000 ML/yr.

Under the waste hierarchy in the *Environmental Protection (Waste Management) Policy 2000* the disposal of associated water should be handled by one or more of the following methods in order of acceptability:

> Avoidance, reuse, recycling/re-injection, disposal in evaporation ponds, running into the environment without treatment.

The gas producing companies are each making their own enquiries and this will always be necessary, as the waters and the potential beneficial users are site-specific. However, a collective investigation would achieve some economies of scale. NRW Toowoomba has launched such an investigation, to examine the potential beneficial uses of CSG water, what are the impediments and the actions necessary to facilitate them. The project will commence in July 2007 and run for two years.

Finding: Water Management and Use should enquire whether a coordinated multi-lateral approach for funding under the National Water Initiative for the preparation of a region-wide strategy to beneficially use associated water might

be worthwhile.

Disposal to mines

The liquid is reported to be good for washing coal but must be in close proximity for this option to be economically viable. In some cases only coal destined for export is washed. The average mine also requires low quality water for slurry pumps, wash down, flotation and quenching. The Spring Gully Power Station will use associated water and other power projects in the Surat Energy province are also investigating this option.

However, even the proximity of a coal mine is no panacea. Some or all waters can initiate stress corrosion cracking and pitting even of stainless steel. Process waters are often saturated with gypsum and so are prone to scaling (but many of the CSG waters are very low in calcium). Future coal mines may use air-based methods of cleaning coal.

Reverse osmosis

Reverse osmosis is now a mainstream technology. The early technology was not marvellous and there were not enough skilled people around to establish them, but this need not be an obstacle now. Membrane technology does require a sophisticated understanding of the incoming waters in order to design the system to match. In most if not all systems, pre-treatment is required to gain maximum efficiency from the plant and to maximise the life of the membranes. A pilot plant should be operated for six months and any changes in water chemistry tracked. For example, Origin has advised that at Talinga, waters were put through an ion exchange to strip the calcium and barium first. Even though the quantities of these were less than 10 ppm, the treatment allowed the reconfigured plant to produce 87% of its volume of water better than 100 ppm from input water of 5000 ppm. Recovery of 75-80% is now routine.

Reverse osmosis plants can be skid mounted and are scalable upwards. However, without considering capital cost, the running cost can be as high as in the order of $250-300 per megalitre which is out of the range of most agriculture.

It is easier to design a reverse osmosis plant drawing from ponds than from direct feed.

Finding: Reverse osmosis is a mainstream technology that can produce near-pure

water from a wide range of CSG waters. The main obstacles are cost (made worse by the relative cheapness of traditional sources) and the fact that some 20% of the volume remains as an even more concentrated brine requiring disposal. All of the disadvantages of evaporation ponds apply to this residual except that its volume is lower and the ponds can be smaller with less risk.

Production of bicarbonate

The bicarbonate could find a market but profitability is said to be marginal. (However, one company Kokstead is currently investigating this process and has applied for mining leases). Bicarbonate is not the only chemical that could be produced: calcium carbonate, sodium sulphate, sodium carbonate and sodium chloride could all be produced from a reverse osmosis plant: the chemistry is mainstream. Sodium chloride is likely to be the least profitable because of the cheapness of competitive sources. Prices obtained depend heavily on purity.

Agriculture

Given that the main land use in the Surat Basin gas fields is agriculture, it is only to be expected that agriculturalists have turned their eyes to the potential of the water, both for intensive and broad acre commodities, both treated and untreated.

Untreated

It has been estimated that a 10,000 head feedlot might consume 250 ML p.a., which could dispose of the output from one gas field.

However, it is not clear whether the untreated water is suitable for intensive animal industries. One company has claimed that the salts can aid digestion in ruminant animals. Another currently uses their CBM water to supplement the water supply to the feedlot (apparently without a permit). The feedlot is expanding in the next few months and wishes to expand more, to the extent of considering installing a reverse osmosis plant. However, a consultant has alleged anecdotally that one of his clients tried a shandy with an existing clean water supply and the cattle did not thrive. Also, emerging information suggests that the high load of salts can disrupt feedlot effluent management systems.

In any case, confirmation that the (untreated) water is of a composition suitable for animals does not overcome the difficulty that the salts are eventually deposited in the landscape somewhere and add to the salt load.

DPI&F, in its facilitation of intensive animal husbandry and fisheries, processes IPA development applications under the *Environmental Protection Act 1994* and *Fisheries Act 1994* respectively. The onus is on the potential user to demonstrate both that the water is suitable for the intended use and that any effluent water can be appropriately treated and used on site or disposed of in a sustainable manner.

To date DPI&F is aware of one application for a feedlot but not of other specific potential users who may have been consulting with industry. No feedlot yet has a permit for CSG water.

Treated

If the price were right (such as if subsidised by the gas producer), there would be an extensive demand for clean water for crops. Some 25% of Australia's watermelons and rock melons are grown in the Chinchilla district and potential additional users are waiting.

Cotton would support a cost of up to about $300 per megalitre but optimistically this will cover only the operational cost of a reverse osmosis plant (if that) and not the capital cost, which, amortised, would be at least as much again. It seems generally agreed that water can be treated nominally for $1000 per megalitre.

One operator is confident that pasture can be irrigated by using gypsum as a soil amendment and heavy applications of feedlot manure to offset potential increases in soil pH.

Finding: Utilisation of untreated water in intensive animal industries is not a solution. Even if the animals cope with the water, the problems of disposal to land are only deferred. There is a virtually unlimited latent demand for treated water for irrigation, but treated water cannot be produced at a price acceptable to growers.

Aquaculture

A current DPI&F project is examining the potential for growing fish species in coal seam water. Preliminary results show excellent potential for aquaculture in CSG water with simple fortification of the receiving water with agricultural

grade potassium. To date, trials with both barramundi and mulloway show excellent potential. DPI&F together with the Cotton Catchment Communities CRC, Arrow Energy and McVeigh Enterprises will soon begin construction of a commercial sized demonstration site at Kogan for the aquaculture of potential freshwater but mainly marine/euryhaline species.

To confirm the suitability of a water for aquaculture, water quality needs to be tested case by case, because of the variability. Laboratory analyses without field trials are not sufficient. Also, there is a need to track the water chemistry over time.

If a water body is static, evaporation may mean that certain kinds of fish can no longer cope, even if the water is suitable at the outset. However, this can be managed. Operators can calculate changes over time given known evaporation rates in the locality and can choose species accordingly.

Finding: Aquaculture may be a minor beneficiary but suffers from the same objection as other intensive industries: that after use, the operator must still dispose of a saline waste; and concerns about building containment structures that do not leak.

Wildlife habitat

Where salt lakes can be constructed, they may serve as quite valuable wildlife habitat, especially for migratory species. Salinity need not be an obstacle, as a wide range of ephemeral animal prey can be supported by a wide range of salinities and by variable salinities. The disposal ponds at Dalby town's treatment plant are already attracting interesting birds not commonly seen away from coastal mudflats. However, this value can be seen only as a side benefit of disposal into ponds and not as a reason for constructing ponds.

Non-statutory Portfolio Responsibilities may be Neglected

State departments' functions are not all set out in statute. For example, DPI&F has a minimal statutory role in relation to the disposal of water. If the beneficial use or disposal option does not involve a feedlot or aquaculture proposal, DPI&F would have only a non-statutory third-party role at the development application stage and it would not necessarily be asked for its opinion. However, DPI&F has a portfolio responsibility to ensure that agricultural industries are profitable and sustainable, so can be legitimately involved.

The list of NRW's portfolio responsibilities not granted a head of power in statutes is even greater (NRMW 2004). Prior to the separation of the Mines portfolio, the Department's "State interests" (a term originated in IPA but now enjoying currency in the broad sense of portfolio functions) included:

1. Protection of land from degradation and inappropriate use.
2. Protection of catchments and natural waters from degradation and inappropriate use.
3. Protection of native vegetation from degradation and inappropriate use.
4. Protection of the economic values and potential of natural resources.
5. Protection of the social and cultural values of natural resources.
6. Provision of effective recognition, protection and conservation of Aboriginal and Torres Strait Islander cultural heritage.

State Interest 4 included "protection of minerals, petroleum, energy and extractive resources from alienation and inappropriate use". Given that this list was endorsed by the Minister, the status of the element regarding mining and petroleum now that the Mines portfolio is in the charge of a different Minister is unclear.

Finding: DME should refresh a succinct statement of its portfolio functions in the form of a an annotated list of State interests as part of a whole-of-Government analysis currently being coordinated by DLGPSR.

Finding: In the meantime, those elements of NRMW's tabulation of State interests that applied to the Mines section of the former portfolio be extracted out and adopted by the Director-General as a guide to the portfolio's functions.

Finding: Once its State interests are identified, DME review its administration of the coal seam gas industry and specifically review the PAG Act to ensure that the statutory regime is not an obstacle in discharging the full range of its portfolio functions.

Skills and Capacities

Each of the three main regulatory departments requires a corpus of professional and technical skills, a corporate memory about its portfolio and adequate numbers of staff to police its regulatory functions. Not only must a workable statutory regime be established and policed, but also there must be sufficient strategic and professional skills to alter the regime and (as inevitably will happen) some producers and consumers of water get into trouble. Water quality issues are much more difficult to manage after de-commissioning when skilled operatives have left the site. So often, the mining industry has left the State to manage the legacy.

Project funding from the National Water Initiative, even if generous, will not necessarily augment core skills. There must be an ongoing corporate memory and project management and planning skills as well as project funds. The consensus is that the skills are not available in the quantity or locations necessary to reduce the Government's exposure to risk as the CSG industry develops.

Referrals between DME (CHQ and region), NRW (CHQ and two regions) the EPA (CHQ and regions) also need to be regularised. Regional NRW people claim that they are inadequately informed about the companies, their level of development or timelines for development of leases.

Finding: That the three main departments with State Development meet regularly (say monthly, at least initially) to ensure that there is good liaison in overseeing the CSG industry. That these meetings consider whether a protocol or MOU is necessary to cement appropriate referrals into place.

Finding: That EPA and NRW meet to consider whether there should be a partial delegation of powers under the EP Act to designated NRW officers for some of the statutory water-related functions.

PART IV – THE STATUTORY REGIMES

Overview

Under the current arrangements, DME issues a petroleum tenure to a company that can best demonstrate the capacity to exploit the gas; the EPA specifies environmental standards; and the company is at liberty to find beneficial users, subject to securing a water licence. The user must apply for development approval unless exempted. In other words, four different statutory regimes administered by four different public agencies from four separate office locations can be involved. Four sets of policies and guidelines of uneven format underpin the regimes.

The statutory situation is actually more complex than that: there are 1923 Act bores, 2004 Act bores and bores in the process of transition. Also, more than one environmental authority may be required. For example, the Spring Gully Power station required both an environmental authority and development approval under the *Integrated Planning Act 1997* to use associated water, while the gas extraction and construction of evaporation ponds was dealt with under a separate environmental authority that did not require development approval. (A water licence is also required). For another example, if the water is used in intensive livestock industry, there is no clear nexus between the two separate environmental authorities required.

In this section, some specific features of the four main statutory regimes and some less well-known statutory provisions are presented, before moving to questions of how they can be coordinated, or whether they should be.

Petroleum Tenures

There are some 250 petroleum production tenures including oil and about 155 prospecting tenures (not all for CSG). The petroleum regime differs from the mining regime in that production including production of water follows as of right.

The PAG legislation does not provide for comprehensive impact assessment of the kind that is possible under the State Works Act or IPA. There are no

statutory public interest criteria by which the Minister can refuse an application, although the Minister can write his/her own. By departmental practice, it is assumed that development of the gas resource is in the public interest and that environmental considerations can be accommodated simply by conditioning. These assumptions are flawed, as discussed in the final section.

Environmental Authority

The Environmental Protection Agency took responsibility for the environmental assessment of mining in January 2001. The EP Act requires decision-makers to operate under the principles of ecologically sustainable development. The Act has a four phase process to achieve this objective. Phase 1 is to clarify the environmental values, which are to be protected. Phase 2 is the licensing of environmentally relevant activities through setting standards, conditions and indicators. Phase 3 involves the integration of environmental licensing with other natural resource statutory systems and the operational requirements of industry. Phase 4 involves enforcing conditions, evaluation and feedback.

S.13 provides that a waste is any product that is surplus to an activity. S.19 allows an activity to be prescribed as an ERA. As a consequence, associated water is considered to be a waste product. It could be declared to be a beneficial use but EPA will consider such applications on a case by case basis. But as one industry representative has commented, there must be a better way of handling the water than to treat all of it as toxic waste! Regulated wastes are listed in the schedule to the EP Reg. Two relevant ones are “saline effluent” (undefined) and “oil”. The legislation is silent on how much salt is required to make water hazardous.

Applications may be code-assessable if generating less than 4 ha of disturbance. Few if any CSG projects will be captured by the code-provisions, so all water disposal projects are likely to be Level 1 activities or Level 2 non-code compliant (see table in accompanying paper for explanation). The code, currently in draft, will have an appendix detailing specifications for the construction of evaporation ponds.

Environmental harm is unlawful if not authorised. Environmental harm in these circumstances could include adding salt to land or streams prone to salinisation, adding contaminants like salts, fluorine or hydrocarbons to streams, contaminating aquifers through say (leakage of dams), destroying biodiversity, or discharging permanent flow into ephemeral streams. However, there is no statutory way of linking environmental harm to a decision to turn off the gas.

Cause and effect are difficult to separate. The companies' capacity to bid down the price they can offer will be limited by the strength of the conditions that the EPA is prepared to set

Apart from Fairview, disposal to date has been via evaporation pods. This practice is unsatisfactory and unsustainable. No CSG projects have yet been refused on environmental grounds.

The environmental licensing regime is not well structured to refuse unsatisfactory applications for CSG. Partly this is because of its subordinate position in the chain of statutory approvals. Partly it is because of the subordinate position of the EPA portfolio. Partly it is a policy mindset of the staff. Refusal is problematic for street-level delegates unless they are confident of the support of their Minister and, in the case of the high-profile energy industries, the Premier.

Finding: That as part of a more comprehensive submission on the CSG industry, a Cabinet decision should be sought to fortify the capacity of the regulatory authorities to refuse CSG applications that are not in the public interest. At present in Queensland, the regimes granting environment authority and development approvals operate in the expectation that development will be approved and that the assessment is merely intended to place conditions to ameliorate damage rather than to refuse on the basis of environmental harm. (Evidence that this is so can be seen in the lack of power in IPA to prohibit development).

Water Tenures

The PAG statute privileges the CSG industry as it in effect prevents further non-CSG access to the Walloon Coal Measures – it regards the WCM as fully committed. The pre-eminence of the PAG Act means that the water resource planning regime is not a suitable tool for *regulating* the production of water (though it can help in *planning* – see next para). Rather than centrally controlling *allocation*, the PAG Act sets out a model of making good, based on conditioning, monitoring and compensation. The regime makes a feature of identifying unsatisfied potential users and ensuring that the companies supply them first. However, it does not envisage that a project will be refused on the grounds that it will extract too much water from the measures. By the time that detrimental effects on others' bores are discovered, the project concerned will be well under way. Further, there is no statutory feedback from the water monitoring provisions to the petroleum tenure allocation provisions, so there is

no pathway by which a project can be halted or a new nearby project refused on the grounds of over-commitment of the water in the measures. By definition, the gas industry cannot give rise to over-commitment.

The GAB Water Resource Plan was finalised in March 2006 and is not due to be reviewed for five years. The right of the CSG tenures to water was considered in preparing the GAB Water Resource Plan and should be re-considered when the WRP is reviewed.

Not every water licence attaches to land: most do, but petroleum tenure holders do not have to be landholders. They hold the water licences in order to on-supply. At no stage does the company own the water. S.370 of the W Act requires any owner of water infrastructure with an intention of charging for water to register as a water service provider. Only the gas tenure holder can get a water licence for associated water. But the designers of the regime never intended that the gas company was to be in the business of water services. Proposals to access and use associated water by third parties, when legally recognised by the PAG Act, may not be recognised by the W Act as an entitlement, which may create legacy issues (notably, pressure upon the authorities to allow a substitute supply from other sources once the associated water runs out).

The petroleum legislation imposes no volumetric restriction on use; but a water licence is assessed on criteria related to the volume of water available, not quality. There is no plan to match good water with good soils or profitable water-dependent industries. However, there are provisions to request a land and water management plan if required. (A condition could be set on licences for associated water requiring the CSG operator to not supply water for irrigation unless the irrigator has an approved LWMP. An amendment to the W Act to require any irrigator using associated water to have this LWMP is being considered).

NRW will oblige the company to make water available to the priority group for the cost of supply, on terms reasonable to both parties. The cost of supply could include any pipeline costs or any water treatment costs. If a priority group member wants associated water, they would need to either arrange their own pipeline, or come to an arrangement with the CSG operator about this. The CSG tenure holder simply needs to make the water available as a first option for the priority group member. If the priority group member can't make use of the water because the cost of supply is too high for them, the W Act is not requiring the CSG operator to supply the water anyway. The landholders in the priority group know well that supply always was patchy in quality and quantity and the companies cannot be obliged to overcome these inherent deficiencies. (Incidentally, no priority group has yet been established).

The new regime was designed in consultation with the gas industry though minutes are not available. The legislation recognises that there are two

industries and the gas cannot affect the water regime without compensation.

Industry has also explained that there are several institutional barriers to reuse, one being the absence of a proper mechanism for trading and for recognising the value of putting what may be very clean fresh water into streams.

The machinery of government changes after the September 2006 election create a potential complication with the administration of this regime. The Department of Mines and Energy has carriage of the PAG legislation and is required to lead the coordination of these matters. However, hydrological expertise and portfolio responsible for groundwater resides in the Department of Natural Resources and Water. It is possible that a protocol or work instruction needs to be signed to clarify the reporting relationships within the government, as discussed above.

Several observations uncovered during this analysis are evidence that the regime is not working as planned. A debate over trigger thresholds is reported later as indicative.

Intensity of other extractions

Industry has claimed that the level of scrutiny being applied to the coal seam gas industry is far greater than that over "the 13,500 boreholes" in the district. How intense is the pressure on the Walloons? The following figures are taken from Foster (2005).

There are four management units that cover the Walloon Coal Measures in the Surat Basin: the Surat East 2, Surat North 1, Eastern Downs 1 and Surat 5.

OBJ

Regulating Land *Development*

Development control (via IPA) plays a relatively minor part in the CSG industry. It is mentioned in the accompanying table that explains the statutory regime. Under IPA's performance-based regime, in the absence of adequate baseline

data and statutory thresholds of environmental damage, there is in effect no effective prohibition, no standard against which to assess a project and a large disadvantage suffered by departmental and community stakeholders who rapidly become fatalistic. However, this feature of IPA is being considered in the current whole-of-Government review of IPA.

Regulating Land *Management*

IPA is the primary statute regulating *development*. Mostly, ongoing *management* of agricultural land by routine farming practices escapes regulatory control. However, there are provisions in the W Act for two kinds of regulatory plan relevant to this analysis.

The Minister may prepare a Water Use Plan before water can be used, where there is a risk of land and water degradation as a result of the application of water. Deposition of large quantities of saline waters in the Murray Darling catchments would seem to be an eminently justifiable trigger for a water use plan. It could create a means of dealing with the bigger picture water quality issues such as third party water use. However as one of these plans has never been produced, it's not really clear what the end result would be.

Also, it is not clear what mischief it would be intended to remedy. It will not discover a benign method of treating associated water. It seems to have been set up to allow cumulative impacts from several otherwise unregulated activities to be brought under the influence of a statutory plan. It would cover a group of properties. It could mop up careless land use practices retrospectively and could uncover lateral solutions or head off otherwise unforeseen consequences.

Similar remarks apply to the preparation of land and water management plans prepared by landholders (s.73(1)(d), s.967 W Act). These instruments can regulate the way that associated water is applied to land. An NRMW guideline entitled "Environmental Management for Activities under Petroleum Tenures" is available.

Finding: For every proposed significant addition of associated water – treated or untreated – to land, NRW should invoke the provisions requiring a land and water management plan (single users) or a water use plan (group of users).

Pipelines

Numerous other statutes are also invoked at various stages of a water-related development. One aspect that has come to attention is the regulation of pipelines. There is some confusion over appropriate tenure and permissions for pipelines, as NRW, Main Roads, local government and the Commonwealth can get involved.

One informant was highly critical of one company's actions in clearing native vegetation along the road reserve rather than bury the pipeline in an adjoining cleared grazing property. A local government officer consulted conceded that his council would allow a company to install a pipeline on a road reserve rather than requiring them to occupy cleared or already cleared land inside the paddock. This practice is regressive and not consistent with emerging best practice nationally for the management of roadsides.

The ownership of pipeline infrastructure within the boundaries of a petroleum lease is also an issue. An infrastructure provider or local government would not have the right to own or operate such a pipe without a separate easement. The PAG Act does not by itself authorise or encourage beneficial use so its leases are not easily used for that purpose.

Finding: DME in consultation with the EPA and NRW's vegetation policy unit should develop policy and best practice guidelines to generally prevent installation of pipelines on vegetated road reserves.

Finding: DME should review the PAG legislation with a view to facilitating efficiency in the provision of water infrastructure.

Connections Between the Statutory Regimes

One of the four main elements of the statutory regime, the development approval, does attempt to coordinate a range of considerations from a number of portfolios, and so it limits the involvement of other parties: without it there may be six or seven steps. But none of the other three do so, all confining themselves to the issues set out in their respective legislation.

Pre-eminently in terms of the subject of this paper, the State's petroleum leasing regime is aimed at fostering development of the industry. If there had

been any doubt, the Director-General's message to staff dated 14 December made this plain: "Our focus will always be to promote investment in mining and energy in Queensland." Similarly, the water licensing regime is single-minded, being aimed at controlling flows and not at monitoring quality, ensuring environmental performance or meshing with land use planning. EPA is primarily concerned to prevent water from escaping into the environment where it will do environment harm.

Is this a problem? The question arises as to whether DME should issue any form of petroleum tenure until the disposal and land-use considerations are locked in. There are notionally two optional models for crafting a statutory regime that crosses portfolio boundaries:

- adopt a disaggregated model, each separate step in the chain of statutory approvals being a discrete step. Avoids any cross compliance and the heavy overheads of a coordinated regime; or
- adopt a coordinated model: no company is permitted to launch a gas development until its downstream consequences are settled. This option is in keeping with the principles of ESD and responsible, 'joined up government', but would require statutory reform to ensure that the four main Acts (1994, 1997, 2000, 2004) at a minimum align with each other and at a maximum form a single regime.

"Lack of coordination" is a common refrain from stakeholders inside and outside government who interact with multiple statutory approvals, particularly when more than one is required for a single developmental project. Where multiple permits are required by legislation, all of them are required: the absence of any single mandatory permit is fatal to the application. Industry would like to see a synchronised approach between the regulators and the industry. There is some frustration on industry's part at the fragmented nature of the statutory regimes.

However, there are several sound reasons why a disaggregated regime might be preferable. First, coordination comes at a price. The overheads involved in cross-referrals can add long delays and also tend to reduce the resilience of the overall system. Second, a centralised system is vulnerable to the particular capacities of the peak coordinator. Either applicants and objectors could be disadvantaged, or both alternately, depending on which department facilitates the coordination, how well resourced they are and their policy mindset. A new appointment to a key position could unravel years of otherwise settled policy. Third, the complexity of some projects is so great that they can tax the discretionary skills of public officers. The logic that a system should be divided into separate regimes according to disciplinary or professional specialties is

sound. Fourth, it can suit applicants to deal with only one regime at a time. This allows incremental progress on a development approval, with the strengths and weaknesses of the project becoming more obvious as additional assessments are carried out and each authority expresses its views. A system relying upon a single decision could truncate individual investigations before they are sufficiently mature to yield insights about the project.

Next are presented some reasons why a coordinated or centralised system might be better. First, the complexity of a disaggregated regime to an un-initiated applicant can be daunting. Under a one-stop-shop regime, the cross-referrals are carried out within government and may be largely invisible to an outsider. Second, the government should always present itself as having a coherent approach to development. Governments are sensitive to the criticism that one agency doesn't speak to another. Third, a good deal of time of applicants and authorities can be wasted through duplicated investigations, non-matching application forms, the start-up and wind down costs of bringing separate officers up to familiarity with the case before the reassigned, and in re-packaging information in different formats to suit each authority's regime. Fourth, and perhaps most important, governments should not raise applicants' expectations unnecessarily early in a regulatory process nor oblige them to expend money in unnecessary impact assessments if it intends to refuse the relevant permits later in the process.

How can a government send consistent signals to the industry and other affected parties without aggregating all of the statutory regimes into a single inefficient, omnibus process?

One response could be that the regime is in fact already coordinated: a privilege of the allocation of the gas is that the company controls access to co-produced water. So in effect, the allocation of gas also allocates the water and subsequent approvals can only condition a development at the margins. The EPA hasn't blocked any CSG projects to date. Expressed in this way, the primary defect of the current statutory arrangements become clear: the PAG legislation is not designed to take into account the range of public interest considerations that a comprehensive regime would address.

In confronting this difficult question of governance, it is worth exploring the legal limits of legislation.

The strength of the tenure power

The power of the State in choosing whether and how to dispose of its natural

resource assets through the allocation of tenure (granting property rights) is a much more direct and powerful form of exercising control than the regulatory power of moderating property rights after they have been allocated. This is well explained in departmental guidelines (such as NRMW 2002). By their nature, regulatory controls (in this context, the environmental regulation and development approval) are less powerful, especially when they are expressed in performance terms as is the post-IPA format. This maxim means that the State should allocate gas resources only when it is satisfied that the associated regulatory functions are perfectly capable of mopping up residual public interest concerns.

Finding: That DME re-shape its tenure allocation power and policy to embrace a wider range of the State's public interest responsibilities so that the State's capacity to oversee the CSG industry is not dependent on the weaker regulatory powers.

Cross-compliance

There is a principle well embedded in law that it is not legitimate to use one Act to achieve another Act's purposes. Officers exercising statutory discretion must confine themselves to the scope set out in the legislation which confers their powers.

An officer is obliged to take into account any statements of government policy or even professional best practice of which s/he is aware and which bear upon the issue. These will be given weight according to the level of official authority of the entity that promulgated them. However, officers cannot go on fishing expeditions and are always subject to the precise provisions of the primary governing legislation.

This traditional position however is problematic when a public authority is challenged by a multi-headed complex problem, particularly one that is regulated by more than one statute. The beneficial use of associated water falls under four primary Acts written at different times with different degrees of emphasis on the proclaimed Government policy of "sustainability".

Several negative manifestations of this problem can be identified:

- if DME issues any form of petroleum tenure before the environmental performance and disposal of associated water are locked in, it is abrogating the precautionary principle and is perhaps giving momentum to an activity that is more easily launched than controlled;
- if a condition (say, of an environmental authority) cannot be consummated because the requirements of the another Act cannot be satisfied, the company applicant may well be trapped;
- the capacities of each of the decision-makers to make a prudent decision will inevitably vary and their willingness to heed advice from other specialists will also vary. It becomes possible for an enthusiast armed with single-minded legislation to lead the Government into error.

Bates (2002) has written: "In the absence of clear statutory guidance as to priority, the courts favour an interpretation which treats each piece of legislation as laying down simply other another layer of control. There is a strong presumption that the legislature does not intend to contradict itself, so the courts will favour an interpretation that does not lead to conflict but allows legislation to operate in parallel."

Why is it important that parallel statutes be consistent and enable departments to act within a broad whole-of-government framework? The reason is the complexity of society and the complexity of the biophysical environment: in other words, the number of factors that can 'go wrong'. The legally precise approach of dividing statutory functions into discrete portfolios for administrative convenience traps the State into inability to adopt a holistic approach to the management of natural systems that are holistic. In other words, an enthusiastic operator can innocently or intentionally drive an environmental wrecking ball through the gaps in a disaggregated statutory regime.

The same issue of cross-compliance arises in the relationship between regulatory development approval and volumetric water allocation for, say, intensive animal husbandry. In this case, a nexus can be created under IPA s.3.2.1(5) by the requirement that a regulation may prescribe that the assessment manager may not proceed to assess an application unless it is accompanied by evidence that a water allocation or equivalent is in place. At the date of writing, no such regulation has been promulgated. In any case, the COAG-inspired advent of trading in water that is disconnected from specific parcels of land has made this provision highly problematic. While in principle an assessment manager could require as a condition that the owner of the development must keep a water allocation on foot (and DPI&F has imposed such a condition on previous permits), and such a condition would run with the

land, major capital-intensive developments such as feedlots are not conducive to stop-start regulation of this kind. It is understood that DPI&F no longer applies conditions of this kind, for legal reasons of cross-compliance.

There is the one and only one adequate solution to the risk of invalidly using one piece of legislation to regulate functions lying in a different regime: that is to amend the primary legislation to create a head of power to allow the missing functions to be factored into decision-making. (See also the proposal to establish "special criteria", explained elsewhere in this paper).

Finding: That DME amend the PAG Act to create a head of power that will allow considerations of water management to be factored into PAG decision-making. The normal method of doing this is to establish some public interest criteria at the beginning of the Act. Such a move may well be opposed by industry but modern governance demands no less.

Cumulative impacts

There is no effective mechanism in place to assess the cumulative impacts of the existing and planned scale of development on natural resources at the landscape scale. Each project is considered on its individual merits.

The extent of the eventual impacts from what could become a dramatic change in land use over a substantial area is unknown, as are the implications for existing programs and projects underway or proposed. While individual projects are regulated, the expanding footprint of gas production in the region constitutes a significant land use in its own right.

Cumulative impacts are notoriously difficult to avoid. Not the least of the challenges is to set thresholds objectively. The process of setting thresholds (targets) for *water quality* is now quite well advanced, through the medium of the Condamine Alliance and other regional NRM bodies funded by the State and Commonwealth Governments. The process of setting thresholds (environmental flows) for *volumetric extractions* is quite well advanced, through the medium of water resource planning, but the coal seam gas industry escapes both. In principle, punitive impact could be identified during an impact assessment process, but no such process is set out in the PAG Act and the industry escapes impact assessment through the State Works Act or IPA.

PART VI – FREE-MARKET OR CENTRAL PLANNING?

Coordinated Production and Disposal

Industry personality Richard Cottee observed at the September Chinchilla Forum that "Capitalism creates this chaos much more than carefully planned economic development … but the chaos is more productive and I would prefer to live in this chaos that has created the nation." The quotation, while charming, misreads history, economics and public policy. Australia's daunting distances were developed not through free-wheeling capitalism (more true of the USA) but on the back of State-provided infrastructure. It wasn't until State legislation prised the best land out of the squatters and re-allocated it to small holders that agriculture, for example, flourished. It was State-sponsored railways that extended settlement throughout coastal Australia and State-sponsored water supplies that gave birth to irrigated agriculture.

It is important to keep the relative strengths of entrepreneurial capitalism and State facilitation in clear focus. It is the energy of entrepreneurial companies which will develop the gas industry but it is coordination by the State that will consolidate the growth, will achieve efficiencies of scale in providing infrastructure and will rein in the natural tendency of free-market capitalism to leave a trail of wrecked environments and disrupted private property rights in its wake as it moves on to the next entrepreneurial challenge.

Also, it is not true that chaotic capitalism is the most "efficient" system. Certainly, other aspects being equal, competitive markets will tend to reduce the prices of goods for *consumers*, but can cause inefficient use of *resources*, waste of sunk *public and private investment* and neglect of what economists call *externalities*: goods and services not traded in identifiable markets.

> As this analysis has proceeded, the evidence has grown that this industry is being developed faster than the capabilities of the authorities to moderate the potential downsides. To mention just one aspect: carbon sequestration depends (where depleted oil and gas fields are not available) primarily upon injecting carbon dioxide into deep, saline, stable aquifers (to maintain pressures). The CSG industry is currently dissipating deep, saline, stable aquifers.

Each company may well be able to manage its own patch, but each company's efforts will not be adequate to manage the interplay of effects once many new

fields are added and flood vulnerability, roadworks, possible new dams, changes in the grain industry and climate change considerations are superimposed.

There are three main options for coordinating production of gas and water and disposal of water:

- a “hands off” or “let the market sort out disposal” model;
- a “ centrally coordinated” model under which the State directs production to pre-determined locations, coordinates disposal and ensures that all appropriate statutory approvals are obtained; or
- an “intermediate” or “networked” model.

It is difficult at present to know how serious are the negative consequences of adopting the pro-market approach, because the statutory regimes are not working as they were intended. At a minimum, to ensure that the pro-market option does not betray the public interest, the regime changes mentioned elsewhere (pre-lease evaluation, impact reporting, dissemination of information) must be made.

Beyond that, the analysis leads this author to conclude that an intermediate or network model is best. The reason for rejecting the hands-off approach is that there are no obvious satisfactory solution for the disposal of associated water. It is irresponsible for the State to foster an industry with (in general) no known feasible pathway for managing the downstream consequences.

The networked model would assign roles as follows:

- DME as tenure allocator is responsible for overseeing and refining the statutory regimes and for evaluating specific project applications in a multi-disciplinary public interest context;
- DME or NRW at DME expense develops a centre of technical and professional expertise in the management of associated water;
- SunWater coordinates disposal projects (putting producers and consumers in touch with each other and building the necessary infrastructure) and in drafting submissions for public subsidies where justifiable (explained in the next section);

- DME and NRW are both responsible for wholesaling data and DME for negotiating a single-portal access to web-based information, perhaps hosted by the Condamine Alliance or the Australian Coal Seem Gas Council;
- State Development facilitates projects in an orderly manner, by matching development of gas with public infrastructure and with SunWater's strategic plans for water infrastructure.

Finding: That DME adopt a networked model for overseeing the CSG industry, building formal relationships with NRW, State Development, SunWater and a web-page host.

Coordinating a network of water infrastructure (especially pipelines)

It is not clear whether coordinated collection, treatment and reticulation through a pipeline grid, which would bring continuity of supply, is practicable, given the distances between fields. Without a coordinator, the companies are unlikely to collaborate to install joint pipelines and treatment plants where this is feasible. There are advantages in centralising facilities: for example, Dalby Town Council prefers to have its desalination plant along with its other water infrastructure in the one place, not scattered over the field. SunWater is actively promoting its credentials as a facilitator of joint schemes. However, it would expect a commercial return and commercial viability has not yet been demonstrated for any scheme.

SunWater is a government-owned corporation, with the Minister for Natural Resources and Water and the Treasurer being the shareholders. It is required to operate commercially and is not subject to routine public interest directions from the Ministers. SunWater (which has a mandate to aggregate users) could be directed jointly by the shareholding Ministers to take on a scheme as a community service obligation, but to preserve the integrity of SunWater's corporate status, this would require a transparent subsidy from the State.

SunWater has a strong capability as an engineering services provider, a planning consultant, a construction body or an operational manager of facilities. Inquiries indicate that SunWater would be quite keen to operate in this field on a fee-for-service basis, or on a build-and-operate basis, or as a manager/contractor. SunWater is already agent for six coal mines and to service additional gas companies would be routine.

An alternative would be to set up a water board under the Water Act. Local

governments would approach the Minister and could then assemble water, build pipelines, build a treatment plant and take on debt. However, even a group of local governments would probably require specialist engineering consultancies and/or would likely contract SunWater to manage a scheme.

Although this problem won't be solved by markets, there is one benefit in leaving any scheme to SunWater: that it will certainly take a hard-headed approach to any schemes and under current policy settings will not be vulnerable to pork-barrelling. SunWater will keep any subsidies transparent whereas a local board is more vulnerable to local special factors. Expressed in other words, farmers have little capacity to pay and will lobby incessantly for favours. SunWater has a greater capacity to ride out these forces.

Finding: It is unclear whether the central coordination of a network of pipelines and treatment facilities is practicable or even desirable; to operate such a network and even to advise on its appropriateness is a specialist task; SunWater is the best placed body to consider such a scheme.

Matching Supply and Demand

SunWater has run a supply model and surveyed demand for a scheme in the Chinchilla district. The models showed that they could supply 2000 ML per annum at $1000 per ML, double the price the users were prepared to pay. The affordable price is capped by cheap water elsewhere and also by limit on demand for produce. Melons would support at a maximum of about $500 per megalitre. Cotton would not spend $2-300 per ML at present but that might change. Indeed, pumping costs at present for some bores feeding cotton can run as high as $90 per ML (diesel fuel) and growers in the district are prepared to pay $150 for temporary transfers. If a grower has some existing water to shandy, the cost can be brought down considerably.

Chinchilla Shire Council is using only 50% of their allocation from the weir (managed by SunWater) and are not using their allocation from the GAB, so are unlikely to want to pay more for gas water

The feasibility of purifying the water depends very much on the alternative supplies available in that locality. Where there is an adequate allocation (even if the quality is patchy), enthusiasm for paying for CSG water will be weak. Although townies have a much greater capacity to pay (for them "Water costs what it costs"), in general they are already being more-or-less adequately

supplied. Dalby is different, sitting on a shallow aquifer that is failing. This explains Dalby's eagerness to sign a contract with Arrow, one that will substantially meet their future demands. Even here, however, the pathway chosen has been subsidies from central government rather than a charge to users. (Interestingly, Dalby Town Council is placing money into a sinking fund so that at the end of 15 years, it will have a kitty to cover the presumed increased cost of an alternative supply).

As pressure builds upon gas producers and governments to not waste this resource, pressure will be applied for governments to subsidise the price. At present the policy environment is signalling that water is worthless. There are two ledgers, one showing profit and loss for gas production; and this is disconnected from the production of water which is simply regarded as a byproduct.

People are accustomed to inexpensive water and market forces will limit the willingness of irrigators and other investors to pay the cost of treatment: by comparison there are other enterprises in which they can invest. Without federal funding, the desalination plant at Dalby could not have been progressed, but if the water were not being used, the community would be demanding to know why not.

Considering just the cost of treatment and not the benefit of removing the salt, there is no obvious reason to justify giving priority to CSG associated water over all the other water conservation and water development projects that are now on the State and national public agendas. CSG associated water projects may not offer any more value for money than numerous other identifiable projects. And a decision to depart from a value-for-money criterion needs to be justified, not assumed.

If this principle means that CSG associated water projects will rarely warrant public subsidies, then the State and the industry have only three options:

- to build the cost of treatment into the cost of the gas (a practice that would be justifiable in terms of mainstream economics); and/or
- to regard treatment as not generally viable and therefore to conclude that there is no general satisfactory disposal option.

Finding: That there are plenty of potential beneficial uses and beneficial users of purified associated water but not at a price for which purified water can be

produced. The gap is probably of the order of $700 per megalitre.

Finding: That DME commission a consultancy in consultation with the Queensland Water Commission and the National Water Initiative to develop a benchmark assessment of value for money presented by CSG associated water projects. Such a benchmark would simplify subsequent assessments and may avoid wasting everyone's time with the lodgement of hopeless applications. It may also help to indicate the quantum of the gap that governments may be prepared to contemplate when funding projects and this would indicate the basic amount that local sources must fund.

Finding: That DME prepare a Cabinet submission exploring the prospect of establishing a trust fund to deposit the royalties from the sale of gas and to fund public benefit water projects, as a more efficient method of funding than project-by-project applications. (This would not be necessary if the gas market is adjusted to allow the necessary investment to be debited by companies against profits).

PART VII - INFORMATION

Throughout the course of this analysis, stakeholders have impressed upon the author, more than any other concern, the absence of reliable information on which they can base their own assessments. Landholders and the regional NRM body (the Condamine Alliance) want assurance that the Department is monitoring the impact of CSG operations – on volumes from existing bore water supplies, on leakage from evaporation ponds to shallow aquifers and on the environment.

To ensure that appropriate information is placed in the hands of those who need it, several steps are necessary: setting of standards, capture, management and dissemination of data. Before dealing with those in turn, it will be helpful at the outset to distinguish between *foundation* and *project* data.

Foundation data is that necessary to understand Queensland's landscapes and ecosystems. By its nature, and also for economies of scale and fiscal efficiency, it requires long-term dedicated monitoring programs and will not necessarily be directly linked to specific projects or investment programs and may not have an immediate client. This data needs to be centrally coordinated and publicly accessible.

Ideally, the State would set out to collect this data systematically over a period of years as funds allow, but in practice, the data sets can and are built up by taking advantage of others' capture projects – such as the logs that licensed drillers must submit for every bore they put down – as opportunities arise.

Project data includes data collected by gas producers with specific operational or compliance objectives in mind. Depending on its durability and confidentiality, project data may not all be centrally coordinated or publicly accessible, although public access is strongly preferred except for the minimum that is commercial in confidence.

It is a well established rule of thumb within NRW that project proponents should be responsible for the collection of such data as is necessary to obtain statutory approvals for their projects and to monitor their effects on the environment and the property rights of others. The impact reporting regime within the CSG industry has been crafted in accordance with that principle.

Finding: The reporting regime ('impact reports') for CSG may well enable the companies and the departments to identify the effects of specific projects, but they are no substitute for systematic capture of regional-scale foundation data. The State needs to invest in collection of data that goes beyond what can reasonably be asked of individual companies.

Standards of Data

Information to monitor the effects of the CSG industry is needed about:

- distribution of current operating bores, approved bores and exploration wells;
- composition of waters and trends;
- life expectancy of individual bores and bore fields;
- practicability of re-injection;
- soil conditions at every evaporation pond disposal site.

NRW requires not only impact reports but also water production reports. This information will help to ascertain the provenance of the water, its origin and how fast it will deplete. All water taken must be identifiable. Each company has some flexibility to decide which tests they will run to satisfy these objectives.

NRW on its part will keep records of the other users relying on each aquifer. Additionally, Queensland is having to embrace national water accounting and the coal seam gas industry will not be able to escape this additional responsibility.

It is particularly necessary to know original baseline conditions. However, the legislation doesn't require companies to report baseline conditions immediately, only twelve months afterwards when the site has already been altered.

The legislation was not written around shell companies and short-life start-ups. Difficulties could arise with long-term record-keeping if there is a high turnover or structural instability among the subject companies.

As soon as someone's bore goes dry neighbours will point to the nearest coal seam gas company and blame them. The smartest thing that the gas producers can do is to put down monitoring bores to demonstrate their innocence. Companies must prove their case of harmlessness. In ten or twenty years' time, good baseline data now may allow them to demonstrate this. As one informant said, "Whatever it costs them, it's cheap". A company representative opined that collecting the data may not require much work beyond what they must do for their own purposes: "as aquifers are their life blood".

Origin's monitoring at Spring Gully is presented as a typical monitoring program. There is a string of observation bores 5-10 m deep around the perimeter of the evaporation pond. There is another set 30-50 m deep into the Hutton Sandstone, the most shallow broad scale aquifer in that locality. (Incidentally, this monitoring program has not been accepted by NRW, as it has not been put to NRW in an underground water impact report).

In discussion, one of the companies claimed that it is difficult to separate the effects of their de-watering from the effects of drought and also that farmers on their part are reluctant to release their own data. These observations underscore the importance of conducting systematic monitoring.

Finding: Regular audits of companies' record-keeping, both in their CHQ and field depots, should be run by DME.

Format of data

Data should be presented in a format that interested parties can understand, can be easily disseminated and is comparable with other companies' formats, not buried within an Annual Report or a return submitted for other purposes.

It has been suggested that the four or five different information requirements (for petroleum tenure, environmental authority, water licence, IDAS, the assessment that DME conducts before allowing a company to relinquish) could be collapsed into a single report, in some form of environmental management system. This could make the reporting requirements less onerous (and a review of the legislation with this end in mind is underway, in consultation with APPEA). Industry was a party to the crafting of the reporting regime but that is not an argument that it is satisfactory.

Finding: A review of the reporting requirements be progressed on a whole-of-Government basis with a view to a simplified but comprehensive environmental

management system for each field. (This would be prepared post-ATP by the applicant(s) but is different from the pre-ATP capability evaluation proposed in the final section of this analysis).

Capture of Project Data for Compliance Purposes

As explained above, as a condition of their petroleum tenures, companies are required to undertake impact assessment reporting and monitoring. Once the statutory impact report is accepted by DME, it becomes the point of truth as to whether the drawdown has damaged another person's capacity to access water from a bore.

Conditions could be enforced either as a condition of the water licence (in regard to the on-supply of the associated water) or of the petroleum lease (e.g. via a management plan). The credibility of the water management provisions of the petroleum legislation is based upon the impact reports.

During this analysis, a misunderstanding about the status of impact reporting was revealed. Some industry representatives argued that reporting other than that included in the Annual Reports was required only if evidence of damage appeared. Companies needed a 'trigger threshold' only if a problem arose with their operations and not as a routine. By this reading of s.253 the wording "A petroleum tenure holder **may** ask…" means that the action is optional; and if a company has good reason for believing that its operations won't cause any significant reduction in performance of existing bores, it doesn't need to ask for a trigger threshold.

However, the intention of the legislation was that the trigger threshold is essential so that the preparation of an impact report may commence. The impact reports should be stand-alone documents establishing baseline data and confirming proactively that the extraction operation is proceeding without adverse consequences on the aquifers. The words "**may** apply" were included because, once a trigger threshold has been set for an aquifer, there is no need for another tenure holder to apply for a trigger threshold in the same aquifer: the newcomer can just use the threshold that had already been set. For this reason it would be inappropriate for the legislation to specify "must apply".

Tenure holders, and not the Government, have the responsibility for making good their impacts. The trigger thresholds are intended to allow the Government to help tenure holders in defining and limiting the extent of these impacts and

to clarify in advance what their "make good" obligations are likely to be. It would be quite difficult for the Government to accept water impact and related reports unless the trigger thresholds have been set.

If tenure holders wait until their neighbours are complaining about problems with their bores, then they do not understand the nature of the problem. The "make good" situation set out in the petroleum legislation is based on similar conditions that have been operating effectively for mine water licences issued under the Water Act for many years. In these cases the impacts on water levels and bore owners are identified well in advance. Impact estimates are reviewed periodically based on monitoring data that can then potentially improve these estimates (via a groundwater flow model if necessary). As potentially affected neighbours are identified (in advance of an actual impact) the tenure holder can start to negotiate a means of making good, so that the bore owner never needs to complain about their bore running dry. If the tenure holder follows the requirements for impact reporting then they will always know in advance the extent of this "make good" obligation, and can plan for it accordingly.

The absence of requests to the Department to establish trigger thresholds is evidence that the impact reports have not been prepared as the legislation intended. An audit in October 2006 revealed that not one company had submitted an impact report as required. Further, in the absence of knowledge of current effects, no one is monitoring the cumulative impacts. Industry commented that honouring their obligations in this regard was a one-on-one issue for each company in turn. This is surely not the case. That there can be such a fundamental misunderstanding over a provision drafted jointly by industry and the State is extraordinary.

It is suggested that it would be best for the companies to band together to engage consultants who will model whole gas fields using groundwater / hydrological / geological / stratigraphic / biological parameters. This task may not be as onerous as one might first expect, as not all fields are going to be equally problematic. NRW should be invited to sit on the reference panel for the consultants.

Finding: The impact reporting regime is not based on the assumption that the Government will step in and tell the petroleum tenure holder what they need to do to make good, after bore owners have made complaints. DME regional staff must make this plain to each company and publish such explanatory materials as are necessary to ensure that all staff and companies are aware of the regime.

There should be a regular (say monthly) meeting between DME (CHQ and region)

and NRW (CHQ and region) until the misalignment of interpretations over impact reporting is overcome and effective new protocols are in place.

Management of Data

There are three stand-alone databases: royalties, QDEX and Merlin (tenures). Annual reports are remitted to QDEX (Queensland Digital Exploration Database. There is an interactive map outside the firewall. DME does not seem to have a central map showing the location of all gas approvals or EPA approvals in a district. One can obtain maps of bore locations from NRW, but it helps to know the number of the particular bore.

The companies are coy about releasing some of their technical information beyond their statutory requirements. There seems to be no formal mechanism in place for relevant information to be injected into a broader, comprehensive water quality monitoring regime, such as that required to assess progress towards overall water quality targets at the catchment scale. It is not known whether arrangements are in place with EPA for monitoring data to be provided to DME/NRW so that there is one single point of truth for all groundwater data. Procedures seem to be required to refer incoming reports to water specialists in DME or NRW for evaluation. It is not clear how NRW regions can access data or information on company reports.

Finding: That NRW and DME each appoint a " Data Coordinator for Coal Seam Gas" to assemble through one portal the information available within their departments. The DME person would also have the task of assembling information sourced from the gas producers and pressing them to release information not yet in the public domain. (It is possible that these roles can be taken up by current officers without additional funding. If facilitative seed funding is required, it should come from the DME portfolio. A sum of $50,000 should be sufficient to scope the problem, assemble the data that is currently available and identify the size of the gaps).

These officers would also have a role of coordinating new data capture projects and soliciting funds for data collection which lies beyond the scope of each company's individual responsibility.

These officers would also negotiate a data sharing agreement between the parties to overcome intellectual property considerations.

Dissemination of Project Data

There seems to be general agreement that such information as does exist about this industry, whether adequate or deficient, is not readily accessible and this is antagonising other stakeholders. The advent of the Internet should make it easy to establish one-portal access to information about any industry, especially one that is likely to generate sensitivities in the community. At present, it is difficult enough for people inside government to obtain copies of various permits and to find out information about the aquifers. The companies should be encouraged to place as much information as possible in the public domain and the State departments should be able to establish an index to their own public data sets. A common portal would be beneficial to the State departments for their internal purposes as well as external stakeholders.

The companies would have more credibility if they published regular results from their networks of observation bores. One company observed that they would be prepared to make public their data on quality and quantity from the monitoring bores, so long as their competitors were obliged to do similarly.

The industry agrees that there is a need for better education and information and, especially, for stronger dialogue with catchment groups. Industry considers that a general website could be helpful. If established, it should deal with all aspects of the coal seam gas industry and not just the water.

A central portal could include links to the following:

- public leaflets and educational materials;
- each department's databases such as MERLIN, QDEX and NRW's groundwater data base; (these could be indexed into a single "CSG approvals" page);
- selected web pages of each department;
- regional NRM bodies and community organisations such as Chinchilla Development;
- web sites of ACSGC and APPEA;
- each company's ASX reports;
- local governments;
- specialist, government and learned documents such as the Ministerial

Council's *Strategic Framework for Water Management in Mining;*

A central FAQ facility could be set up if funding and protocol issues could be overcome.

Finding: The two Data Coordinators should negotiate as to who will undertake the role of disseminating or retailing information. They should facilitate the supply of information to the host of a new web page.

Finding: A web page indexing information about this industry is required. This "Coal seam gas" page could be hosted by the Australian Coal Seam Gas Council, the Condamine Alliance, the University of Southern Queensland or the Australian Centre for Sustainable Catchments.

Finding: A new web page indexing development approvals is also required as a satellite to the main CSG industry web page. This should be developed by DME. NRW's "Approvals" http://www.nrw.qld.gov.au/planning/approvals/index.html

Web page is a good start in this direction and this needs to be extended across State Government. This could be done through a Smart State project.

PART VIII – SOME CONCLUSIONS IN PERSPECTIVE

The economic benefits to the region, the State and the nation from the development of the coal seam gas industry in the Surat Basin to date and into the foreseeable future are undeniable. It is no longer an emerging industry but a critical component of Queensland's energy supply. Power stations, pipeline owners, gas producers and gas users are becoming enmeshed in a web of path dependencies. This growing momentum makes it vital that the State be confident that the industry can develop without unintended consequences and without leaving a legacy of unfunded liabilities for future generations. Governments of the future will own the liability for impacts that arise or that remain after other accountable parties have left the scene. Whether there is significant existing damage is not relevant.

As with any start-up industry based upon extraction of raw materials, the industry will attract or is already partly buoyed along by energetic entrepreneurs. This phase will fade as the industry matures and as some of the low-overhead start-ups are consolidated into more established enterprises.

Generally, however, the desire of the gas producing companies to be good local citizens and to leave their communities in a better condition is not disputed. While the corporate and ethical reputation of companies is variable, this author has no doubt that overall the industry's concern not to waste water, not to sterilise ground and not to jeopardise their social licence to operate is genuine. An Origin spokesman said that the company's emerging position now is that it won't develop a field without being able to facilitate a beneficial use for the water. However, in a competitive gas market, this policy could threaten the company if its competitors refuse or fail to internalise their costs in this way.

There is an attitude of 'technological optimism' among the 'can-do' people who populate the industry, a confidence that the engineers and geologists (and markets) will solve whatever disposal or environmental problems arise. It is this, rather than any ethical carelessness, that explains why the industry is powering ahead to sign long-term contracts for gas while long-term solutions to disposal of water are not yet cemented in place. However, the optimism is potentially misplaced as it is quite likely that for many fields no solutions that are both financially viable and environmentally benign exist.

It is quite possible that the CSG industry is inflicting and will inflict less damage on the landscapes of the Surat Basin than is currently being caused by agriculture. The gas companies however face the two-pronged challenge in that, first, their impact is additional to what is already stressing local aquifers and

local river systems; and second that the effects of agriculture are fairly well understood and a "part of the furniture".

Holistic Government Responsibility

This paper has been written from a whole-of Government perspective. The Government as a whole must be holistic, even if specific agencies have constrained responsibilities. The public service must look at the total water balance in a catchment, the loads of salt in the landscape, the stress on rivers from all sources and the ripple socio-economic and environmental consequences. The companies are not just tapping coal seams with water as a by-product, they are altering Queenslanders' heritage of natural resources in irreversible ways.

It is not appropriate for the State Government to launch an industry and then run the risk that in five or 10 years' time, a serious and/or irreversible problem has been caused. The duty of the public service is to protect the public interest, not the interests of the industry as such. This requires public officers to take all reasonable steps to predict consequences and to put remedial steps in place at the outset. The precautionary principle obliges us to do that, as does suitable language in the Water Act and the EPA Act, to mention only two of the relevant statutes. It is invalid to assume that the promotion of this industry in its current form is automatically in the public interest.

The State Government must be confident that the risk is being accepted by some entity capable of managing the risk (the precautionary principle). It may well be true, as some have noted, that volumes are relatively small and any beneficial reuse will be local and close to the site of production. Infrastructure requirements may well be modest and pipework may well be funded by the users. But this analysis has uncovered no satisfactory method of benign disposal, whether on a small scale or a large.

The preferred method of giving these long-term and holistic aspects sufficient weight is to direct that the public service run a multi-disciplinary, multi-departmental and multi-resource evaluation of every proposed development in advance. This responsibility should lie upon the DME portfolio. It cannot be delegated to industry, a process which is adopted currently for impact assessment generally and is a major reason for the general dissatisfaction with impact assessment. Furthermore, it should be signed off by an officer who is not the delegate of the Minister making the eventual decision whether to grant an ATP or lease. A suitable model for such a procedure is in s.16 of the *Land Act 1994* which is mandatory before the State moves to allocate its land resource. DME should dedicate experienced officers to this role.

The critical stage at which this multi-dimensional evaluation should be run is before the issue of an ATP. Once a prospector has invested funds, it is problematic to refuse a lease on grounds unrelated to the conduct of the prospecting program.

The Minister's discretion to set out "special criteria" against which applications will be evaluated does not seem to be fettered by the PAG Act. Such criteria could include environmental and socio-economic criteria and, specifically, could include a requirement for tenderers to submit details of how they intend to dispose of associated water. Of course, the special criteria should be made transparent in the tender documents. No statutory criteria are set down for evaluating tenders other than procedural matters (s.39ff PAG) and *capability criteria* (s.43,49 PAG) and again, so long as natural justice is observed, the Minister's discretion is relatively unfettered. Also, the Minister could issue statutory policy guidelines as per s.43(1)(a).

By informal current practice, tenders are assessed primarily on how much exploration activity the bidder is prepared to undertake to prove up the resource, as evidenced in particular by how much money the bidder will spend. At present, there is no evaluation of land use and no environmental or hydrological criteria. This practice is not compatible with the satisfaction of the State Government's five advertised priorities, with the achievement of a range of Government policies other than the promotion of the CSG industry and with the protection of the public interest in the land and waters of the regions in which the industry is developing.

Finding: The current practice of not considering public interest criteria other than the promotion of the industry during evaluation of tenders to prospect is a matter of informal practice, is contrary to a range of Government policies and has no support in statute.

This practice has the potential to create anger in the community and to mire the State Government into authorising developments that it later finds to be unacceptable but irreversible except by payment of large quantums of compensation.

A more thoughtful pre-evaluation would not necessarily slow the rate at which gas projects are brought on line. Indeed, it could well simplify the issue of other permits such as environmental authorities, water licences and development approvals – and impact assessments where they are required.

A simple example of a "special criterion" (though not water-related) would be that tenderers should calculate the greenhouse footprint of their project and detail how long they intend to flare or vent unwanted gas. Such a consideration is likely to loom large in the Government's horizon during the next five years but without a test of this kind set out in the tender documents, the State the would be discarding the tenure allocation power to minimise greenhouse gases and would be obliged to rely upon a carbon trading scheme which does not yet exist or obliged to compensate companies for not releasing greenhouse gases that their lease entitles them to waste.

Summary and Main Findings

Challenges facing any program of benign disposal (including beneficial use) include:

- quality: most associated water requires treatment for most beneficial uses;
- reliability: by its nature the production of water is unsustainable;
- cost: both treatment and distribution are expensive;
- geographical spread: the four main companies have numbers of separate developments scattered over hundreds of kilometres.

Expressed optimistically, the best solution will be project specific, depending on location, access to water infrastructure and developmental infrastructure, water quality, and the needs and priorities of stakeholders.

Expressed pessimistically, no general pathway for overcoming these challenges has been discovered by this analysis, either at a local scale or at a Basin-wide scale. In other words, there is no satisfactory technical or economically viable general solution.

Finding: That the interdepartmental steering committee overseeing the preparation of this Issues Paper continue to meet, regularly on a monthly basis at first, until strategic plans for each most affected district are in place.

Finding: That a summary of this issues paper be presented to the Australian Coal Seam Gas Council and be subject for **managed** *ongoing discussion there.*

Finding: There is no satisfactory general solution for benign disposal of associated water. Evaporation ponds are unsatisfactory from all perspectives. Re-injection is not practicable or less not proven on most fields. Application of untreated water by other industries does not dispose of the salts. Desalination (purification) is technically feasible but would require economic support and in any case still leaves a residual brine.

Finding: That the State Government progress the preparation of three different kinds of strategic plan for disposal of associated water:

- *the industry development plan currently being prepared for the Department of State Development. Contact should be made with State Development to ensure that its plan serves the broader purposes of the State government as well as industry facilitation;*
- *a Surat Basin-wide non-spatial strategy for the benign disposal of associated water, coordinated by DME in consultation with industry and other departments, using this report as a starting point but incorporating more in-depth technical engineering input about options such as re-injection; (this could be followed by a Bowen Basin-wide strategy);*
- *spatial strategic plans for each district, perhaps crystallised in the form of a Water Use Plan .*

Finding: That the Director-General as a matter of priority instruct that all future tender documents for authorities to prospect for CSG include "special criteria" of a public interest nature. These would include criteria aimed at securing the best possible proposal for benign use of associated water, at evaluating the most appropriate use of the gas/water resource being targeted, at assessing the impact on other natural resources and at demonstrating how the proposal meshes with other State Government policies.

Finding: That the Director-General concurrently instruct that each tender process be supported by a report from the chief executive's delegate (not the Minister's delegate) on each application or each tendered field in terms of the special interest criteria.

Finding: That the PAG Reg be amended to set out "standard special criteria"

generally along the above lines so that these become unambiguous and mandatory.

This evaluation need not bog projects down in unnecessary caution. A certain amount of uncertainty as to eventual beneficial uses can, arguably, be accepted when assessing a new project. The precautionary principle is not absolute. Rather the purpose is to oblige DME to accept responsibility for the downstream consequences of each project that it is launching.

Geoff Edwards

Principal Policy Officer

Policy and Resource Strategy

Department of Mines and Energy

30 December 2006

APPENDIX

COAL SEAM GAS CO-PRODUCED WATER

STATUTORY REGIMES

Explanation

This chart maps the statutory processes that apply to the development of a new coal seam gas field with associated water. It does not cover safety matters or transitional matters or tenures under the 1923 legislation or the mining legislation. Some entries will be superseded by forthcoming amendments to the petroleum and gas legislation.

TABLE 1: NEW STANDARD PROJECT

OBJ

OBJ

OBJ

OBJ

Ends Version of 30 Dec. 2006

References

This list is a small subset of the references consulted. A folio of technical and learned reports has been collected.

AER (Australian Energy Regulator) 18 April 2006.

http://www.aer.gov.au/content/item.phtml?itemId=697257&nodeId=655bfa141197658a9180e91cbfa067ad&fn=Issues%20paper%20(%2018%20April%202006).pdf)

ALL consulting. July 2003. *Handbook on Coal Bed Methane Produced Water: Management and Beneficial Use Alternatives*. Consultants' Report for US Department of Energy, National Petroleum Technology Office. Tulsa, Oklahoma.

ALL Consulting and Montana Board of Oil and Gas Conservation. Feb. 2004. *Coal Bed Methane Primer*. Consultants' Report for US Department of Energy, National Petroleum Technology Office. Oklahoma.

Anon. 2005. *Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area.*. Department of Natural Resources and Mines. Brisbane

APPEA. May 2006. *Australia's Upstream Oil and Gas Industry: a Platform for Prosperity*. APPEA Issues Paper. Canberra. (Australian Petroleum Production and Exploration Association).

Bates, Gerry. 2002. *Environmental Law in Australia*. Fifth Edition. New South Wales: Butterworths. page 115.

Bullen, Emma. Aug. 2006. "Legislative Limits on Environmental Decision-making: The Application of the Administrative Law Doctrines of Jurisdictional Fact and Ultra Vires". *Environmental and Planning Law Journal*. Vol 23(4): 265-.

Environment Australia. 1999. *Water in Management*. In series Best Practice Environmental Management in Mining. Commonwealth of Australia with Partner Rio Tinto.

Environmental Protection Agency. 2005. *Draft Code of Environmental Compliance for Petroleum Exploration and Production.* Queensland.

Evans, Peter. June 1994. *Report on Groundwater Extraction from Queensland Sections of the Great Artesian Basin Due to Hydrocarbon Extraction Operations.* Internal report by DPI Resource Management. Queensland.

Foster, Linda. 2005. *Hydrogeological Framework Report for the GAB WRP Area.* Version 1.0. Indooroopilly: Department of NRMW.

Natural Resources and Mines. c.2004. “Request for a Trigger Threshold". "Application for a Water Monitoring Authority”. “An Application to Amend a Water Monitoring Authority". Guidelines for Applicants under the PAG Act 2004. Queensland Government. Brisbane.

NRMW. 2002. *Allocation, Regulation and Management of Natural Resources*. Resource Planning Guideline B2. Brisbane.

http://www.nrw.qld.gov.au/about/policy/details.php?number=LRP%2FB2

NRMW. 2004. *State Interests in Natural Resources*. Resource Planning Guideline A2. Brisbane.

http://www.nrw.qld.gov.au/about/policy/details.php?number=LRP%2FA2

Nunan, Tony. 2006. “Legal Issues Emerging from the Growth of the Coal Seam Gas Industry in Queensland”. *Australian Resources and Energy Law Journal* 25:189-200.

Parsons Brinckerhoff. August 2004. *Coal Seam Gas Water Management Study*. Consultants' Report for the Department of Natural Resources, Mines and Energy. Brisbane.

Trebeck, David. Commissioner, National Water Commission. 14 November 2006. “Implications of the National Water Initiative for the Mining Industry”. Address to AUSIMM Conference – Water in Mining Brisbane.

ends

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Management Unit	Number of Bores	Estimated Stock & Domestic Use (ML/Yr)	Licensed Non-Stock & Domestic Entitlement (ML/Yr)
Eastern Downs 1 (Walloon Coal Measures)	1,522	15,182	9,139
Surat East 2 (Walloon Coal Measures)	249	2,570	1,162
Surat North 1 (Walloon Coal Measures as well as all Injune Creek Group)	309	3,039	22
Surat 5 (Walloon Coal Measures as well as all Injune Creek Group)	184	4,425	44
Total for Walloon units	**2264**	**25,216**	**10,367**
GAB bores in the Surat, Surat East, Surat North and Eastern Downs	7,969		
Condamine alluvium	Many more		
Toowoomba basalt	Many more		

Present Criteria	**Step in Statutory Process**	**Comments, including scope for the amendment**	
AUTHORITY TO PROSPECT Discretions in decision-making are extensively delegated to the Regional Manager Mines, South East Region			
	Geological Survey conducts public good (pre-competitive) investigations and discovers some prospectivity▼		

A sensitive area could be excluded. The Minister could sequence areas to maximise efficiency There are restrictions on advertising tenders over coal or oil shale leases (PAG)	Minister advertises a potential exploration area for competitive bids (s.35, PAG)	As this is resource allocation, it is at the Minister's sole discretion whether to proceed

No statutory criteria are set down for evaluating tenders other than procedural matters (s.39ff PAG) and *capability criteria* (s.43,49 PAG). Minister could issue statutory policy guidelines as per s.43(1)(a). Minister can determine the conditions of a tender. By informal policy, tenders are assessed primarily on how much exploration activity the bidder is prepared to undertake to prove up the resource, as evidenced in particular by how much money the bidder will spend. There is no ESD criterion. There is no evaluation of land use. Tenderers are asked to submit an exploration *work program* as per s.48 PAG etc Native title is a primary Consideration.The ATP is not dependent on land tenure, although the Minister may choose to exclude certain sensitive or public interest tenures. Restricted areas (as under MRA) generally not applicable.RPP not required (W. Reg.; PAG, anomaly with PA to be remedied by C'mas W Reg.)Special provisions apply to reduce conflict with coal miners (s.304ff PAG)	Competitive bids evaluated	

	Company awarded ATP Authorises activities such as reconnaissance, drilling, light clearing and seismic surveys, commonly less intensive ***Conditions*:** ➢ s.20 PAG ➢ exploration Work Program, ➢ s.65 PAG relinquishment conditions ➢ must obtain EA (s.41(2)(b) PAG) (successful tenderer will be advised that a requirement for issue of ATP is to obtain EA plus security) ➢ security may be payable (s.488 PAG) ➢ must submit water monitoring report, concurrently with annual report (s.266,552); also provisions for review reports ➢ must collect information to underpin the 'make good' obligation (s.187,190ff PAG) ➢ must make good the supply of water to specified bores or compensate (s.244,250ff, etc PAG).Must lodge an underground water impact report within one year plus 20 days after first testing (s.256 PAG). This must include an underground water flow model and proposed monitoring program. There can be exemptions.There are provisions for decommissioning (s.292ff PAG, s.50 & sched.3 PAG reg) and compensation (s.531ff PAG)	MinisterMinister may require the ATP holder to give the State a security s.487ff PAGOnus is on the ATP holder to advise the date
EWP is on the register and can be made publicly available upon application EA required under both EP Act and PAG Guidelines on the quantum of a PAG bond are in s.150 PAG Reg Annual report need not be published		

An ATP holder may be issued a data acquisition authority (this fact is in the public domain) but there are no requirements to make the collected information public (s.176ff PAG). See regulation for details of confidentiality period. A regulation may prescribe reports or samples that must be kept. May include advanced interpretations. Must be lodged with the State within six months (s.547,548, 553 PAG). Then available publicly s.550 PAG The State can publish submitted information after the confidentiality period (s.51, 52 PAG Reg) Flaring or venting permitted if company decides it is not feasible s.72 PAG		

ENVIRONMENTAL AUTHORITY		
ATPs, pipeline licences and production tenures are all deemed to be petroleum activities.EA may cover several ERAs such as regulated waste storage and regulated waste disposal. All would be assessed at the same time.Only a holder of or applicant for petroleum tenure may applyChapter 4A EP Act in particular refers. Included 1 January 2005		

Tenure-neutral except protected areas. Native title is not a consideration because tenure is not been granted A series of guidelines and fact sheets is available, listed in Guideline *Petroleum Industry Regulatory Framework*	Company submits application with work program	Exempt from IPA under Sch. 9 of IPA
Codes under EP Act. None yet promulgated, all applicants non-code compliant. However, EPA is using the draft code as a template when compiling conditions (it is expected that a code will be promulgated during 2007)Any site with significant disturbance such as an evaporation pond more than 4 ha cannot be code-compliantEPA has a draft Operational Policy	If code compliant, application is self-assessed	

Saline effluent is a regulated waste, level 1. If the petroleum lease holder producers even small amounts of water over a salinity threshold (not specified in statute but specified in Appendix B. of the draft Code of Environmental Compliance), level 1 assessment is necessary, but if there is no water, may be at level 2	If not code compliant, must be assessed	Activities can be Level 1 or Level 2, prescribed in schedule 1 of the EP Reg under s.20(1) EP Act. Level 1 ERAs are medium to high risk of causing serious environmental harm. Level 2 ERAs are not otherwise prescribed as level 1 and are considered to have a low risk of causing serious environmental harm. An EA for a level 2 petroleum activity can be either a code compliant authority or a non-code compliant, site-specific authority

s.113 EP Act sets out criteria for decision e.g. must consider the standard criteria, the first of which is ecologically sustainable development. Guideline *Preparing an Environmental Management Plan (EM Plan) for Level 1 Petroleum Activities* Design, construction and inspection of regulated dams must be undertaken by a suitably qualified and experienced person. Engineering standards are not codified. New code on regulated dams is being drafted. (Needs RIS)	Application for a level 1 activity must include an EMP which specifies disposal options.Purpose of the EMP is to suggest commitments that can become conditions of the EA	
Guideline *Environmental Impact Assessment Process for Petroleum Projects* explains when EIS is necessary	EIS may be required	Could be run under State Works Act, EPA Act or EPBC Act.EPA will advise whether the project is likely to have a significant impact on a matter of national environmental significance, in which case an application under EPBC Act is required.

	If a new level 1 activity, must be publicly notified	
	Application is assessed	
	EA issued	In principle, EPA could specify “no discharge off site”

Policy to determine amount of bond for level 2 activities is set out in Appendix C of the draft code of environmental compliance. See also guideline *Financial Assurance for Petroleum Activities*	Financial assurance payable	

MANAGEMENT OF EXPLORATION AND EXTRACTION		

s.46 LProGuidelines by chief executive s.15 LProAlso s.555 PAG	Land protection measures followed, including wash down for parthenium	
s.319 EP Act	Must not do environmental harm	A company holding an EA has an obligation to report environmental harm. Also, EPA can discover from routine inspections or third-party reports

Aboriginal Cultural Heritage Act 2003 and guidelines	Must protect cultural heritage	
A regulation may prescribe requirements (s.281 PAG)	Driller must comply with regulation	
	Company applies to do production testing	Minister. EPA does not limit production wells/activity unless there is a need to increase the amount of bond

	Company may need to apply for development approval for ancillary operations which fall within the definition of operational works	
PETROLEUM LEASE		
	The Minister may call tenders (s.127 PAG)	
	Company holding ATP applies for PL; has a prima facie statutory right to proceed to production	

Assessed against PAG and regulations, see s.121, s.131 PAGNo technical guidelines yet approved (drafts exist) but industry codes would be taken into accountDevelopment Plan to be submitted with application (s.136ff PAG). Guidelines could specify content of a Development Plan (drafts exist)Criteria for evaluating Development Plan s.141ff. The intent is that the development plan will maximise the effective recovery of the resource and the return to the State. Environmental issues, ESD, land-use issues generally not a consideration. Too late for fundamental issues – make or break considerations must be applied at ATP stageLimits of the area, company knowledge are relevant (s.118 PAG): Act is focused on development capabilityOverlap with coal tenures – ensure that both resources are recoverable (Ch.3 PAG)The lease is not dependent on land tenure, although the Minister may choose to exclude certain sensitive or public interest tenures. Restricted areas (as under MRA) generally not applicable. (See s.26,27 PAG)	Evaluated	Minister

DP defined in s.24 PAG. Not entered on QDEX. Obtainable under FOIAnnual report can be made available when the confidentiality condition expires (s.51 PAG reg)EA required under both EP Act and PAGGuidelines on the quantum of a PAG bond are in s150 PAG RegAn ATP holder may be issued a data acquisition authority (this fact is in the public domain) but there are no requirements to make the collected information public (s.176ff PAG). See regulation for details of confidentiality period.Bores are considered unduly affected if drawdown exceeds a 'trigger threshold' (s.246 PAG). The chief executive may fix a trigger threshold (s.251-4 PAG)Flaring or venting permitted if company decides it is not feasible s.151 PAGA regulation may specify requirements for an underground water flow model (s.257 PAG)A regulation may prescribe reports or samples that must be kept. May include advanced interpretations. Must be lodged with the State within six months (s.547,548,553 PAG). Then available publicly s.550 PAGThe State can publish submitted information after the confidentiality period (s.51, 52 PAG Reg)	Company awarded PL Allows associated activities and pipelines in the area of the lease (s.109-12 PAG) ***Conditions*:** ➢ s.20, 150ff PAG ➢ Development Plan ➢ must submit water monitoring report, concurrently with annual report (s.266,552); also provisions for review reports ➢ must obtain EA (s.121(1)(f) PAG) (applicant to take initiative) ➢ security may be payable (s.488 PAG) ➢ must collect information to underpin the 'make good' obligation (s.187,190ff PAG) ➢ must make good the supply of water to specified bores or compensate (s.244,250ff, etc PAG).Must lodge an underground water impact report within one year plus 20 days after first testing (ATP or PL) or the date of first lodging a royalty return (PL) whichever is earlier (s.256 PAG). This must include an underground water flow model and proposed monitoring programA pre-closure report must identify bores that may be unduly affected by extraction (s.261,2 PAG)There are provisions for decommissioning prior to relinquishment (s.292ff PAG, s.50 & sched.3 PAG reg) and compensation (s.531ff PAG)	MinisterMinister may require the ATP holder to give the State a security – s.487ff PAGOnus is on the lease holder to advise the date. Mines tenure administration is not routinely advised of the date of first royalty

ENVIRONMENTAL AUTHORITY		
ATPs, pipeline licences and production tenures are all deemed to be petroleum activities.EA may cover several ERAs such as regulated waste storage and regulated waste disposal. All would be assessed at the same time.		
See above	Company submits application with work programSame process is applied as for the ATP; same EA number; additional conditions may be applied or additional uses specified	See above

Repeat process as for EA for ATP above

	EA issued	
MANAGEMENT OF EXPLORATION AND EXTRACTION *See similar title above*		

WATER ALLOCATION		

Company has right to take associated water and water for the authorised tenure activity and stock and domestic on this PL land or adjacent land in same ownership (s.185-9 PAG; Ch.2 Pt.6 WA by exception). The following explains the intent of the legislation: Tenure holders, and not the government, have the responsibility for making good their impacts. The trigger thresholds are designed so that the government can help the tenure holders in defining and so limiting these impacts. The intention is to enable them to clarify in advance what their “make good” obligations are likely to be. Although the legislation has not made it compulsory to apply for these thresholds, it would be difficult for NRW to accept water impact reports unless the trigger thresholds have been set. Once a trigger threshold has been set for an aquifer, there is no need for another tenure holder to apply for a trigger threshold in the same aquifer. They just use the threshold that had already been set. This is why the legislation states that tenure holders “may” not “must” apply. If the tenure holder follows the requirements for impact reporting then they will always know in advance the extent of this “make good” obligation, and can plan for it accordingly.		

	The petroleum tenure holder (and only them) can apply for an associated water licence (s.206 WA)	S.38 WA in principle allows a *water resource plan* to be launched, presumably if there is an aquifer- or district-wide concern about the volumes extracted. (A water resource plan can include groundwater). However, associated water is not water in an aquifer. It has already been taken from the aquifer. A water licence for associated water is in many respects an authority to re-use or on-supply water, which is quite different from most licences to take water. So associated water lies outside water resource planning process by policy intent.

s.210 WA: sets out what may be considered when deciding an application. Includes: • 1 strategies and policies for the sustainable management of water in the area (includes effects on third parties and ecosystems by drawdowns); • 2 sustainable resource management strategies and policies for the catchment, including any relevant coastal zone and regional aquifer systems; • 3 *the public interest*.Water quality and end land use not considerationsMust be satisfied that priority has been offered to people on a waiting list (defined in s.203 WA) s.206A WAFurther information may be required s.207 WA.	Application evaluated	Chief executive, delegated to NRW RegionCondition could be placed on the licence requiring that water can only be supplied for irrigation when the irrigator has an approved land and water management plan. This is not explicitly set out in legislation, would rely on general powers of CE to set conditions on licences.Other likely conditions might be that CE is informed of volumes supplied to which other parties, and for what purposes.Monitoring of water salinity might also be required.

		It would be possible to create a jurisdiction under s.59ff WA by a *water use plan*, if concerned about the impacts of the use on the land. No such areas have yet been promulgated. A Water Use Plan s.73(1)(d) WA; s.967 WA could specify that a LWMP is required. Deposition of large quantities of saline waters in the MDB catchments would seem to be a justifiable trigger for a water use plan. It could create a means of dealing with the bigger picture water quality issues such as third party water use. However as one of these plans has not been produced, it's not clear what the end result would be. Minister prepares a Water Use Plan, GIC approves, becomes stat. instrument (like a planning scheme) Not delegated

For associated water licence is not attached to land – s213(e)(vi)Conditions may include monitoring and may cap the price that a gas company charges (limitation on charges applies only to water supplied to the priority group)Chief Executive may require the holder of a water entitlement (incl. WL) to collect and supply informationChief executive approves guidelines for LWMPs (s.72 WA)Criteria for approving LWMP s.76 WA	WL issued Conditions s.214 WA Prepare LWMP if required Development permit not required for the bores that extract the water: they do not have a primary purpose of taking water, i.e. they are not water bores. Development may be required for development by a third party off the PL. S.967 WA not relevant **unless** there is other development not associated with the PL that also includes ops work to take or interfere with water, such as works that take overland flow in a WRP area that regulates overland flow.	Chief executive (s.211 WA) Delegated to regional Water officers LWMP could be required before supply of water to any irrigation (under general powers to condition licences) The tenure holder would also need to be registered as a water service provider if they had the intent of charging for the water they intend supplying to others. (s.370 WA)

	WL ends when the petroleum tenure ends	
DEVELOPMENT APPROVAL – INTENSITY ANIMAL HUSBANDRY		
The case of an application for an intensive animal industry is considered here. Other kinds of development may or may not require development approval, depending on IPA , the planning scheme, the EP Act and certain other legislation		

	Landholder applies for development approval	If applicant is not the landholder, they need resource entitlement for the *land* as per Sch.10 IPA Reg.Applicant needs WL or comparable evidence that the chief executive of NRW agrees – see s.967(3,4) WA and s.3.2.1(5) of IPA - but only if the application includes operational works that take or interfere with water regulated under the WA. If using associated water then only the overland flow aspect could trigger need for consent of chief executive as no Development Permit required for supply of associated water. Where consent required it needs to be written consent – a copy of an entitlement is not sufficient for s967(3)WL holder need not be the landholderIf a proposal is to capture overland flow under a WRP, a DA is required for the activity before DA for the works that capture the water

	Precise pathway depends upon whether the proposal is: ➢ material change of use or operational works or reconfiguration of a lot; ➢ an ERA ➢ code assessable or impact assessable ➢ and how it is treated in the planning scheme	For aquaculture, EPA is assessment manager For feedlots and piggeries, DPI&F is a concurrence agency or occasionally the assessment manager (in most cases the local authority will be the assessment manager) EPA has delegated to officers of DPI&F authority for all matters relating to cattle feedlots and piggeries DPI&F's main concern is that the applicants (potential water users) fulfil their obligations under the *Environmental Protection Act 1994* or *Fisheries Act 1994*. Where they source water for these activities is up to them. DPI&F informs them that they need legal access to water for the activity however the onus is on them to ensure that water is legally able to be used. It is also the potential user's responsibility to ensure the water is of adequate quality for the desired application. Apart from its legislative responsibilities DPI&F are also interested in providing advice to producers on crops/pastures that can utilise this water effectively, and appropriate application rates. But the persons using this water are responsible for testing quality prior to application.

s.966 WA sets out criteria where the chief executive is Assessment Manager or referral agencyA regulation may establish a code for assessing development for which the chief executive NRW is Assessment Manager or a referral agency (s.1014 WA)	Application is referredApplication is advertised	Referral agencies become involvedThird parties become involved
Legal access to water is not a condition of permits for intensive livestock projects (DPI&F policy)	Application is evaluated	
	Concurrently, DPI&F evaluates, as cattle feedlots and piggeries are ERAs	EPA nowadays issues a Registration Certificate, not an EA for animal husbandry ERAs and all require a DAThe RC accompanies the DA(EA is now the document only for petroleum and gas activities)
	Gas coy may need to apply for amendment to its PL EA. which may have required on-site treatment. This may require dialogue between the gas coy and the development project proponent.	

DEVELOPMENT APPROVAL – TOWN SUPPLY		
The special case of water supply for urban potable purposes to a local government is considered here.		
	Consider whether the proposal is best handled as a stand-alone development, or a group or networked system	SunWater may coordinate a number of potential sources of water or a number of potential users.A Water Authority may be created by regulation under s.548ff WA to coordinate a number of potential sources of water or a number of potential users.

	Buyer of the water applies for DA	The Council may be assessment manager even if it is the beneficiary. EPA will be concurrence agency as municipal water supply is an ERA and as regulated waste treatment is an ERA Water Industry Regulation has a strategic role.
	State Development may declare it a Significant State Project, then it will coordinate	
	Application is referredApplication is advertised	Referral agencies become involvedVegetation approval may be requiredThird parties become involved

	Holder of the EA associated with the PL applies for an amendment to that EA	
	Buyer of the water applies to DLGP for a government subsidy if required	Water Industry Regulation will approve engineering design if any government funds are required.
	A Registration Certificate under the EP Act is issued if proposal is acceptable	
	DA is issued	
	All normal statutory requirements on project managers such as LPro apply	
PIPELINE LICENCES **PETROLEUM FACILITY LICENCES**		

Chapter 4 PAG	The owner of land or rights over land may apply for a pipeline licence or a petroleum facility licence *Detailed steps are not explained here*	The Minister may grant a pipeline licence or a petroleum facility licence
	There are provisions for decommissioning prior to relinquishment (s.559ff PAG)	

Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River

A Report for the

Central Downs Irrigators Limited

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August, 2010

Groundwater connections between the Walloon Coal Measures and the Alluvium of the Condamine River

1.0 Introduction

The Alluvial Plains of the Condamine River between Brookstead and Dalby are among the most productive of agricultural land in Australia. The area contains a mixture of both irrigated and dryland cropping, with water for irrigation obtained from groundwater resources, harvesting of overland flow and to a limited extent, the Condamine River. Water allocations are controlled, with demand heavily outstripping the available supplies.

Groundwater has been subject to restrictions on further development since the early 1970s, and over recent years, groundwater allocations have been reduced in an attempt to reduce use to the sustainable yield.

Any development or action that could impact on the yield of the groundwater resources of this region is a major concern to local landholders.

2.0 Geology

The alluvium of the Condamine River overlies the Clarence-Moreton geological Basin which is separated from the adjoining Surat Basin by the Kumbarilla Ridge, a sub-surface bedrock high. Both the Surat Basin and the Clarence Moreton Basin are part of the Great Artesian Basin. Figure 1 shows the structure of the Basins that underlie the Condamine River alluvial sediments

The sedimentary rocks that compose these large Basins generally slope to the west. The sediments lap over the Kumbarilla Ridge and are hydraulically connected over the ridge. They outcrop east of the ridge, with the younger formation, the Kumbarilla Formation generally outcropping to the west of the Condamine River, and the underlying formations outcropping further to the east, with much outcrop covered by the Condamine River alluvium. Closer to the Great Dividing Range, the basalts of the Main Range Volcanics also overlie the sediments of the Moreton-Clarence Basin.

The surface geology is shown on Figure 2. The main groundwater resources occur in the alluvial sediments and also in the basalt. Within the alluvium, the extent of the productive groundwater area is in central part. The western part of the mapped alluvium (as shown on the figure 2) is superficial and contains no large groundwater reserves.

The alluvium is up to 150 m deep, and consists of sand, gravel and clay. It has quite significant clay in its upper sequence and this inhibits direct recharge from rainfall. Over much of the area, the alluvium is underlain by the Walloon Coal Measures, the Formation that is targeted for Coal Seam

Gas (CSG) production. In many areas, the Springbok Sandstone lies between the Walloon Coal Measures and the alluvium, but this is mostly identified by the coal company geologists. Most water wells intersect sandstone, shale or coal below the alluvium (as logged by the drillers) and this has historically been referred to as the Walloon Coal Measures. There is little data to identify if they have separate hydrological properties, but generally they appear to be hydrologically connected.

Figure 1 –Structure and Basins of the Eastern part of the Great Artesian Basin (From Queensland Government, 2005)

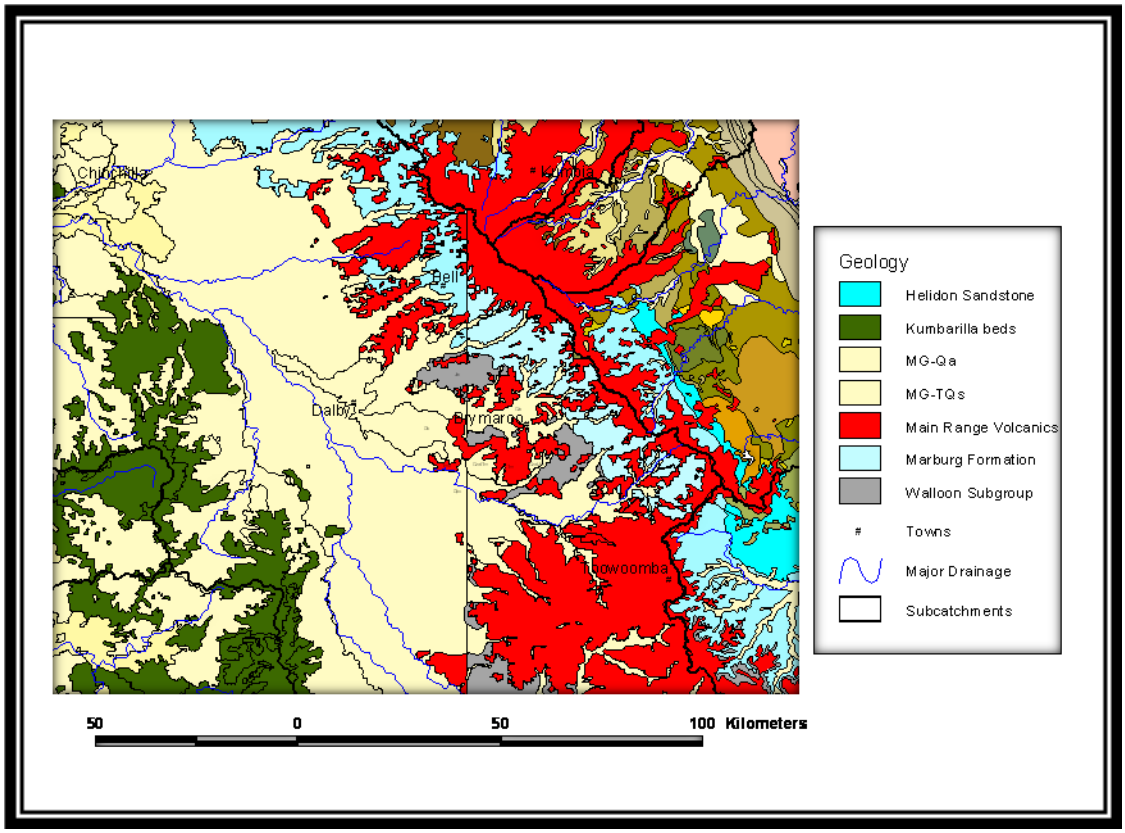

Figure 2 – Surface Geology of the Condamine Plains area. (From Queensland Department of Natural Resource and Mines)

The Walloon Coal Measures are reported to be up to 650 m thick (Exon, 1976). In this investigation area, the thickness is about 500 m at its maximum, but generally less. The formation consist of sandstone, siltstone, carbonaceous mudstone and coal, and lies conformably over the underlying Hutton or Marburg Sandstones. The coal seams vary in both thickness and quality, and often appear to not continuous. Figure 3 shows the relationship of the Walloon Coal Measures to the other Formations across this area. The alluvial sediments overlie these sediments.

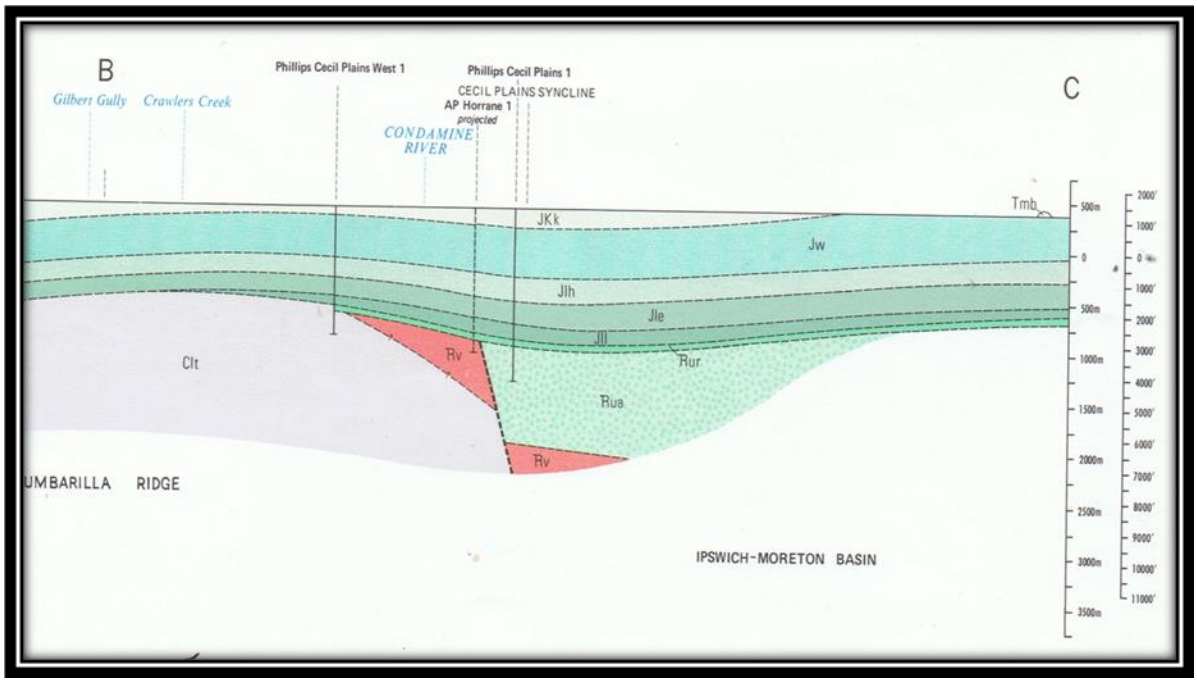

Figure 3 – Geological Section Through Cecil Plains to Mt Maria. (From Exon et al, 1972). The Kumbarilla Ridge at "B" separates the Surat Basin to the west from the Clarence Moreton Basin. The Walloon Coal Measures (Jw) overlies the Hutton Sandstone (Jlh) and other GAB sediments. The Condamine River alluvium has eroded a channel into the Kumbarilla Beds (JKk) and the Walloon Coal Measures and filled the eroded channel with clay, sand and gravel.

3.0 Hydrogeology

3.1 Alluvial Sediments

The alluvium of the Condamine River has been deposited in a broad valley, and consists of unconsolidated clay, silt, sand and gravel. The groundwater in the sand and gravel aquifers has been accessed since the early 1960s for irrigation purposes, but by the 1970s, it was obvious that groundwater was being used in excess of the rate of recharge. Groundwater levels were falling, and the Queensland Government introduced conditions on water licenses that restricted the drilling of new bores, metered the use of water from existing bores and imposed limits on use by the implementation of a water entitlement system. Several bores have been selected to show the rate of depletion of the groundwater. These are outlined in Table 1, with the bore locations shown on

Figure 4, and the plots of the water levels over time in Figures 5 (a) to 5 (f). Some of the shallow monitoring pipes have gone dry as the groundwater levels have fallen to below their bottom. All bores show a consistent downward trend, emphasising that use is in excess of the natural recharge.

Table 1 – Details of selected bores tapping the alluvial aquifers in the Condamine, with hydrographs shown on Figures 5(a) to 5(f).

Bore RN	Elevation	Latitude	Longitude	Log	Depth Shallow Pipe (B)	Depth Deep Pipe (A)
42230047	387.58	27^{0}43'02"	151^{0}26'23"	0 m-clay, minor sand		
				46.3 m-sand & gravel	49.7 m	
				49.5 m-clay, minor gravel		
				68.6 m-sand & gravel		73.2 m
				73.2 m-blue clay, sandstone (EOH 86m)		
42230062	369.04	27^{0}41'43"	151^{0}16'04"	0 m-clay, claybound sand, dry sand & gravel		
				15.2 m-sandy clay (moist)	18.0 m	
				18.3 m-sandy clay		
				24.1 m-sand & water (EOH 26.8m)		26.1 m
42230096	357.56	27^{0}32'32"	151^{0}15'50"	0 m-clay, claybound sand & gravel		
				14.0 m-silt & clay		
				22.3 m-clay	18.6 m	
				26.2 m-gravel & clay		
				31.1 m-clay (EOH 32m)		30.8 m
42230113	357.21	27^{0}39'57"	151^{0}19'42"	0 m-clay, sandy clay		
				19.5 m-sand, minor clay	23.8 m	
				24.1 m-layers of clay & sand & silt – some coarse sand layers (EOH 72.2m)		54.4 m
42230160	340.28	27^{0}10'12"	151^{0}13'39"	0 m-Sand, silty sand & sandy clay		58.6 m
				93.3 m-Sand & gravel with clay bands		
				124.4 m-Shale, coal and sandstone, (EOH 134.1 m).		
42230159	338.77	27^{0}09'56"	151^{0}12'54"	0 m-clay, sandy clay		
				59.5 m-silty sand & clay		
				65.3 m-clay, minor sandy layers		
				104.6 m-sand, minor clay (EOH 119.4m)		118.6 m
42230148	343.52	27^{0}23'24"	151^{0}15'35"	0 m-clay, sandy clay & gravel		
				33.2 m-sand & gravel	34.2 m	
				35.2 m-clay, sandy clay		
				48.2 m-sand & gravel, some clay		54.0 m
				58.2 m-sandstone (EOH 76.2m)		

Figure 4 – Location of selected alluvial bores

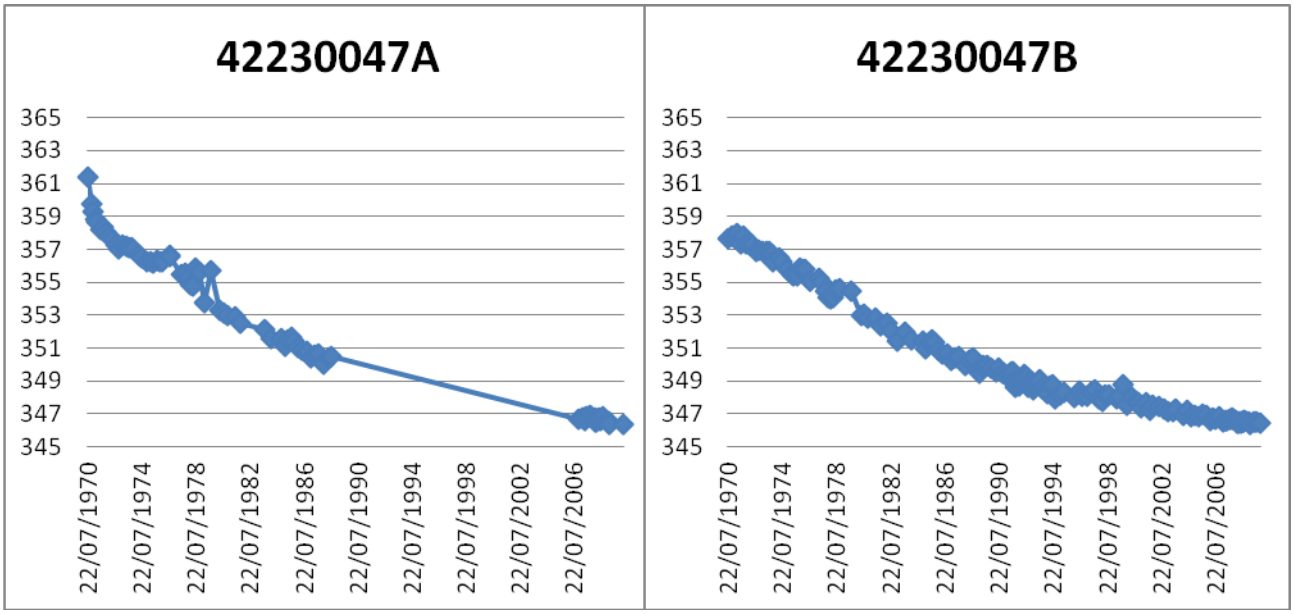

Figure 5 (a) – Bore 42230047 Hydrographs; 42230047A pipe seated at 314.4 m; 42230047B pipe seated at 337.9 m.

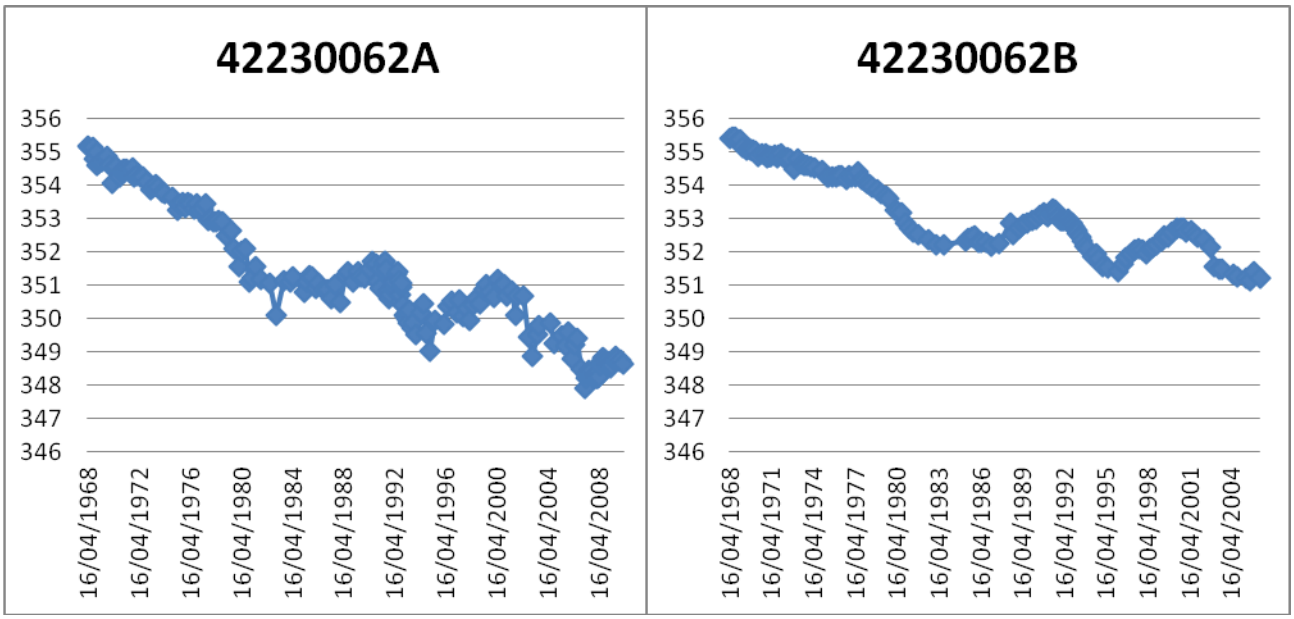

Figure 5 (b) – Bore 42230062 Hydrographs; 42230062A pipe seated at 342.9 m; 42230062B pipe seated at 351.0 m.

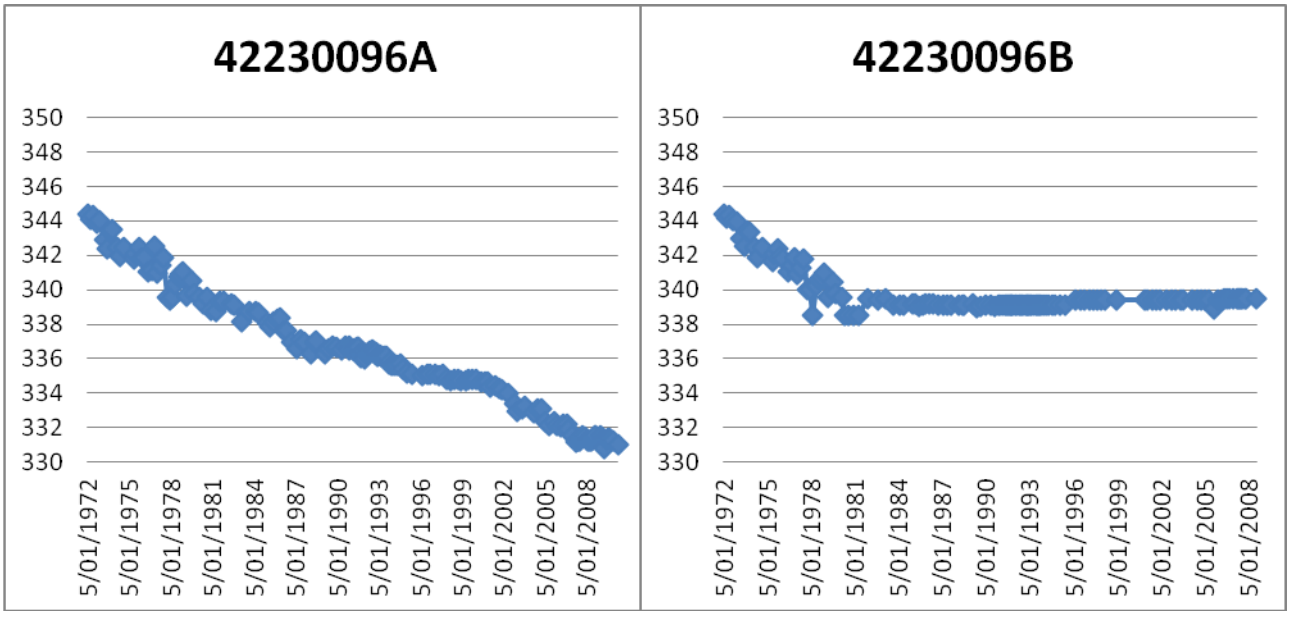

Figure 5 (c) – Bore 42230096 Hydrographs; 42230096A pipe seated at 326.76 m; 42230096B pipe seated at 339.0 m.

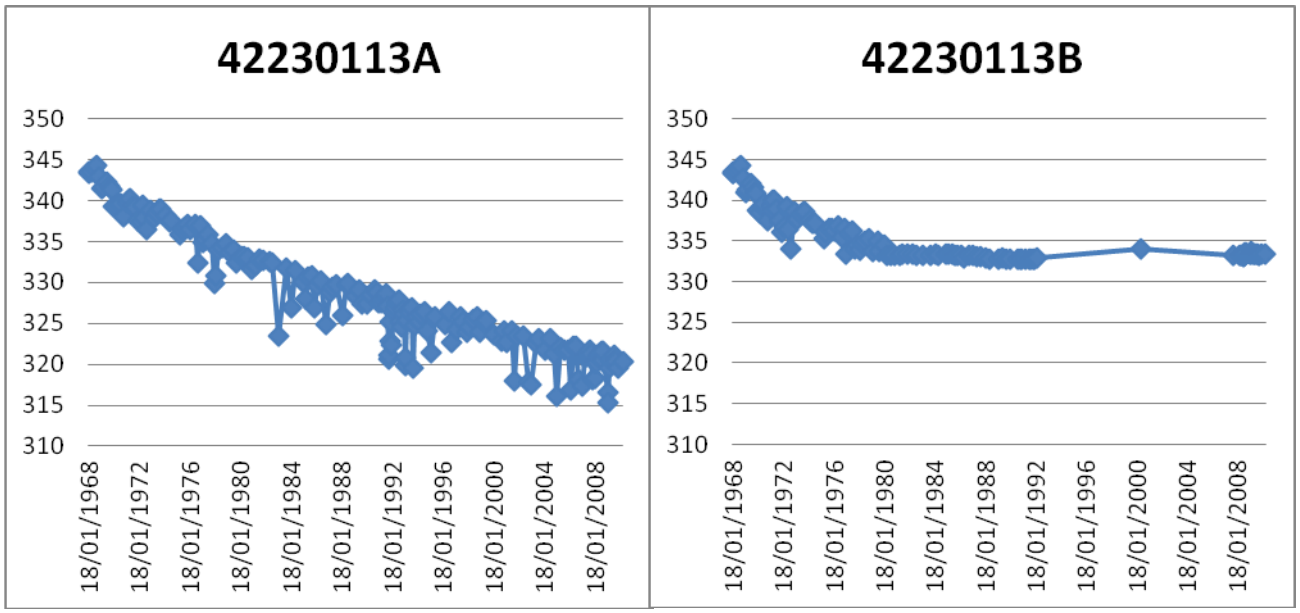

Figure 5 (d) – Bore 42230113 Hydrographs; 42230113A pipe seated at 302.8 m; 42230113B pipe seated at 333.4 m.

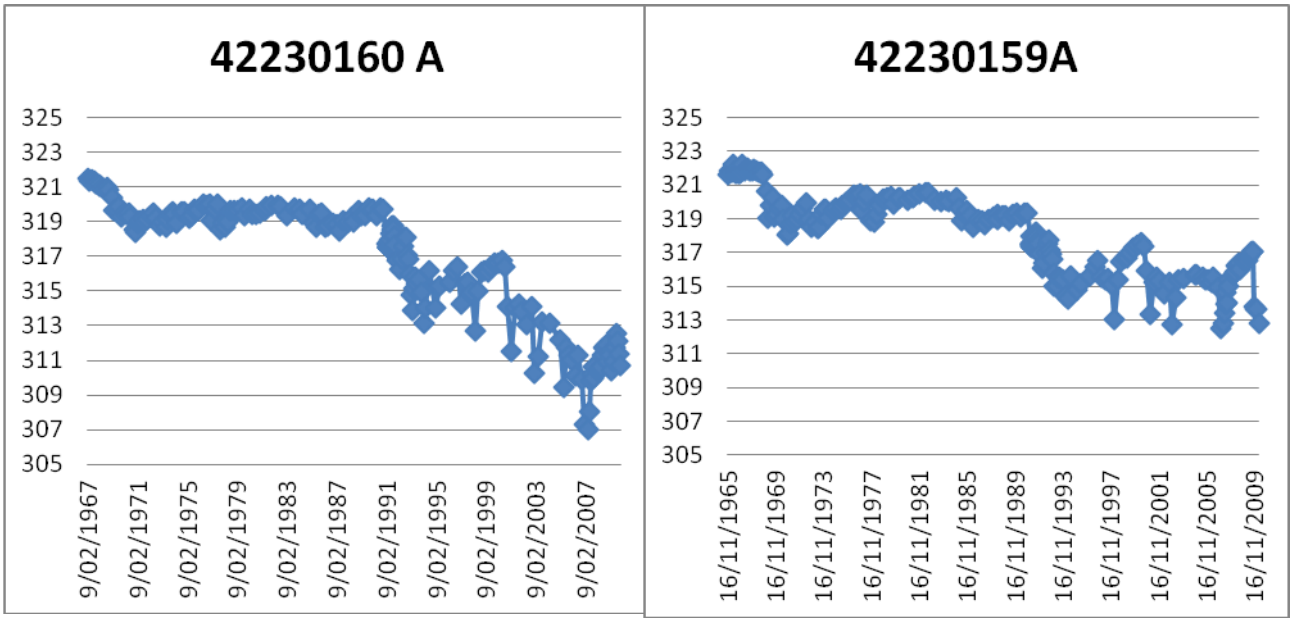

Figure 5 (e) – Bore 42230160A hydrograph; pipe seated at 281.7 m; 42230159A hydrograph, pipe seated at 220.2 m.

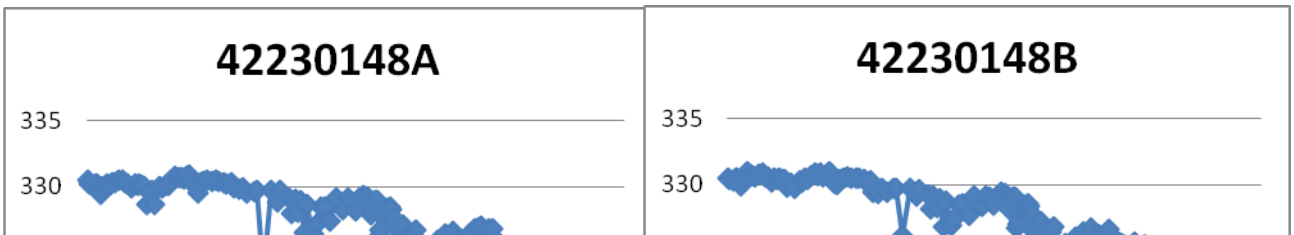

Figure 5 (f) – Bore 42230148 Hydrographs; 42230148A pipe seated at 289.5 m; 42230148B pipe seated at 309.3 m.

SKM (2002) carried out an investigation of the alluvial area between Pittsworth and Dalby, basically the current area of concern. Their estimate of groundwater use at that time (2001) was 40,000 ML. Irrigation bores in the Condamine Groundwater Management Area are all metered, but a small part of the SKM investigation was outside this area.

Although groundwater is supplemented by supplies from other sources (harvesting of overland flow, river diversions etc), in drought times the groundwater is often the only reliable source of irrigation water for the landholders. SKM constructed a groundwater flow model of the area, and following calibration of the model came up with the figures for the groundwater water balance in the modelled area of the alluvium, in Table 3.

Table 3 – SKM (2002) calibrated Groundwater Water Balance.

WATER IN (ML / YEAR)		**WATER OUT (ML / YEAR)**	
Rainfall recharge and Irrigation recharge	20402	Groundwater pumping	44379
River recharge	11539	Down-catchment aquifer flow	12568
Abandoned channel recharge	0	Leakage to basement	0
From eastern flank	1604		
From up-catchment aquifer	1163		
From western flank	441		
From Oakey Creek alluvium	0		
TOTAL	**35149 ML/YEAR**	**TOTAL**	**56479 ML/YEAR**

This indicated that there is some 21,330 ML of groundwater coming out of the system in excess of that which is replaced by recharge and other processes. Included in the "in" processes is inflow from the eastern and western flanks. This is water from adjoining/underlying formations as a positive gradient existed between the groundwater in the underlying formation (Walloon Coal Measures) and the alluvium. In this report, SKM estimated this as 2045 ML/Year.

SKM considered that at that time, there was only transfer of groundwater into the alluvium from other formations, not transfer out to the surrounding formations.

3.2 Walloon Coal Measures

The Walloon Coal Measures contains consolidated sediments – sandstone shale, mudstone and coal. Its depositional environment was in swamps, lakes and sluggish streams (Exon, 1976). However, most of these sediments contain poor quality water, probably derived from remnant salt from salt water intrusions into the swamps during deposition. In addition, generally the sandstones have a low permeability, and supplies from these are usually quite small – stock water supplies only. The coal seams contain the most water – in their fractures and joints. Water in the coal can be variable in quality, with some reasonable quality in some areas, but mostly it is brackish to saline.

Because these sediments have never been treated as a significant resource for water, its resources have been poorly monitored. Very few bores have been constructed to monitor either water levels or quality. The bores that access the Walloons and are monitored are shown on Figure 6, with water level plots shown in Figures 7(a) to 7 (e).

Of interest is the east – west line of bores 42231211 to 42231214. The bores closest to the alluvial edge show a fall in water level, with the fall decreasing away from the alluvial edge until bore 42231214 shows a rising trend.

Bore 42231390, located in the Walloon Coal Measures under the alluvium west of Dalby, shows a falling trend since 1990, very comparable to the nearby by alluvial bore 42230160. Other Walloon bores to the east of the river show some falls (e.g. 42231358, 42231135), though bore 42231340 shows a slight rise.

It is evident that the geology of the Walloon Coal Measures is complex, with non-continuous beds, thickening and thinning of layers (shales, sandstone and coal) and varying hydraulic connections between layers. However, based on the very limited hydrological information available, it appears that the formation does act as a single unit with one piezometric surface and with general movement of groundwater to the west.

Figure 6 – Location of bores monitoring the Walloon Coal Measures

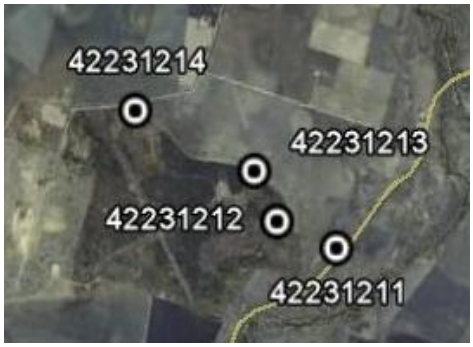

Figure 6(a) - The area covering bores 42231211 to 42231214 in Figure 6 has been enlarged.

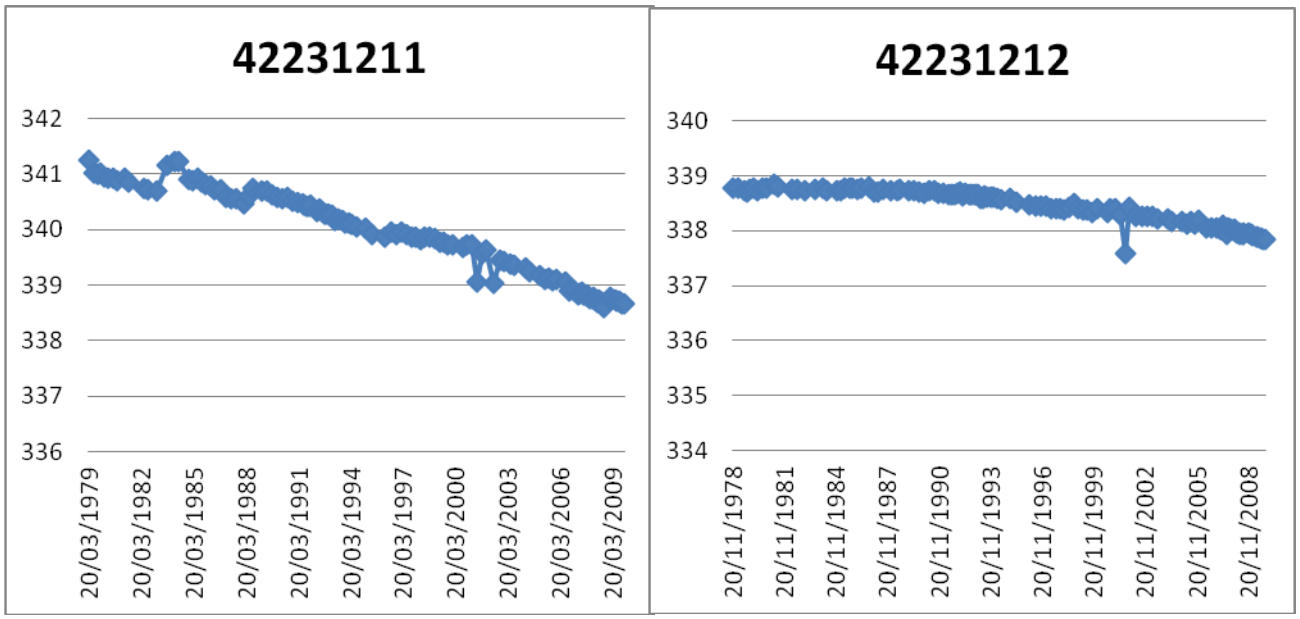

Figure 7(a) – Hydrographs for Bores 42231211 and 42231212, tapping the Walloon Coal Measures

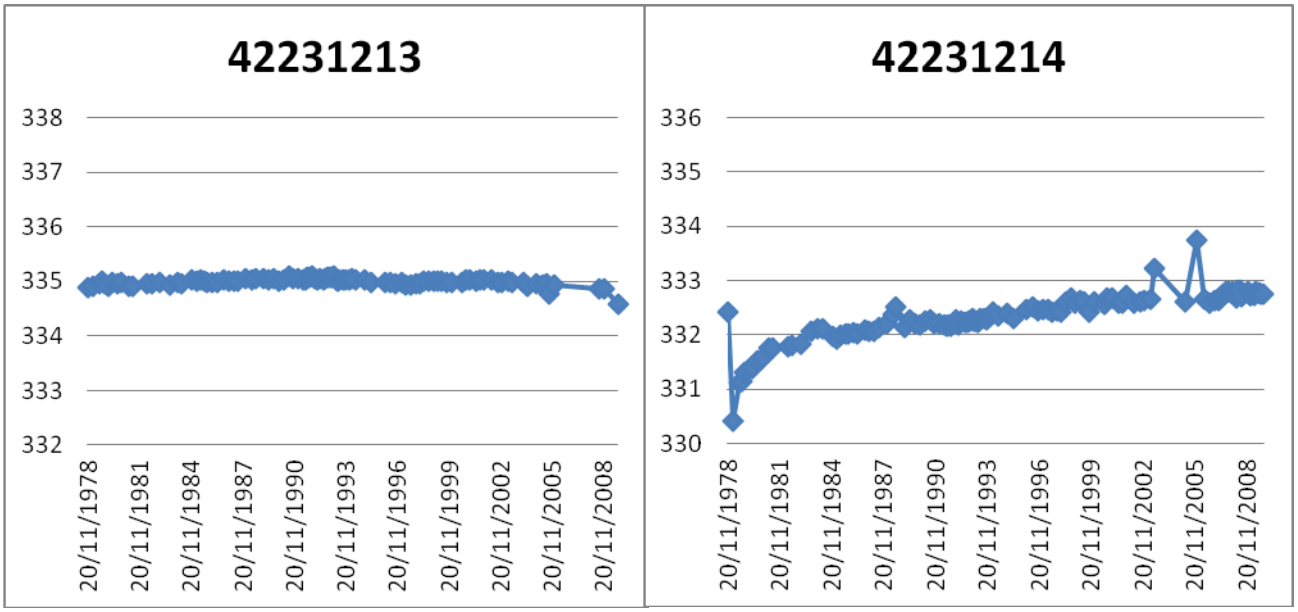

Figure 7(b) – Hydrographs for Bores 42231213 and 42231214, tapping the Walloon Coal Measures

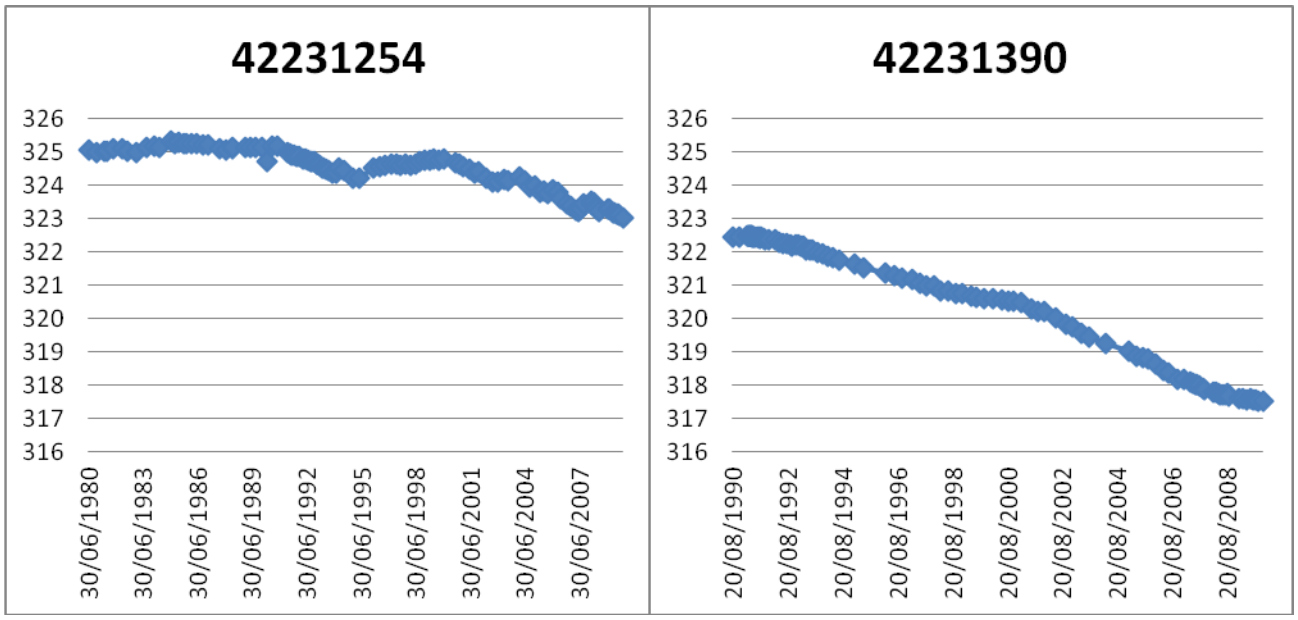

Figure 7(c) – Hydrographs for Bores 42231254 and 42231390, tapping the Walloon Coal Measures

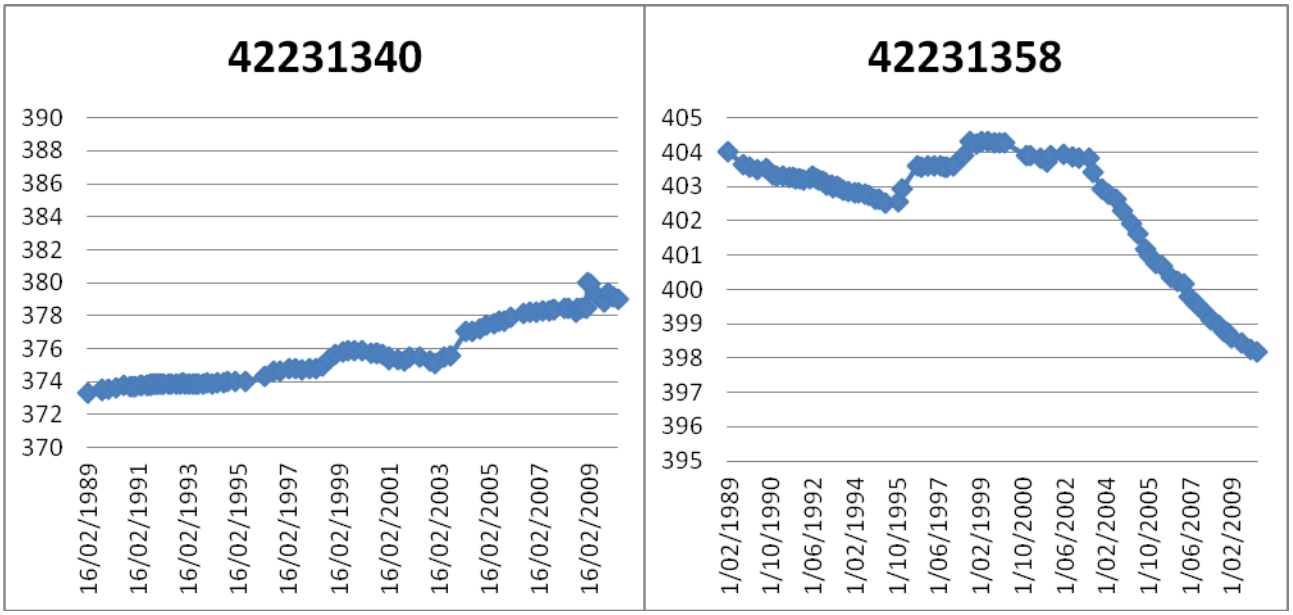

Figure 7(d) – Hydrographs for Bores 42231340 and 42231358, tapping the Walloon Coal Measures

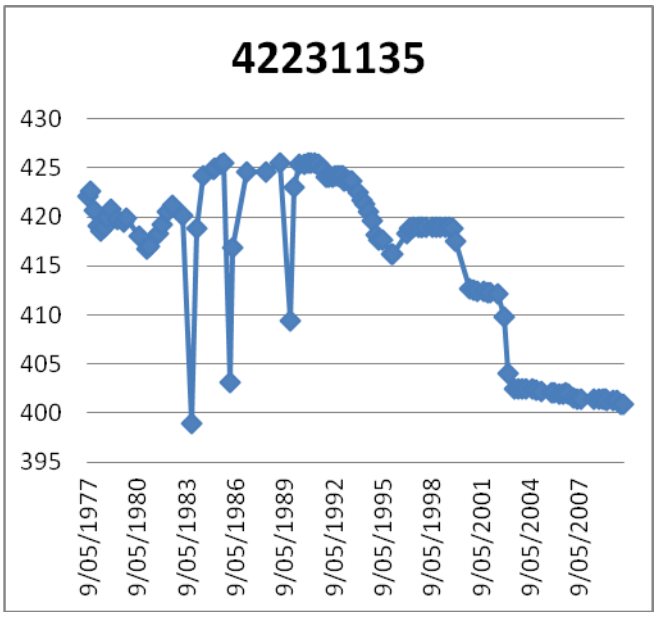

Figure 7(e) – Hydrographs for Bores 42231135, tapping the Walloon Coal Measures

3.3 Water Quality

There are significant differences in the water quality of these two formations. The alluvial sediments generally will contain much younger water, and be subject to more localised recharge. It would be expected to contain much better water quality than the Walloon Coal Measures, which has limited local recharge, and contains remnant salt.

There was a significant program of water sampling conducted by DERM (or its predecessor, QWRC) in 1988. There has not been such an extensive sampling program since then, and the 1988 data has been used in this analysis.

3.3.1 Alluvial Groundwater Quality

Table 4 contains an abbreviated water analysis from the alluvial bores that are shown on Figure 8. This figure also contains the electrical conductivity measurements of the water and these highlight the change in water quality in the alluvium in a downstream direction. (The electrical conductivity provides a guide to the total dissolved salts, with sea water having a conductivity of about 55,000 µS/cm, and the maximum for general human consumption about 1,500 µS/cm). There is generally little within the alluvial sequence that will drastically change groundwater quality – natural recharge is from rainfall and stream flow, both providing good quality water with low salt content. The recharge figures from SKM (2002) indicate that over 90% of recharge comes from these sources. The increase in dissolved salts (indicated by the conductivity readings in Figure 8) has to be caused by the inflow of poor quality water from underlying strata – mostly the Walloon Coal Measures, with inflow from both the edges of the alluvium and upwards from the bottom. There may be a small amount from concentration of salt in the soil water by evapotranspiration.

The increase in the dissolved salt content in the downstream alluvium is almost totally due to an increase in the sodium and chloride concentration.

Table 4 – Water Quality in the Alluvial sediments

Bore Number	Conductivity (µS/cm	Total Dissolved Solids (mg/l)	Sodium Adsorption Ratio	Na*	Ca*	Mg*	HCO_3*	Cl *	SO_4*
42230047A	910	553	3.3	115	43	29	390	125	7
42230047B	810	543	3.3	115	39	33	420	105	4
42230062A	495	308	3.5	77	20	10	245	39	2
42230096A	660	416	4.5	110	25	12	340	51	7
42230096B	950	615	5.2	160	40	20	395	135	12
42230113A	700	434	2.6	84	32	29	385	39	15
42230148A	1800	1055	7.6	290	36	45	435	350	73
42230148B	3200	1882	15.3	600	32	51	445	780	165
42230159A	6200	3730	16.5	1100	67	160	365	2050	125
42230160A	6000	3600	16.0	1050	94	140	325	1950	160

* = Concentration in milligrams/litre (mg/l)

Figure 8 – Location of alluvial bores ("A" pipes only), with the conductivity in µS/cm shown in brackets.

3.3.2 Walloon Coal Measures Water Quality

The water quality in the Walloon Coal Measures varies from reasonable and suitable for stock to some that has a conductivity greater than 10,000 µS/cm and is unsuitable for most purpose. The quality generally appears to be better east towards Toowoomba, which is to be expected, as the groundwater flow direction is from the east to the west (i.e. away from the area of recharge). There are many properties that do rely on bores in the Walloon Coal Measure for stock water, but anomalies occur in some areas with some bores having very poor quality. This is probably due to isolated pockets or lenses where historically there may have been virtually no through flow to flush out or dilute salt. Exposure of such lenses either by bores or from erosion may release these salts. Table 5 gives the quality in the Walloon bores, with their location and conductivity shown on Figure 9.

The east – west line of bores tapping the Walloon Coal Measures, bores 42231211 to 42231216 (refer section 3.2) show an increase in conductivity further from the alluvial edge. The conductivity varies from 1200 µS/cm near the alluvium to 14,000 µS/cm further away, indicating past interaction of the groundwater in the alluvium with that in the Walloons.

Table 5 – Water Quality in the Walloon Coal Measures

Bore Number	Conductivity (µS/cm	Total Dissolved Solids (mg/l)	Sodium Adsorption Ratio	Na*	Ca*	Mg*	HCO_3*	Cl *	SO_4*
42231135A	1100	610	12	220	12	9	495	4	2
42231211A	1200	730	5.9	190	38	25	405	195	19
42231212A	1500	890	17.5	300	8	8	165	395	33
42231213A	4200	2420	16.0	740	63	62	310	1250	80
42231214A	3000	1680	26	600	24	10	295	880	2
42231216A	14000	8414	35	2750	220	150	250	5100	37
42231254A	17500	11000	49	3700	93	205	0	6500	360
42231255A	8800	5130	12	1200	400	205	190	3150	8
42231340A	24500	18154	26	4550	920	850	280	10000	1650
42231358A	1250	719	5.1	180	53	25	370	225	27

* = Concentration in milligrams/litre (mg/l)

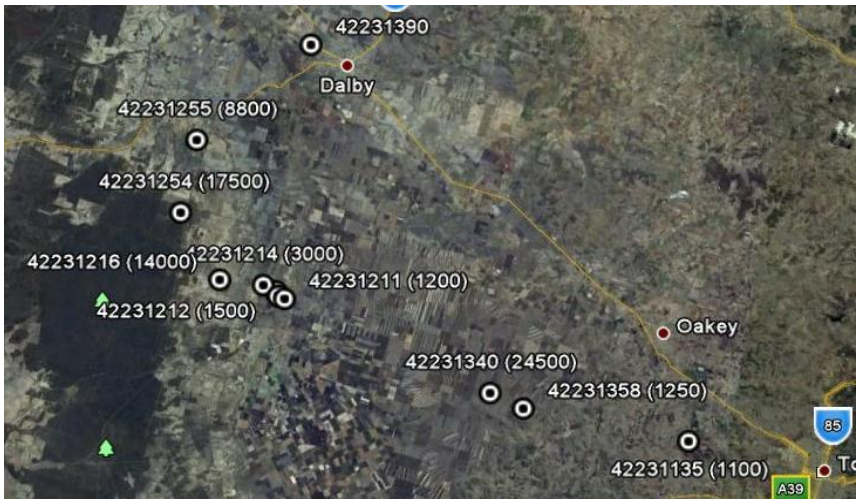

Figure 9 – Location of Walloon Coal Measure bores, with the conductivity in µS/cm shown in brackets.

4.0 Interaction between the Groundwater in Alluvium and the Walloon Coal Measures

The groundwater in the alluvium recharges mostly from rainfall infiltration and from the river. SKM (2002) calculated that, in their project area, recharge from the river and from rainfall and from irrigation water penetration amounts to 31,941 ML/year out of a total recharge of 35,139 ML/year. Groundwater movement is basically downstream, but a depression in the piezometric surface has developed as a result of water pumped from the aquifer for irrigation purposes. Figure 10, from SKM 2002, shows the surface as it was in 2001, with the depression in the surface evident.

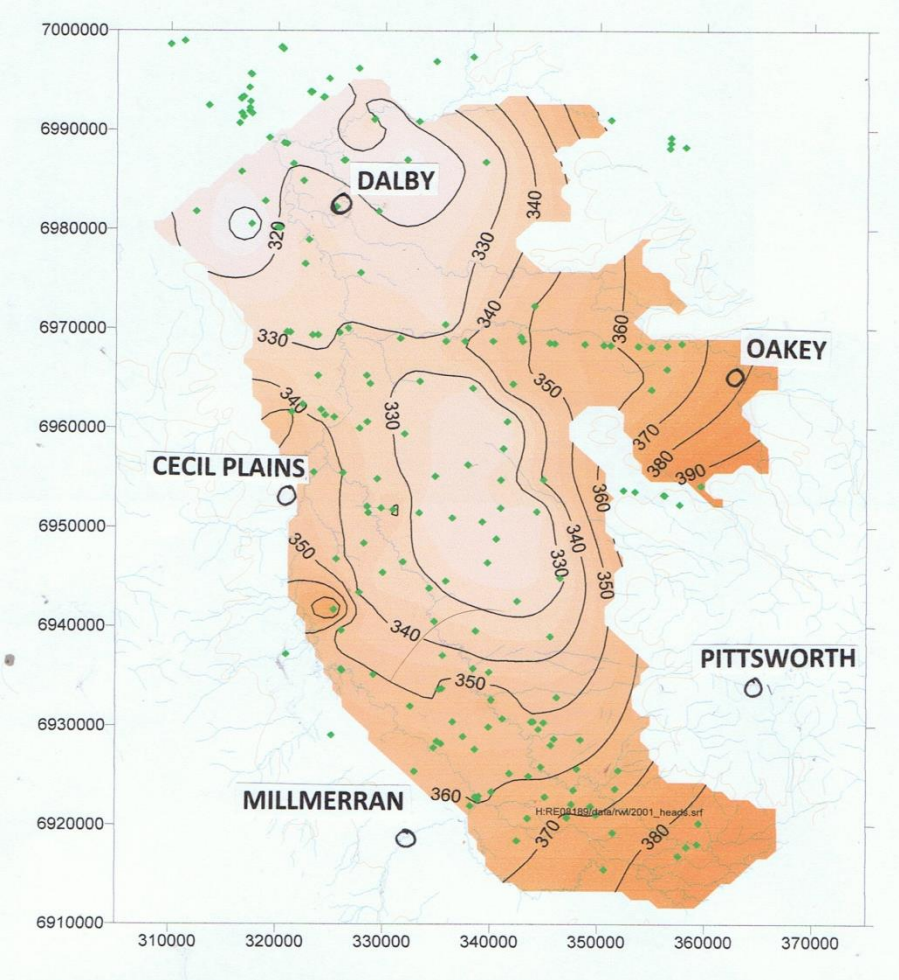

Figure 10 – The piezometric surface in the Condamine alluvium in 2001. (From SKM, 2002)

The contours of the groundwater piezometric surface in the Walloon Coal Measures is difficult to derive as there are few dedicated monitoring bores from which accurate information can be obtained. Hence data from private bores that tap these sediments have been used, but the water levels are spread over several years, thus affecting the contour accuracy. However they do give a very good indication of the direction of flow of the groundwater and are shown in Figure 11. Flow is to the west, with evidence that there is vertical discharge into the overlying alluvium of Oakey Creek (near the centre of this figure) and into the Condamine River alluvium (in the north west of the figure), where the streams have cut into the Walloon strata.

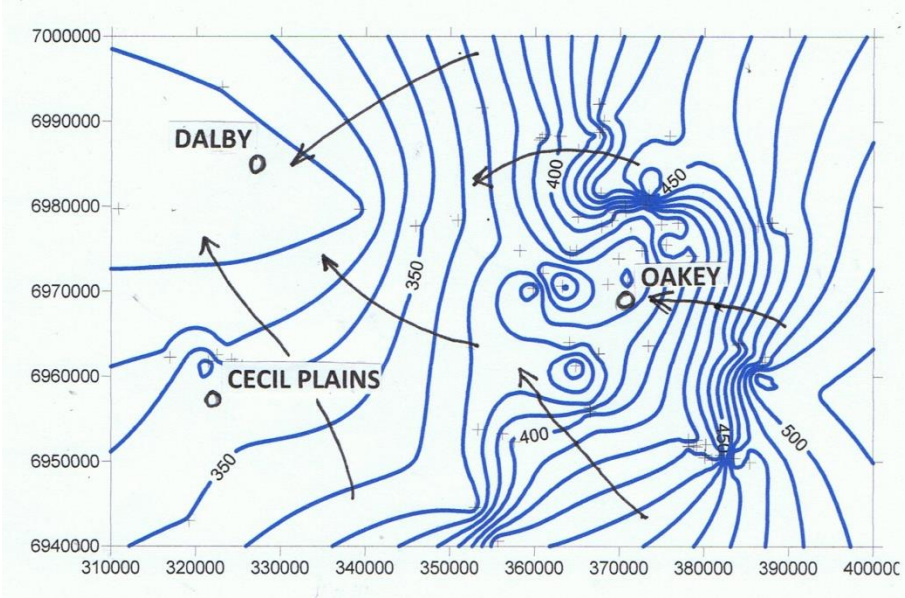

Figure 11 – Contours of the Piezometric surface in the Walloon Coal Measures.

Vertical discharge of groundwater from sediments in the Great Artesian Basin (GAB) has been well recorded. Initial investigation were carried out by Woods et al (1990) in investigations into discharge from the GAB near Lake Eyre in South Australia and their work has been widely utilised. Cox and Barron (1998) consider that up to 45% of the total discharge from the GAB can be accounted for by upward leakage. Welsh (2006), in the calibration of a transient model of the GAB, calculated a maximum vertical leakage of 88 mm per year out of parts the Basin, with an average leakage of 0.9 mm per year. However, for any leakage to occur there must be an upward gradient – the head of the groundwater in the underlying sediments must be greater than the head in the receiving bed (in this area, the Condamine River alluvium). If the head is higher in the overlying aquifer (the alluvium), the flow will be reversed, with the flow away from the higher head to the formation with the lower head, in this case, the Walloon Coal Measures.

Some work on this has been carried out on the hydraulic connections between GAB sediments and overlying alluvial sediments in southern Queensland. A detailed investigation into the possible effects of use from the GAB across the New South Wales – Queensland border (Sinclair et al, 2000) resulted in conclusive evidence that the alluvium of the Dumaresq/McIntyre River acts as a drain for discharge of water from the GAB. A similar conclusion was recently reached concerning discharge from the Walloon Coal Measures along Hodgson Creek. In both these cases, the higher head was in the deeper Great Artesian Basin sediments, and so the flow was to the alluvium.

In order to compare the relative groundwater heads between the alluvium and Walloon Coal Measures, an East – West section has been drawn, as shown on Figure 12.

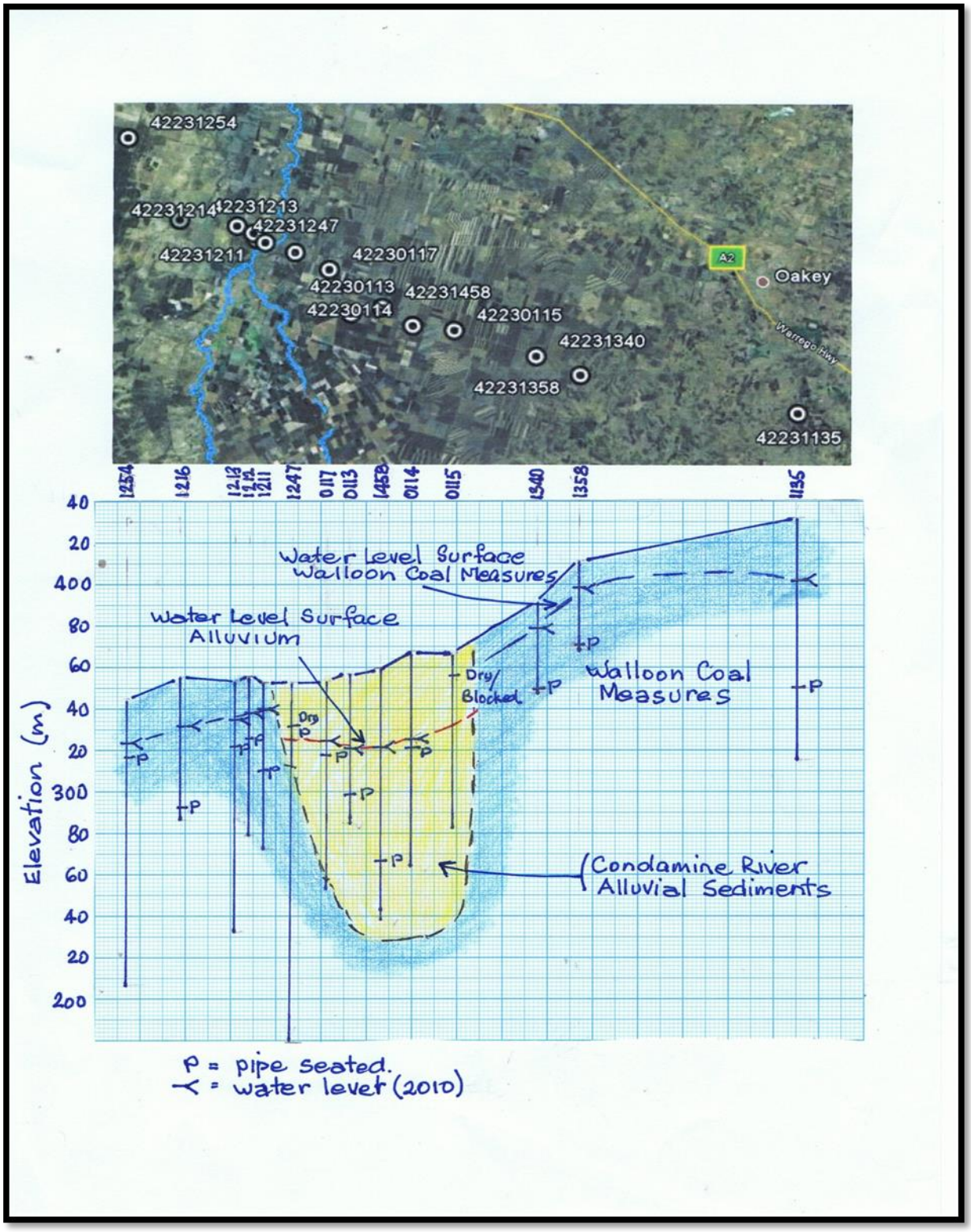

Figure 12 – East West Section showing the incision of the Condamine River into the Walloon Coal Measures and the groundwater level in each, with bore locations. The bores in the section have been projected from the plan above.

This section clearly shows that the Condamine River has carved an old valley into the underlying Mesozoic sediments, predominantly the Walloon Coal Measures. Although the Coal Measures consists of multiple layers sandstone, shale, siltstone and coal beds which vary in thickness, there appears to be one main piezometric surface. The section in figure 12 indicates that the monitoring bores are of quite different depths, but the water levels form a consistent level that slopes to the west. This surface is interrupted by the Condamine River alluvium. The groundwater surface in the alluvium is lower than that in the Walloons, and therefore a gradient exists between the two groundwater systems. This gradient would promote movement of groundwater from the Walloons into the alluvium.

Before there was development of the area and subsequent groundwater use, the two groundwater systems would have developed a type of equilibrium. There would have been some interaction between the two systems, dependent mostly on seasonal conditions. The majority of discharge, though, would be from the less permeable Walloons into the alluvium, resulting in a general mixing of the two waters in the alluvium. The quality of the groundwater decreases downstream, as shown in Figure 8, with the addition of more saline water.

The fall in water levels in the alluvium that has resulted over the last 40 years has increased the gradient between the two. This appears to have induced a fall in the water levels in the Walloons as well, especially those close to the alluvial edge or penetrating the Walloons beneath the alluvium (e.g. Bore 42231390). There is insufficient use of water from the Walloon Coal Measures for the use to cause these observed water level falls. The water is used mostly for stock, with the odd bores that tap the formation near the alluvium equipped with low producing wind mills.

The hydraulic connection between the two groundwater systems will cause water to move when a gradient exists. The water quality deterioration in the alluvium is indicative of movement from the Walloon Coal Measures to the alluvium. Should the gradient be reversed, it would be expected that movement of groundwater would be from the alluvium to the Walloon Coal Measure aquifer.

5.0 Rate of Groundwater Movement

There is very little data on which even rough estimates of water movement from one formation to another can be based. It basically depends on the permeability of the strata through which the groundwater has to move and the head difference that is driving the movement.

Horizontal movement of groundwater along individual beds can usually be calculated, as bores tapping the aquifers (the permeable horizontal beds) can be tested and the transmissivity and permeability of the aquifer calculated. Vertical permeability through what are generally considered to be confining beds is very small by comparison and movement much slower

Interaction of groundwater between the two formations will occur from horizontal movement at the edges where the alluvium has cut down into the Coal Measures, and also from vertical movement where the formations are in contact at the bottom of the alluvium. The latter can be significant if more permeable beds directly underlie the alluvium.

The permeability or hydraulic conductivity of the strata between the water in the Walloon Coal Measures and the alluvium can only be estimated at this stage. Golders Associates, (2009), modelled the likely impact of Coal Seam Gas extraction in the Surat Basin. They quote K values for the coal beds in the Walloon Coal Measures at about 1.4 m/day, and for the aquitard layers, 1×10^{-1}

to 1 x 10^{-4} m/day. These values are for horizontal hydraulic conductivity. They state that vertical values are considered to be between 100 to 1000 time less, due to the horizontal bedding of the sediments.

The beds that are in contact where the formations adjoin plays a very large part in the rate of movement from one formation to the other. Obviously contact between sand and gravel in the alluvium with more permeable beds such as sandstone and fractured coal in the Walloons will result in more movement of groundwater than through clay and shale.

Some testing needs to be carried out in order to determine the permeability of the sediments that separate the coal seams that will be dewatered from the alluvial sediments that contain the groundwater that is used for irrigation. It is essential that this possible transfer of water from the alluvium to the coal seams that contain the gas and will be dewatered be quantified. There has been movement from the Walloon Coal Measures to the alluvium in the past, and with the decrease in pressure in the Walloons, this reversal of gradient must have an effect.

Because the hydraulic conductivity of some beds is so low, there could be a substantial time lag between the commencement of the gradient reversal and the equilibrium rate of transfer of water.

6.0 Conclusions

From a detailed examination of available data on bores in the Cecil Plains area, it is concluded that:

- The alluvium of the Condamine River is incised into the Walloon Coal Measures
- The groundwater levels in the alluvium are generally falling, and have been trending downwards for the past 40 years
- The water levels in the alluvium are lower than those in the Walloon Coal Measures
- Water quality information points to a transfer of water from the Walloons to the alluvium
- If water can move from the Walloons to the alluvium, if the gradient is reversed, groundwater will move in the other direction
- There is insufficient information available on the likely dewatering level or the hydraulic conductivity of the beds between the coal seams and the alluvium for volumes of flows to be calculated.
- Because of the very real likelihood of movement of groundwater from the alluvium to the Coal Measures, more data is required to allow the calculation of the volumes that could be involved.
- A program should be instigated to obtain the data required - the permeability of the various strata that lies between the alluvium and the coal seams, water levels in the Walloon Coal measures, volumes that will be pumped etc.

7.0 Recommendations

It is recommended that the following investigation be undertaken before de-watering of Coal Measures be permitted.

1. A monitoring network be established to obtain heads at various depths in the Walloon Coal Measures. It is considered that 3 to 4 bores with monitoring pipes isolated at depths of about 50 m, 150 m and 300 m (depending on strata) need to be constructed to a high standard on each side of the alluvium. Site locations are dependent on possible mining locations, but a spacing of about 5 to 6 km would be suitable.

2. About 3 dedicated bores to monitor the Walloon Coal Measures underlying the alluvium should also be constructed.

3. A study be undertaken to determine the horizontal and vertical permeability of various beds in the Walloon Coal Measures.

4. A groundwater flow model be constructed using data obtained from 1, 2, 3 and 4 above and calibrated. The model could then be used to simulate the long-term changes and impact that the mining of Coal Seam Gas would have on the alluvial groundwater resources of the area.

5. That a decision on mining of Coal Seam Gas be dependent on the results of this study into the likely impacts.

7.0 References

Cox, R & Barron, A, (eds), 1998. Great Artesian Basin Resource Study. Report for the Great Artesian Basin Consultative Council, 235p.

Exon N F, 1976. Geology of the Surat Basin in Queensland, Bureau of Mineral Resources, Geology and Geophysics, Bulletin 166, 1976.

Exon N F, Mond A, & Reiser R F, 1972. Geology of the Dalby 1:250000 sheet. Bureau of Mineral Resources, Geology and Geophysics, 1972.

Golder Associates, 2009. QGC Groundwater Study Surat Basin, Queensland. Coal Seam Gas Field Component for Environmental Impact Statement. Queensland Gas Company, Environmental Impact Statement, 2009.

Queensland Government, 2005. Hydrogeological Framework Report for the Great Artesian Basin Water Resource Plan Area. Report prepared by the Queensland Department of Natural Resources and Mines 2005.

Sinclair P, Williams M, Gates G, Hillier J, Foster L, Caruthers R, McAlister D, Hansen A, 2000. Yelarbon – North Star – Coppa Creek. Assessment of Irrigation Impacts, Status Report 2000. Centre for Natural Resources, NSW Department of Land and Water Conservation, November, 2000.

SKM, 2002. South-East Queensland Recycled Water Project – Darling Downs Hydrological Study. Groundwater Modelling. Report prepared for Brisbane City Council and the Southeast Queensland Regional Association of Councils

Welsh, W D, 2006. Great Artesian Basin transient groundwater model. Bureau of Rural Sciences, Canberra Report, 2006.

Woods, P H, Walker, G R & Allison, G B, 1990.Estimating groundwater discharge at the southern margin of the Great Artesian Basin near Lake Eyre, South Australia. *International Conference on Groundwater in Large Sedimentary Basins, Perth*, 1990.

LAND ACCESS REVIEW SUBMISSION
19 December 2011

At the heart of BSA's concern about the land access framework is the <u>imbalance of power</u>. BSA believes that the current framework does not fully recognise or acknowledge that CSG exploration and production infrastructure and activities are not voluntary for landholders. The framework needs precursor to recognise that there is an imbalance of power.

BSA's response is guided by Principles relating to land access as outlined in "Not at any cost: A Blueprint for Sustainable CSG Operations." (March 2011).

- More certainty and transparency is required. We have reports of poor detail of activities being given by the companies which makes it difficult for Landholders to understand what they are facing. The companies should also be required to give as much insight into their overall plans for each property as soon as they are reasonably available with a good general description of what might be involved for the Landholder (i.e. how long the activities will go, the full range of activities that might be expected etc). The companies are the ones that know that as Landholders have no prior experience of it.
- Legal representation at all times through the negotiation process should be the option of the Landholder and in particular at the conference called under section 537A..There can be no justification for making legal representation the option of the CSG companies (see section 734 D (3)) in a conference under section 537A . The imbalance of bargaining power is so great and the consequences of poor outcomes so long-lasting for Landholders. It is inequitable that the CSG companies have the power to deny Landholders legal representation.
- Fair compensation must be offered to any and all affected landholders. CSG companies must be able to pay full compensation and have the capacity to fund make-good arrangements. We are very worried for Government to make sure that companies are financially capable of honouring Conduct and Compensation Agreements or compensating for breaches, such as environmental damage. The industry will last a long time but the companies might not especially if they use $2 subsidiaries.
- Landholders also want protection against unforeseen on-farm impacts. CSG Companies must carry insurance or have some other surety to be able to meet any such contingencies in future. We also demand public disclosure of bonds and insurance policies. Any insurance policies must not have "outs" that make them useless or mean that the insurance company can refuse to pay – eg. breaching an Environmental Authority. Landholders should be able to access government bonds etc to ensure the companies have a capacity to pay for damage they cause to individual properties.
- Recognition of and a commitment by CSG companies to respect the landholder's tenure rights associated with the land. Whilst petroleum and gas tenures in Queensland give CSG companies the right to extract CSG, current landholders enjoy the right to utilise the surface resources of their land. CSG companies must avoid unreasonably interfering with a landholder carrying out their lawful business. The temporary and "once only" activity of gas extraction must be done in a sensitive way , especially given the crown – the model citizen- is the owner of the resource and grants an exceptional monopoly privilege to a third party to extract it . Extraction must be done in a way that preserves the ability of the landholder to continue after the extraction is done and leave the Landholder still able to be viable as the activity occurs.

LAND ACCESS REVIEW SUBMISSION
19 December 2011

The Basin Sustainability Alliance (BSA) Committee has identified the following issues in response to the land Access Review.

Notification of EISs / EMPS / changes to conditioning / CSG activities

- Landholders whose property may be potentially impacted by an EIS or EMP (even if that impact may or may not occur, or may occur in many years time) should be notified directly via personal letter rather than relying on landholders to "find out" via a public notice process.
- Naming of fields/areas in public notices and letters to landholders should be identified in a way that the landholder clearly recognises the location
- Landholders should be notified-directly about any changes / activity on their region.
- Notification of neighbours – landholders on neighbouring properties to CSG companies should be notified regarding CSG activities (just as neighbours to a development application such as a renovation of a business premises would need to be notified).

Holistic Planning

- Landholders need better knowledge of what's planned and what's coming.
- There should be a requirement for CSG to provide indicative area wide plans – holistic management plans
- More Transparency for CSG future planning
- Operational plans should be provided - Life of project plans – operational plan which includes details of land impacts
- Govt/companies should provide resources for landholders for advice such as independent property management planning – post notification / prior to agreement to ensure better property planning.
- Staged development plan showing maximum development / scale – timing

Access Arrangements

- Disclosure of agreement details be at landholder's discretion.
- There should be a clearly identified invoicing process - Onus should not necessarily but on the landholder to generate an invoice. (at the landholder's discretion)

Enforcement

- Landholders need to have some way better confidence in ensuring coal seam gas companies meet their obligations

Review of Agreements

- Review of all existing access agreements (if required by landholder). Framework should require all companies to agree to review existing agreements – CSG companies must invite landholders to review if they wish. (BSA recognises that some CSG companies are reportedly doing this voluntarily. However, there needs to be a enforceable consistent approach. QGC has sent letter to all landholder inviting them to review – but we know of landholders who have not received an invitation to do so.
- Right to include review periods in agreements
- Avoid blanket formulas /formulas linked to number of wells /well production
- Prefer framework to encourage move away from a per well compensation
- Ensure framework disallows Compensation that is tied to well production (the infrastructure and activity impacts landholder regardless of well output)
- Keeping the framework in a way that landholders can determine individual needs / expectations when it comes to right of way (for on farm activities like spraying etc).
- Avoiding any blanket equations for compensation – recognising that each landholders circumstance is different.

General Issues

- Don't want to see section P&G Act 804 undermined. Must remember landholder's right to demand no Unreasonable interference
- Section 804 of the P&G Act should be given equal coverage/weighting in practice as 805 – in terms of education and police enforcement
- Need better review process. Better mediation process. Better funded. Better education.
- Strongly support recommendation 18 of interim senate report. Must Give priority to the maintenance of agricultural production with minimal disruption in deciding any dispute
- Also support recommendation 21 of interim senate report – which highlights the involuntary nature of landholders dealings with CSG companies
- Any framework must show that scientific research proceeds development and must demonstrate a capacity to mitigate risk

PLEASE REFER TO THE FOLLOWING LANDHOLDER CASE STUDY.

Case Study of Landholder

The following response to the Land Access Review Committee has been completed by BSA Committee Member Katie Lloyd. This is her personal view, which reiterates many of the BSA statements, and should help put a human face on the BSA submission.

Has implementation of the land access framework improved relations between landholders and resource companies?

As we have been dealing with companies over the past 10 years I don't think I can say this framework has had an impact on our relationship with CSG companies. However we believe it is essential that landholders have the information available to them to assist them with the process they are set to endure. We certainly would have liked to have had information such as this available to us when we were first approached by companies.

We believe companies have been put on notice when it comes down to land access however whether it can be credited to this framework, or simply the negative public perception this industry has, is anyone's guess. It is reassuring to finally see something in black and white that highlights the expectations and responsibilities of each party during such a complex negotiating process however at the end of the day I believe companies and individual landholders will do whatever they believe necessary to protect their interest.

I have friends who have recently had contact from a company for the first time and they have certainly stated the representatives have been reasonable, presented them with all of the information suggested and have acted accordingly which is reassuring. However, I have also heard of another instance where representatives from that same company were still using the bully boy tactics they are renowned for and being arrogant. Different circumstances will no doubt create different attitudes.

Are you clear about your rights and obligations in relation to land access for resource activities on private land?

I feel a lot more informed now than even two years ago, let alone 10. I think there is a huge onus on landholders to be informed, and there is so much they need to be aware of, yet I still believe landholders' do their homework; and I can understand why. There is so much information to get your head around; it is not a simple process.

Companies will only supply the basic information and this often leads to disappointing outcomes and a loss of trust further down the track.

When it comes to landholders' rights and obligations, I still don't believe they count for much. We can't restrict the number of wells that go on our property; we don't necessarily get the right to implement no-go zones; restrict activity to a minimum; restrict who accesses the property. To implement any of these requests the onus rests with the landholder to negotiate and effectively justify the point; and this process can be extensive and exhausting.

Have you been involved in the negotiation of a Conduct and Compensation Agreement? Did you have concerns about the process?

Our family has been through two of these processes with two separate companies to date. One was unsuccessful and exhausted in 2006, and another agreement was reluctantly reached with a second company in 2008.

What is so frustrating about this process is that we go in blindfolded. We are dealing with companies who have very clear objectives of what they want to achieve yet they divulge little, extract as much information from you as they want, which ultimately gets the best outcome for them.
To have a company ask for your business plans when you know nothing about what they want to do on your land, we believe, puts the landholder on the back foot. Does the landholder risk the potential for more wells or infrastructure by being so upfront? I believe companies must put their plans upfront and work with the landholder on exact location, number, roads, access etc.

At the time of signing off on our agreement, recalling it was back in 2008 prior to there being so much focus on this industry, we felt very much pressured into signing. Threats of land court were being thrown around and we were being accused of "dragging the chain" as such.

What's more, we unfortunately did not have a review clause in our agreement which we now believe should be mandatory. Signing off on such development on a piece of paper is vastly different to seeing that agreement come to life. We believe we were very much lured into our agreement under false pretences. We were told things would be vastly different to how they operate now a couple of years on. We were expecting activity to decrease rapidly on our property however only now have been informed that the current activity will remain for the life of the project.

In light of this perhaps land access representatives should not be solely responsible for the handling of conduct and compensation agreements. Perhaps field superintendents need to at some stage of the process need to be included to outline exactly what the landholder can expect down the track in terms of access and general activity. I question whether land access representatives, or their managers for that fact, are aware of the ground work and can therefore provide the landowner with an honest impression.

The biggest problem landholders' face down the track, once they sign an agreement, is attempting to prove any potential impact or unreasonable interference to the company and getting them to act in good faith, or actually take those issues seriously.

Was the entry notification process satisfactory? If not how could this be improved?

I firmly believe that all landholders should be provided with Environmental Authorities, Social Management Plans and Environmental Management Plans well in advance of the negotiation/entry period to ensure they can gain an understanding of the future development. The onus should be on the companies to provide this information, not the landowner.

We have certainly had periods where we've requested companies not to access our land because of wet weather events and this has been accommodated. Companies must attempt to understand the needs of landholders' business operations and realise that adequate entry notification is essential to allow for any necessary farm management practices. I believe landholders should be given right of way so as to avoid any unreasonable interference to their operations.

As a landowner surrounded by company held land which comprises the development of significant CSG infrastructure, I would have appreciated notification from the companies prior to it starting outlining what was going on and what we could expect, if anything. We are in a situation where we have eight screw compressors going in at a location, on company owned land, that is under 3km from our house, and only 1km from our neighbours. I expressed to a company representative that it would be appreciated if they considered meeting with nearby landowners to explain what was going on, how noise impacts would be mitigated and how any compliance issues would be dealt with. The company has not made an effort to address this issue with us, however they perhaps may have dealt with those living in closer proximity. We came across this development in an EA Amendment advertised in a newspaper. Why isn't the company obliged to notify neighbours directly?. Again we are required by law to notify our immediate neighbours of any material change to our operation and this is done via an advertisement and directly by letter.

Have you been involved in a dispute resolution process associated with private land access? Were you satisfied with the result?

We have recently had situations with one company about the way in which they operate on our land following the realisation they were making water releases that we weren't aware of. While we have been working directly with the company, and officials from the CSG Enforcement Unit, on the issue I was very disappointed about the time in which it took to get answers and clarification on what happened and why.

I believe this particular issue highlighted a problem with the lack of detail featured in the particular Environmental Authority so while the company had done the wrong thing to us as landholders they were able to use the EA as their first line of defence because it had authorised the activity.

It is cases like this that lead me to believe the companies will always find a "get out of jail card" and that concerns me greatly. Conditions must be definitive, protect the environment, and the landholders' interests.

Have you had experience with the compliance and enforcement provisions or processes of the land access laws? Any suggestions for improvement?

What has concerned me in the past is the fact that the CSG industry has appeared to self regulate and dictate to Government how their enforcement officers can operate. When we noticed a serious leaking CSG well on our property, we were told by a Government CSG well compliance officer that they had tried to access our property to inspect wells however were informed by the relevant CSG company that access was restricted citing there were problems with the landholder relationship. Why should a company reserve the right to refuse a regulator access? Government regulators can access our property at their behest to inspect our registered weighbridge without warning so, why should these companies be afforded different treatment?

I realise there are more risks and regulations with CSG infrastructure however surely regulators can be trained and inducted by all companies to conduct inspection and compliance reviews without warning.

As a landowner, I would welcome the regulator to conduct random inspections of infrastructure to ensure the company is doing the right thing. I would however like forewarning of their visit because of our personal security and biosecurity requirements.

How could the land access code be improved?

Please refer to suggestions outline within this response**.**

Any general comments about the framework?
Refer to pages 1 – 3 of BSA submission

RESEARCH GAPS

IDENTIFIED BY RUTH ARMSTRONG

PROVIDED GASFIELDS COMMISSION 2012

Groundwater Investigations

- Review available literature and studies of the Condamine Alluvium area and adjacent areas where CSG activities are likely to impact on the CA and comparable information from all reputable sources and list relevant risks towards which the studies are to be done
- Comprehensive baseline water quality analyses for all hydrogeological layers within the above mentioned area at multiple sites accounting for water quality variation as per DPI Eastern Downs Land Management Manual Salinity Yield Matrix
- Map bottom of Condamine Alluvium and top of Walloons and including intervening strata for the above mentioned area
- Determine vertical and horizontal permeability and specific storage for all formations over multiple locations for the above mentioned area
- Draw down Walloons at chosen sites and conduct multi nest piezometric analyses over the above mentioned area
- Assess all the various formations for suitability for reinjection or other forms of replenishment over the above mentioned area

Substitution of Allocation Investigations

- Review available literature and studies in relation to RO and comparable information from all reputable sources and list relevant risks towards which the studies are to be done
- Investigate all currently operating Surat Basin company RO techniques and data to analyse treated water quality, potential quality and identify current best practice
- Desktop investigation using groundwater model data from above to determine whether substitution of allocation will offset predicted damage to non-target aquifers in the area
- Review by independent and appropriately qualified independent experts of Arrow's beneficial water reuse trials at Arrow's farm, Theten and any relevant and comparable CSG treated water farming operations elsewhere. Water quality and quantity, pre and post soil analyses, crop performance data and control data to be included

Soil Investigations

- Review available literature and studies of the area and list relevant risk towards which the studies are to be done
- Investigate interaction of all the various soil types in the region (e.g., Anchorfield, Hazelmere, Mywybilla etc. as per DPI Eastern Darling Downs Land Management

Manual) with treated and untreated CSG water to determine impacts and suitability of treated water for irrigation

- Investigate impacts of compaction from CSG activities on soils and resulting effects on crops
- Investigate the impact of soil movement (particularly reactive black vertosols) on integrity of aboveground (wellheads) and buried (pipelines of all sizes and types) infrastructure
- Audit all existing buried infrastructure for subsidence in all comparable areas in QLD and elsewhere
- Determine the ability of the various vertosol soil types encountered to be successfully rehabilitated to their previous use and suitability class and determine the long term impact on crop yield

Land Use Investigations

- Determine the current land uses and review the literature to establish current and evolving farming techniques for the area mentioned in the Groundwater Investigations section
- Desktop investigation of impact of gas field development on current land use and current and evolving farming techniques and intensive cropping land use (this must include all aspects of production field development and so should be done over a large area, not 1 farm e.g., the area between the Condamine River and Nangwee and including the Horrane Trough) All constraints must be applied – legislative, OH&S etc. Substitution of allocation layer able to be included
- Map the area within Arrow tenure where pad drilling is possible and identify all constraints to pad drilling
- Map the area within the Surat Basin where directional drilling techniques are possible and identify all constraints to directional drilling
- Review the literature and investigate the relative risk of all types of non-vertical drilling on the geological formations in the areas identified above (e.g., increased surface area contact creating higher incidence of water and gas migration, capacity to seal the well etc.)

CSG Infrastructure Integrity Investigations

- Review available literature and studies of the area and comparable information from all reputable sources and list the relevant risks towards which the studies are to be done
- Current production wells within the Surat Basin to be audited for integrity (steel casings, concrete sleeve, wellhead infrastructure etc.)
- Investigate the potential for gas and water migration through existing monitoring bores and third party water bores in the Surat Basin
- Locate all coal core holes in the Surat Basin and assess for water and gas leakage. Plug and abandon correctly as required
- Audit all Surat Basin CSG produced water and brine storage dams for leakage

Health Investigations

- Review available literature and studies of the area and comparable information from all reputable sources and list the relevant risks towards which the studies are to be done
- An appropriate air quality monitoring network must be installed in the Surat Basin. Currently, the nearest stations are at Toowoomba and Charleville?
- Determine the current and predicted fugitive emissions for all CSG related compounds in the Surat Basin
- Assess the incidence of temperature inversions and impacts on fugitive gas emissions, noise and dust in the area
- Determine all health risks and impacts from full scale CSG field development using the desktop gas field developed for the land use assessment for the Horrane Trough and weather and emissions data from above for the sensitive receptors in the same area

Economic Investigations

- Review available literature and studies of the area and comparable information from all reputable sources and list the relevant risks towards which the studies are to be done
- An independent economic cost benefit analysis of Arrow's proposed Surat Gas Project must be undertaken. Arrow's CBA in their EIS is inadequate and incomplete. CBA to be determined at the state level and must include costs for agriculture, environment, state and local infrastructure etc. and must extend for the duration that costs are incurred
- Valuation studies to be done on impact to intensive cropping property values using information provided from groundwater, soil and land use investigations

Other Investigations

- Arrow's EIS states that any or all petroleum activities are potentially notifiable activities. Determine the impact of listing on EMR or CLR on property values, organic status and on land used for food production
- Audit Surat Basin companies and state government records to assess the incidence, frequency, timing and quantities of accidental and intentional leaks and venting of CSG water and gas
- All Surat Basin companies to be directed to provide data for amounts of produced CSG water over project life, details of impacts to existing water bores, details of CSG water management strategies accounting for all produced water and details of 'make good' strategies for the entire extent of time that landowner bores are impaired