Management of water produced from coal seam gas production

Discussion paper

Achieving environmentally sustainable outcomes and greater beneficial use of coal seam gas water

May 2009

Queensland the Smart State

Queensland Government
Department of Infrastructure and Planning

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Purpose of this paper

This paper has been prepared to inform stakeholders of a number of decisions that the government has recently made in relation to the management of coal seam gas (CSG) water and to seek stakeholder views on a number of specific issues related to these decisions. The paper provides the Queensland CSG industry and the community with the opportunity to help shape government's final policy on management of associated water produced from CSG production. In particular, views are being sought on the government's position that the CSG industry be required to cooperate to develop and fund a CSG water aggregation and disposal system (or systems), to deal with CSG water which cannot be directly injected back underground or has no immediate customers.

Please note: For the purposes of this discussion paper, the 'associated water' from CSG production is referred to as CSG water.

Ways to comment

Comment online

You can complete an online response form at www.getinvolved.qld.gov.au.

Post your comments

You can post your comments to:

CSG Water Discussion Paper
Department of Infrastructure and Planning
PO Box 15009 CITY EAST QLD 4002
Australia

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Closing date for comments

Written comments on the discussion paper must be received by no later than 1 June 2009.

How to find out more

For more information please contact:
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What is coal seam gas water?

CSG water is water extracted from coal seams in order to release coal seam gas.

CSG is a natural gas consisting primarily of methane, which is adsorbed into coal. Once produced it can be used for the same purposes and applications as conventional natural gas.

CSG is liberated by reducing the hydrostatic pressure in coal seams by dewatering. The water that reaches the surface is referred to in state legislation as 'associated water'. The term 'associated water' may also be used to refer to water produced from other petroleum activities. For the purposes of this discussion paper however, the associated water related to CSG production is referred to as CSG water.

CSG water typically contains significant concentrations of salts, has a high sodium adsorption ratio and may contain other substances.

Why is the policy being developed?

CSG production is booming in Queensland, and is likely to increase even more dramatically if a number of proposed liquefied natural gas (LNG) projects eventuate.

Significant quantities of water are produced in CSG production. In 2007, 12.5 gigalitres (GL) were produced in Queensland. If the CSG industry continues to supply gas to the Australian domestic market, it is estimated that the Surat Basin will produce an annual average of 25GL of CSG water for the next 25 years. Development of an LNG industry however will see gas and water extraction increase considerably.

The salty nature and commonly poor quality of CSG water mean that it has the potential to cause environmental harm if released to land or waters through inappropriate management. As a result, there are significant ecological risks associated with its disposal and, without treatment, government believes that beneficial uses for CSG water are limited.

Importantly, the Queensland Government has made a number of decisions related to the management of CSG water, but wants to provide the CSG industry with an opportunity to cooperate and collectively investigate opportunities to aggregate and transport excess CSG water to locations where greater beneficial use can be made from the water. This might involve the development of one or more CSG water aggregation and disposal systems.

What is the current approach to managing CSG water?

Relevant legislation

Please note: The following section provides broad information about the relevant legislation and is not intended to describe every provision relating to CSG water in detail.

CSG water may be regulated by some of the following legislation:

- *Petroleum and Gas (Production and Safety) Act 2004*
- *Petroleum Act 1923*
- *Environmental Protection Act 1994*
- *Water Act 2000*
- *Water Supply (Safety and Reliability) Act 2008*
- *Integrated Planning Act 1997.*

The *Petroleum and Gas (Production and Safety) Act 2004* (PG Act)*, Petroleum Act 1923* (P Act)*, Water Act 2000* (Water Act) *and Water Supply (Safety and Reliability) Act 2008* (Water Supply Act) establish the regime for the taking, use and on-supply of CSG water and impose obligations for monitoring and making good any impacts the extraction of CSG water has on existing bores licensed under the Water Act. The EP Act deals with the regulation of environmental impacts arising from the use or disposal of CSG water.

Petroleum and Gas (Production and Safety) Act 2004 (PG Act)

The PG Act gives a petroleum tenure holder the right to take underground water during the course of, or resulting from, the carrying out of another authorised activity for the tenure. This water is referred to as associated water.

The petroleum tenure holder can use the water taken for the carrying out of another authorised activity for the tenure.

The Act allows for the on-supply of associated water for stock and domestic purposes to land in the area of the tenure or adjoining land owned by the same person. These provisions reflect the rights that an owner or occupier of land has to water under the Water Act.

These rights in relation taking, interfering and supply of water are referred to as underground water rights.

The right of the petroleum tenure holder to take underground water as part of authorised activities is balanced by a 'make good' obligation if the taking of the water adversely impacts upon existing Water Act bores.

Petroleum Act 1923 (P Act)

The rights in relation to the taking and interfering with underground water are inferred rather than specifically defined in the P Act. The Act restricts the on-supply of water to owners and occupiers of land for stock and domestic purposes and includes the 'make good' obligation in relation to exiting Water Act bores. Few CSG operations are regulated by this Act.

Environmental Protection Act 1994 (EP Act)

Relevant legislation associated with the EP Act includes the *Environmental Protection Regulation 2008, the Environmental Protection (Waste Management) Policy 2000* and the *Environmental Protection (Waste Management) Regulation 2000*. This legislation is also supported by the former Environmental Protection Agency's (EPA) 2007 operational policy entitled *Management of water produced in association with petroleum activities (associated water)*.

Under the EP Act (s13), CSG water is considered to be a waste, as it is deemed to be a leftover by-product from an industrial activity. However, although it is classed as a waste product, it may be approved as a "resource" on a case-by-case basis by the administering authority if it has beneficial use other than disposal. When used for an approved beneficial use, CSG water is no longer defined as a waste.

If defined as a waste product, disposal of greater than 50 tonnes per year of waste is considered to be a level 1 environmentally relevant activity (ERA). Therefore a CSG company will require a level 1 petroleum authority under the EP Act. All level 1 petroleum activities require an environmental management plan (EMP), which must include a description of the proposed petroleum activities, a description of the receiving environment, a description of the potential impacts on the environmental values of the receiving environment resulting from the petroleum activities, details of wastes generated and waste minimisation strategies, environmental protection commitments, rehabilitation program and proposed level of financial assurance for the rehabilitation liability.

Saline effluents are listed as regulated wastes in the *Environmental Protection Regulation 2008* (Schedule 7), with CSG water generally less than 10000 TDS not regarded as saline,

unless it is likely to become more concentrated by evaporation. Part 6A of the *Environmental Protection (Waste Management) Regulation 2000* sets out the process to approve a resource

for beneficial use. If CSG water is approved for beneficial use, it is no longer considered a waste.

The management of CSG water, in relation to the requirements specified under the *EP Act*, is undertaken according to the *Management of Water Produced in Association with Petroleum Activities (Associated Water) Operational Policy 2007*. The aim of this policy is to promote beneficial use of associated water from petroleum activities in Queensland in accordance with the waste management hierarchy.

The key objectives of this policy are to:

- provide consistency, certainty and transparency in decision-making about appropriate management strategies for associated water during the pre-design phase of applications for non-code-compliant environmental authorities (petroleum activities)
- promote beneficial use or injection in preference to any disposal options for the management of associated water
- achieve the best net environmental and social outcomes for the management of associated water while providing flexibility in how the outcome is achieved.

Management of associated water has been outlined in the policy based on preferred options and non-preferred options. Preferred options include injection into natural underground reservoirs or aquifers of equal or lesser water quality, direct use or treated use. Non-preferred options include disposal through evaporation ponds or discharge to waters, such as surface water or underground waters after the water has first been brought to the surface and stored in dams.

Water Act 2000 (Water Act) and *Water Supply (Safety and Reliability) Act 2008* (Water Supply Act)

The Water Act vests all rights to the use, flow and control of groundwater, overland flow water and water in watercourses, lakes, springs and dams in the state and provides a comprehensive planning and management regime for all vested water resources in Queensland.

Sections 188 and 196 of the PG Act provide authorisation from the Water Act for petroleum tenure holders to:

- take or interfere with underground water (and use for authorised purposes on tenure) to produce gas or for authorised water monitoring purposes
- supply CSG water to land in the tenure area for stock and domestic purposes or to adjoining land owned by the same person.

To use or supply CSG water for any other purpose, petroleum tenure holders must:

- apply for a water licence (Section 206 Water Act)
- register as a water service provider if they are the legal owner of infrastructure which is supplying water and for which a charge is intended to be made (Section 20 Water Supply Act).

In applying for a water licence, petroleum tenure holders need to demonstrate that:

- the water is CSG water
- they are testing for gas production or producing gas for commercial purposes (the application for a water licence must be accompanied by copies of the petroleum tenure and each environmental authority under the EP Act that relates to the petroleum tenure)
- they have provided members of any priority groups with the opportunity to make a written expression of interest about access to the CSG water. The priority groups are people who have previously applied for a water licence to take underground water, but have been refused due to the exercise of underground water rights by petroleum tenure holders. (The water licence application must be accompanied by each expression of interest from priority group members).

Currently there are no priority group members – that is, no applications to take underground water have been refused because of the exercise of underground water rights by petroleum tenure holders. It is now unlikely that there will be any such applications in Great Artesian

Basin (GAB) areas as the GAB Water Resource Plan and Resource Operations Plan were approved in 2006 and 2007 respectively. These plans prevent water licence applications being made for water from CSG aquifers as this could not be done on a sustainable basis, because of the statutory right that petroleum tenure holders have to take associated water.. In non-GAB aquifers, issues of water quality and quantity make it unlikely licence applications would be made for water affected by extraction of CSG water.

Water licence applications from petroleum tenure holders do not require public notification. The Chief Executive of the former Department of Natural Resources and Water (NRW) must consider a range of criteria in deciding an application, (Section 210, Water Act), but it is unlikely any of these conditions will be relevant to water licences for the on-supply of CSG water. Conditions may be placed on the licence if granted (Section 214, Water Act). In relation to priority group members, a water licence may contain conditions relating to the volume and rate of supply to members as well as limiting the charge for supply to an amount no more than the cost of supply and treatment.

Chapter 2, Part 4 of the Water Supply Act requires service providers to prepare and maintain a strategic asset management plan, a system leakage management plan and a drought management plan as well as submit an annual report. Exemptions may be sought for system leakage management plans and drought management plans under certain circumstances. In addition, if a drinking water service is provided (treatment, transmission or reticulation of water for supply as drinking water), a drinking water quality management plan is required. The provisions for recycled water in the Water Supply Act do not apply to CSG water.

Integrated Planning Act 1997

Authorised petroleum activities undertaken on a petroleum authority are exempt from most provisions of the *Integrated Planning Act* (IPA).

However, if petroleum tenure holders wish to construct infrastructure, such as pipelines, off tenure, they will need to comply with the provisions of the IPA. Operational works for taking, or interfering with, water are assessable development (Schedule 8, IPA) and the Chief Executive of the NRW is the assessment manager for such development.

Current CSG water management approaches

Most CSG water is currently disposed of in evaporation ponds ranging from 1 to 100 hectares in area. Limited quantities of untreated CSG water are used for feeding stock, coal washing and related petroleum activities.

A number of CSG producers have trialled other beneficial uses including the use of treated CSG water to augment town water supplies, as cooling/blowdown water in power stations and for irrigation and aquaculture.

Identified concerns

Salinity of CSG water is variable. Total dissolved solids (TDS) values vary from 200 to more than 10 000 milligrams/litre (mg/l). More common TDS values are in the range from 1000–6000 mg/l. (For comparison, good quality drinking water has TDS values of up to 500 mg/l. Some plants are affected by water with TDS as low as 1000 mg/l; and TDS of seawater is about 35 000 mg/l).

Assuming an average salinity of 2500 mg/l, the expected annual production rate of 25 gigalitres (GL) of CSG water in the Surat Basin, will generate 62 500 tonnes of salt per

year. Over a 30-year period, this amounts to 1.8 million tonnes of salt. If the industry expands further this volume will increase.

A broad estimate of the area required to dispose of CSG water in evaporation ponds, assuming an annual net evaporation rate of one metre and ongoing operations for 30 years, is as follows:

- Disposal of an annual volume of 25 GL (the estimated volume resulting from gas production in the Surat Basin for domestic use) in two-metre-deep ponds requires 1250 hectares (ha) in year one and 2500 ha (25 km^2) by year 15.
  If eight-metre-deep ponds are used, 312.5 ha are required in the first year, building up to 25 km^2 by year 30.
- Disposal of an annual volume of 100 GL (based on some estimates of the potential size of a Queensland LNG industry) in two-metre-deep ponds requires 5000 ha in year one, and 10 000 ha (100 km^2) by year 15. If 8-metre-deep-ponds are used, initially 1250 ha are required, building up to 100 km^2 by year 30.

The above estimates are for area only and do not consider design requirements for maximising efficiency of brine concentration, safety, allowance for rainfall, nor maintenance or decommissioning requirements. Exploration activity may also add to the total water produced.

So, the area of evaporation ponds required for disposal of an annual volume of 100 GL of CSG water over 30 years is roughly equivalent to the surface area of Lake Wivenhoe at full supply level. At the end of 30 years, this area could contain up to 7.5 million tonnes of salt.

Under the *Murray-Darling Basin Salinity Management Strategy* (BSMS), Queensland is accountable for any approved actions (those approved, permitted or licensed under a Queensland Act or Regulation) made after January 2000 that increase or decrease stream salinity. Queensland is obliged to ensure that the net effect of actions is at least in balance, or preferably, positive.

Members of the Independent Audit Group for Salinity, appointed to review progress on implementing the BSMS, were sufficiently concerned about potential impacts of CSG operations to recommend in their 2006-07 report – *that Queensland assess the salinity and chemical risks to land, groundwater systems, vegetation and surface water, from the disposal of water pumped, as part of coal seam gas and petroleum production in the Condamine-Balonne catchments.*

Generally, there are widespread concerns about evaporation ponds, and the long-term legacy associated with salt stored in them. Also, as the CSG industry expands, there are concerns from landholders, local governments and community groups about the groundwater and landscape impacts of CSG extraction and CSG water disposal methods.

Clearly there are increasing risks, both ecological and agricultural, associated with the significant quantities of salt being brought to the surface and requiring disposal as a result of the expansion of CSG production, and with the increasing areas evaporation ponds require if used as the primary means of disposal for untreated CSG water.

Some CSG industry representatives have expressed the view to government that the current regulatory regime is not facilitating development of beneficial uses for CSG water. However, government has reviewed this issue and believes that given the potentially harmful nature of CSG water, the requirements of the relevant legislation are appropriate and protect the respective interests of industry and community stakeholders.

CSG industry representatives have expressed a view that they would benefit from some broader discussion on the implementation of the policy and the assessment process. Government commits to work with the CSG industry to facilitate a greater understanding of the implementation and application assessment processes in relation to beneficial use of CSG water.

Policy options considered by government in developing this policy so far

Continue with current requirements: This would allow the use of evaporation ponds to continue as a primary water management option. Government considers that this option presents significant ecological risks to landscapes, shallow aquifers and nearby streams, particularly when considering the likely expansion as a result of LNG projects. Further, Government believes that it will not maximise beneficial use of CSG water.

Relax current requirements: This option would respond to industry views that the current regulatory arrangements do not encourage beneficial use of CSG water. This option is likely to increase risks to agricultural and ecological values, through an inability to regulate impacts. Government believes that the current regulatory regime provides for beneficial use, and appropriately balances the interests of stakeholders.

Tighten current requirements to achieve more environmentally sustainable outcomes and greater beneficial use of CSG water: This option responds to the significant increase in anticipated CSG water production and associated management risks. Government believes that the proposed policy represents a balanced response to the need for CSG producers to dispose of their industrial waste appropriately, while also considering the need for environmental protection and the interests of regional communities and agricultural stakeholders. This is government's preferred option.

Policy decisions already made

The Queensland Government has already determined the following policy response to concerns related to the current management of CSG water:

1. **CSG producers are responsible for treating and disposing of CSG water and the government will not subsidise these activities.**

Government considers that CSG water is an industrial waste and just as other industries are responsible for appropriate management and disposal of their wastes at their cost, so should the CSG industry manage disposal of CSG water as a cost of CSG production.

2. **Unless the producers use direct injection of CSG water or have arrangements for environmentally-acceptable direct use of untreated CSG water, the producers must treat CSG water to a standard defined by the Environmental Protection Agency (EPA) before disposal or supply to other users.**

Government accepts the view that as the CSG industry expands, there will be an increased potential for impacts from CSG operations on aquatic ecosystems, groundwater aquifers, biodiversity, and productive agricultural land. These centre on the salinity and sodicity of CSG water, and the potential for contamination either directly or from leakage from evaporation ponds, as well as the draw-down impacts on groundwater aquifers.

Government therefore considers that all water that is not able to be directly reinjected underground or used in its untreated form for environmentally-acceptable direct uses, should be treated. This policy intends to reduce the footprint of facilities that concentrate salts and other contaminants and improve the ability of government to regulate the safe disposal of these substances in years to come.

Government considers the cost of treating CSG water, to a standard which has greater market appeal, to be the responsibility of CSG producers, and that treatment costs should be

factored into CSG production costs. CSG producers may have to recognise that the cost of treating water may not be fully offset by sale of water for beneficial use.

The standard to which CSG water should be treated will depend on the end uses proposed for the water and the environmental values of the receiving environment for any water proposed to be released into the environment. For example, livestock may be able to drink water treated to a lesser standard than that used for human consumption. The quality of water acceptable for irrigation would depend on the soil characteristics, the crops being grown and the environmental values of any waterways into which runoff might occur.

3. Evaporation ponds are to be discontinued as a primary means for disposing of CSG water. Transitional arrangements will be developed by government in consultation with industry to address issues with existing evaporation ponds. Remediation of existing evaporation ponds is to occur within three years.

Government is of the view that there are increasing risks–ecological and agricultural–associated with the significant quantities of salts being brought to the surface and requiring disposal as a result of CSG production, and that it will be inappropriate to allow the use of evaporation ponds to continue as the primary means of disposing of untreated CSG water.

Government recognises that evaporation and storage ponds will still be required for brine disposal and as balancing storages. In these cases, it is proposed that government work with industry to address problems with existing evaporation ponds, and that industry undertakes necessary remediation within a three-year period.

4. Ponds necessary for water aggregation and the storage of brine from treatment facilities must be fully lined to a standard determined by the EPA.

In line with the already expressed views related to the risks of managing CSG water, government believes that all aggregation and brine ponds should be constructed to a standard that reflects the hazardous nature of the salts and other contaminants within the water, the size of the containment structures and the potential impacts on humans and the environment should the contents be released to the surrounding area. Linings should be designed to prevent contamination of underlying soil or surrounding areas during the expected life of the structure which will need to be designed and constructed to appropriate engineering standards. The EPA is developing a manual for the design and operation of ponds that could contain hazardous materials.

5. A CSG water management plan is to be incorporated into the environmental management plan required for an application for a level 1 environmental authority.

Government believes that plans for management of CSG water need to be considered during the development phase of CSG projects in order to allow approval agencies and stakeholders the opportunity to input to these plans.

This plan should require proponents to demonstrate compliance with the required policy hierarchy.

CSG projects are expected to develop CSG water management plans for both level 1 and level 2 projects, although environmental management plans are only required for level 1 activities.

What government needs to know before finalising this policy

Government wants to consult with the CSG industry, community groups and stakeholders on a number of issues:

1. **The circumstances under which industry should be required to cooperate to develop and fund a CSG water aggregation and disposal system (or systems) to deal with CSG water which cannot be directly injected or has no immediate customers.**

Government wants to encourage the greatest beneficial use possible for treated CSG water and recognises that CSG production occurs in locations where not all treated water can potentially be beneficially used. Government therefore wants to encourage the CSG industry to cooperate and collectively investigate opportunities to transport water to locations where there are more potential uses. This might involve the development of a CSG water aggregation and disposal system (or systems).

While government is not mandating industry to pursue aggregation options or being prescriptive about the design of such systems, it proposes to assist industry through facilitation and possibly through technical investigations. The opportunities for use of CSG water should also be taken into account in regional water supply planning, decisions about infrastructure development and when addressing issues such as the over-allocation of groundwater.

In addition, as part of the Commonwealth-funded Healthy Head Waters project in the Queensland Murray-Darling Basin, $5 million has been allocated for a feasibility study to examine the use of CSG water in addressing water sustainability and adjustment issues, including relieving demand on groundwater for irrigation in heavily committed aquifer systems near the Condamine River.

2. **What remediation action for existing evaporation ponds is reasonable and appropriate.**

Government wants to ensure that the CSG industry is provided the opportunity to address concerns about the current management practices for CSG water. It is therefore proposed that government work with industry to identify problems with existing evaporation ponds, with any necessary remedial action to be undertaken within a three-year period. By the end of 2009, CSG producers should be in a better position to advise government of their plans to transition their existing operations in accordance with the new policy.

Remediation of existing evaporation ponds would require removal and use/disposal of remaining water in the first instance. Options for this would be included in the CSG water management plans prepared for the project. Remaining contaminants could be either removed to another location for safe storage and disposal, or the site could be encapsulated and capped to prevent release of the contaminants to the surrounding environment. In the latter case, the site would need to be managed in the long term as a contaminated site.

Given the vast range of variables such as soil type and permeability, the EPA will consider proposals on a case-by-case basis, having regard to both regional and site specific factors.

3. **What disposal options are appropriate for the saline effluent resulting from treatment.**

Most treatment options will produce concentrated saline effluent that will need to be adequately managed to prevent environmental harm resulting at some time in the future.

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