A Risk to Groundwater from Coal Seam Gas Extraction in the Surat Basin

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Keywords: coal seam gas; Surat Basin; agriculture

Abstract

The potential exists for land use conflict to arise between coal seam gas mining and traditional agriculture in the Surat Basin in Southern Queensland. Farming and grazing enterprises, businesses and towns in the region are largely dependent on the underground aquifers for their water supply. The process of extracting the gas from the coal seam results in the withdrawal of large quantities of water from the aquifers which underlie the basin and form part of the Great Artesian Basin water resource. Under State Government legislation the Coal Seam Gas Companies are allowed unlimited take of underground water while extraction of water for other users is controlled by the State Government. There is concern that due to connectivity between the coal seam and the aquifers that the dewatering during the gas extraction process is unsustainable. The risk of connectivity may be increased through the fracturing process used to enhance the release of the gas from the coal seam. It appears that the legislation governing the Coal Seam Gas industry does not protect the underground aquifers and that the Queensland Government has not followed the Precautionary Principle for sustainable development of this industry.

Introduction

It is acknowledged that the mining, petroleum and gas industries are underpinning the Australian economy at the present time through their contribution to export income; however agriculture is also a major contributor to the national economy accounting for approximately

one quarter of all export earnings, depending on the seasons and international markets (Encyclopedia of the Nations, 2010). In some parts of the rangelands of Australia there is the potential for conflict between the two industries over land use and sustainability, due in part to ineffective or defective regulation and legislation leading to poor governance (Schand and Darbas, 2008).

This paper focuses on the effect on ground water from the extraction of Coal Seam Gas in the Surat Basin of Southern Queensland. This is a region where the State Government and irrigators extracting water from the Condamine Alluvium have agreed that extraction at the rate of 47 gigalitres a year is unsustainable and it is recommended that the level of extraction be reduced to 30 gigalitres per year (Barnett and Muller, 2008). At the same time the Coal Seam Gas industry has been given the right under State legislation to unlimited take of underground water during the gas extraction process (Petroleum and Gas [Production and Safety] Act, 2004).

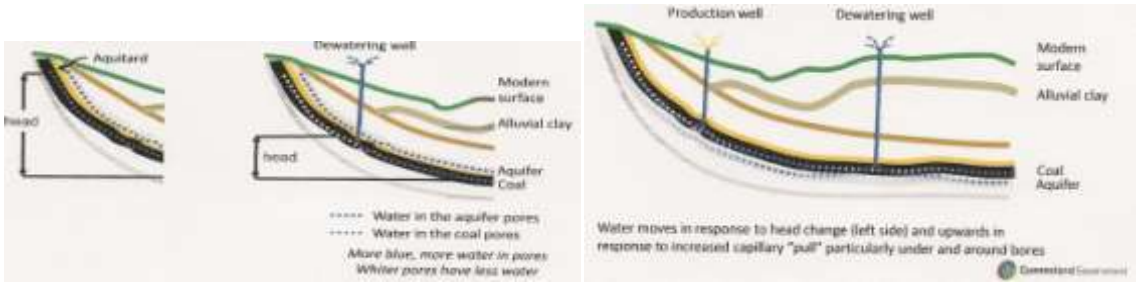
Our Water and Gas Resources

Ground water is the lifeblood of businesses and towns in rural and regional Queensland and predicted climate change towards lower rainfall and higher temperatures (Allen Consulting Group, 2005) will exacerbate this reliance. The Surat Basin is one of three major depressions which comprise the Great Artesian Basin (Department of Natural Resources and Water, 2006) and the Walloon Coal Measures, from which coal seam gas is extracted, are part of this system (Hellmuth, 2008; Great Artesian Basin Resource Operations Plan, 2007). The Springbok and Hutton aquifers lie above and below the coal seam and, in the Eastern part of the basin, the Condamine alluvium aquifer, though not part of the Great Artesian Basin, lies directly above the coal seam or the Springbok aquifer and is the highest allocated groundwater source in the State (Hellmuth, 2008). Escalation of coal seam gas extraction in the Great Artesian Basin by its very nature of unregulated and unlimited dewatering threatens the sustainability of this system over time.

Coal seam methane is held on cleats in underground coal seams and the current extraction method used by Coal Seam Gas companies is to de-pressure the coal seam, by dewatering, to

allow the gas to be released from the cleats in the coal. The coal seams are not discreet systems separate from aquifers above or below them, and while there are confining layers between different stratigraphic layers, these confining layers are not watertight and water can migrate between the layers (Figure 1). The dewatering of the coal seams may establish connectivity through the disruption of the hydraulic conditions that maintain the dynamic flow equilibrium in the aquifers (Hellmuth, 2008). Settling of the individual sedimentary formations in the Surat Basin of the Great Artesian Basin has resulted in numerous faults, folds and fractures in the water containing porous sandstone (Hillier and Foster, 2002). If dewatering of a system changes the level of the heads significantly, water will migrate laterally and from aquifers above and below (Figure 1) and in areas where there is fracturing or faulting the risk of this process will be exacerbated (Hellmuth, 2008).

Risk A **Risk B**



Risk C **Risk D**

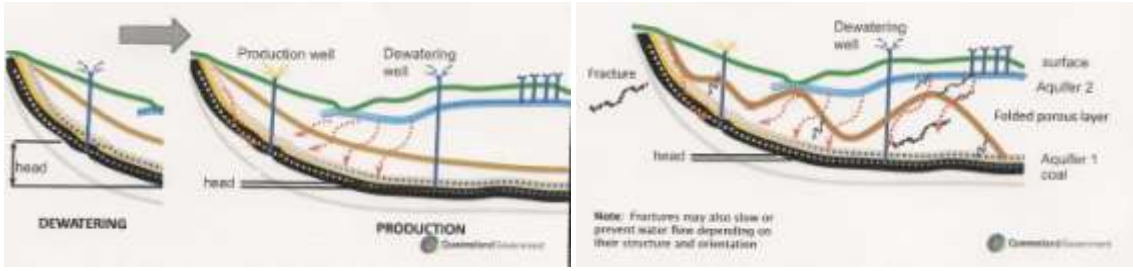
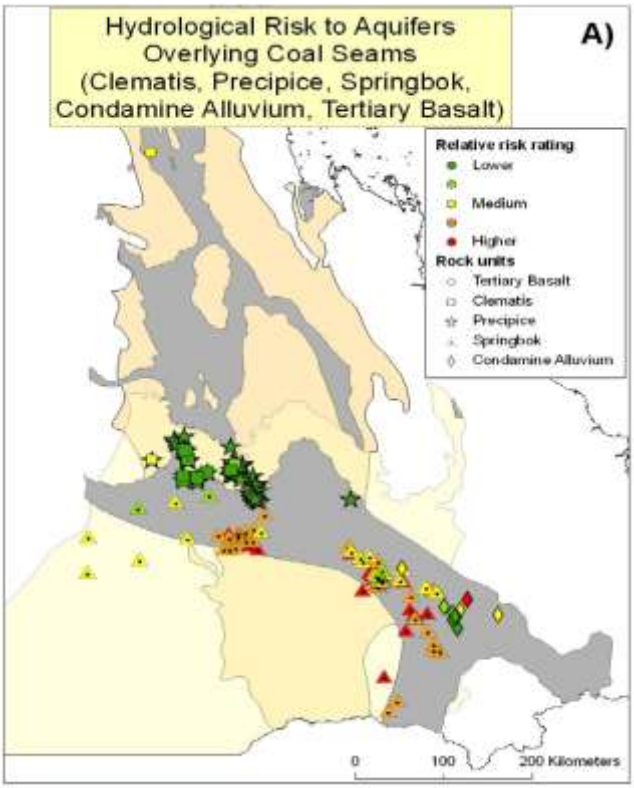


Figure 1. Risk A: water movement through the aquitard from aquifer into the coal seam in response to a drop in head; Risk B: Water movement from aquifer below coal into coal responding to dewatering; Risk C: Gas production and dewatering reduce head and trigger possible second (and subsequent) aquifer interactions; Risk D: Fracturing and folding increase the chance that water movement from distant aquifers is triggered). Source: Department of Employment, Economic Development and Innovation, 2010.

The hypothesised risks to the overlying (Figure 2 A) and underlying aquifers (Figure 2 B) in the Surat Basin indicae that the highest risks are to the Condamine aluvium aquifer, the Springbok aquifer and the Hutton aquifer, the latter is an aquifer of the Great Artesian Basin (Hellmuth, 2008).



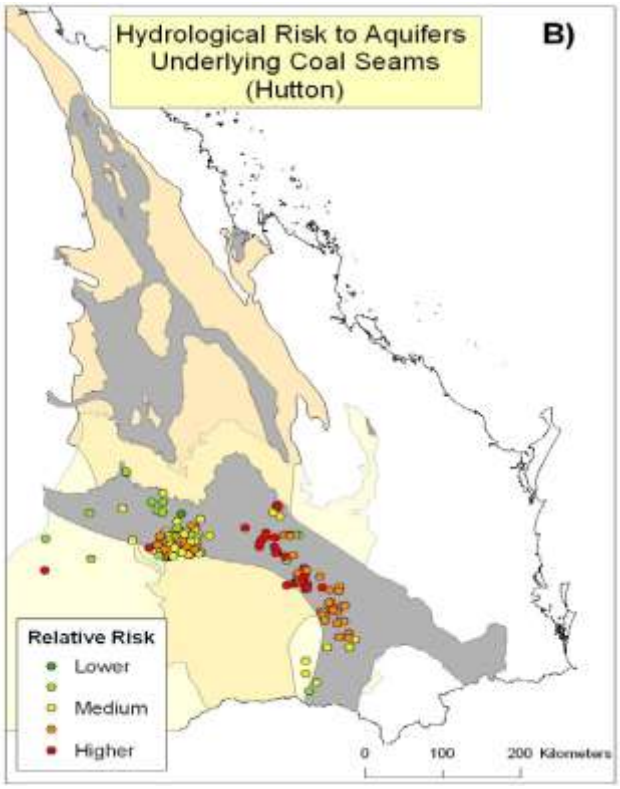


Figure 2 – Relative risk to aquifers A) overlaying coal seams and B) underlying coal seams in the Bowen and Surat Basins Source: Hellmuth, 2008

The problem and Concerns

In coal seam gas extraction, where gas is slow to release from the cleats in the coal as the water is removed, hydraulic fracturing may be used to improve gas recovery. Hydraulic fracturing involves pumping a chemical mixture under high pressure (+3000psi) to blast (fracture) open the coal seam and keep the fracture open. It is understood a typical mixture comprises water, a "carrying solution" and silica or fine sand. The length, angle and direction of the fracture cannot be fully controlled and the blast at the fracture site in the bore can radiate 360 degrees. (American Petroleum Institute, 2009).

In Queensland, under the Water Act, 2000 Section 19, all rights to the use, flow and control of water are vested in the State. Under the Queensland Petroleum and Gas [Production and Safety] Act (2004) Section 185, Coal Seam Gas companies have the right to take *unlimited*

volume of water during extraction. It is considered unlikely that the Queensland Government would impose a limit on water taken in the extraction process as the process used in the Surat Basin requires the seam to be de-watered and de-pressured in order to extract the gas. Modelling by the Department of Employment, Economic Development and Innovation in November, 2009 estimates a mid-range of 196 gigalitres of associated water per annum will be released by Coal Seam Gas extraction, which is between 120-350 gigalitres per annum of water removed from the aquifers over the next 20-40 years (DEEDI, 2010).

Entitlement to water under the Water Act (2000) is only possible if water is available in the specified aquifer, there is also provision for an un-interrupted water entitlement for stock and domestic use. However the Petroleum and Gas [Production and Safety] Act (2004) does not appear to protect this provision though it does contain a "make good" provision which is intended to balance the right of the petroleum tenure holder to take unlimited underground water as part of its authorised activities against any adverse impacts upon existing bores.

However, to utilise the "make good" provision, water drawdown against specified trigger levels must be proven and requires baseline assessment prior to Coal Seam Gas activity commencing as well as proper and regular monitoring. Monitoring and reporting of underground water impact by Coal Seam Gas Companies required under the Petroleum and Gas Act (2004) had only been met by one company up until June, 2009 (Response to Question on Notice 641, Queensland Parliament, 18th June, 2009). Further, there is no "make good" provision for water supply where water quality is unduly affected, the "make good" provision only covers impact to water quantity or pressure (Petroleum and Gas [Production and Safety] Act, 2004).

It is not immediately apparent just how the "make good" provision in the Petroleum and Gas (Production and Safety) Act (2004) can ensure an alternative water source for rural and regional communities in the event of their ground water being unduly affected by coal seam gas extraction. There is a moratorium on accessing new water from overland flow in Queensland (Condamine Balonne Resource Operation Plan, 2010); there are no new water entitlements available from the Great Artesian Basin (Great Artesian Basin Resource Operation Plan, 2007);

Coal Seam Gas companies do not own “spare” Great Artesian Basin water licence entitlements to pass on to affected stakeholders (Great Artesian Basin Database search through Department of Environment and Resource Management, June 2010) and climate change predicts lower rainfall and higher temperatures (Allen Consulting Group, 2005). In some regions of the Surat Basin groundwater impact caused by Coal Seam Gas companies is just a matter of time (Hellmuth, 2008).

In a scoping study looking at mining and energy driven economic development in the Surat Basin, Schand and Darbas (2008) suggested that the guiding principles for sustainable development should be using the resource prudently and implementing the “Precautionary Principle”. There appears to have been little “Precaution” evident in the development of the Coal Seam Gas industry to date and the potential loss of existing industries and communities could place an enormous social and financial burden on the people of Queensland. Damage to, or depletion of, our precious aquifers and the iconic Great Artesian Basin would place an indelible stain on our environmental record.

Conclusions

It is more than four years since landholders in the Surat Basin first raised concerns regarding the sustainability of Coal Seam Gas extraction in relation to underground water in their region. This extraction presents long-term ground water sustainability concerns under current State Government policy. The sheer volume of water predicted to be removed from the regions aquifers over the next 20-30 years should be sending shock waves to bore water users, small businesses, towns, communities and the Queensland people. It is difficult to reconcile the actions of a Government which professes to be sensitive to environmental and sustainability issues when those actions strongly favour development of an industry without thought to the environmental consequences and an apparent disregard to the “Precautionary Principle”.

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Bridle, A. and Harris, C. (2010). A risk to groundwater from coal seam gas extraction in the Surat Basin**.** In: *Proceedings of the 16th Biennial Conference of the Australian Rangeland Society*, Bourke (Eds D.J. Eldridge and C. Waters) (Australian Rangeland Society: Perth).