Queensland water Commission

Submission Form

Draft Underground Water Impact Report for the Surat Cumulative Management Area

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For Individuals

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First name _____

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Please sign and date:

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Signature *Date*

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Signed for and on behalf of (insert name of corporation)

BASIN SUSTAINABILITY ALLIANCE

Please sign and date:

ANNE BRIDLE
Name – Sole Director/Director

Anne Bridle 26.6.2012
Signature *Date*

_____
Name – Director/Secretary

_____
Signature *Date*

Please complete

Which of the following apply to ~~you~~? BSA Membership
(You may tick more than one box)

- [x] Landholder within CMA
- [x] Landholder outside CMA
- [ ] Not a Landholder

Which interest group do you primarily represent?
(You may tick more than one box)

- [x] Grazier
- [x] Farmer
- [x] Stock and domestic user
- [x] Community group
- [ ] Local government
- [x] Groundwater user in the CMA
- [ ] Research/academic organisation (please specify)
- [ ] State/Federal government
- [ ] Industry group
- [ ] Petroleum industry
- [ ] Mining industry
- [ ] General public

_____

- [ ] Other (please specify)

_____

Optional

Completion of this section will assist QWC process and consider your submission.

Which part of the report does the submission relate to?
(You may tick more than one box) *

- [ ] Chapter 1: Introduction
- [ ] Chapter 2: Petroleum and Gas Production
- [ ] Chapter 3: Regional Landscape and Geology
- [ ] Chapter 4: Hydrogeology
- [ ] Chapter 5: Historic and Current Groundwater Extraction
- [ ] Chapter 6: Predictions of Groundwater Impacts
- [ ] Chapter 7: Water Monitoring Strategy
- [ ] Chapter 8: Spring Impact Management Strategy
- [ ] Chapter 9: Responsible Tenure Holder Obligations
- [ ] Chapter 10: Periodic Reporting and Review
- [ ] General comments

* Where possible the specific page number has been provided to identify which part of the report the submission relates.

Submission Text

Please provide details of your comments about the content of the report:

See Detailed Submission attached

Please give your reasons for your comments:

See Detailed Submission attached

- [x] **Detailed submission attached**

The Queensland Water Commission is collecting your personal information to manage your comments on the draft report. We may contact you to clarify aspects of your submission. The information you provide on this form will only be used for the purpose of informing development of the final report and Submissions Summary. The contact details you provide on this form will not be disclosed to third parties unless required and authorised by law.

Read our privacy statement www.qwc.qld.gov.au/privacy for details.

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26 June 2012

Dear Sir/Madam,

Detailed Submission on Queensland Water Commission's Draft Underground Water Impact Report (UWIMR) for the Surat Cumulative Management Area

BSA welcomes the Draft Report as a valuable starting point to bring forward groundwater systems knowledge, isolate gaps where more knowledge is needed and address the management of groundwater impacts from CSG extraction. BSA is grateful for the opportunity to make a submission to the Queensland Water Commission on the Draft Underground Water Impact Report (UWIMR) for the Surat Cumulative Management Area.

Background of BSA:

BSA was established in early 2010 to represent landholder, community groups and individuals with serious concerns about the unrestrained development of the coal seam gas industry across Queensland and the associated environmental, health and social impacts.

Our role is to provide a conduit between stakeholders (industry, landholders, community and government), to encourage and promote fair and proper legislative and administrative processes surrounding CSG exploration and development, and to work towards the sustainable management of rural land and water resources for future generations throughout the Great Artesian Basin.

At the heart of our charter is a desire to ensure we preserve the rural lifestyle, the existing rural social fabric and contribution of farming families to Australian society.

BSA is committed to working with government and industry to achieve a coal seam gas industry that has minimal negative environmental, economic and social impacts and preserves groundwater resources for future generations.

Issues:

The following issues and concerns with the **Draft Underground Water Impact Report (UWIMR)** are raised on behalf of the many BSA members whom reside and operate successful rural businesses in the Surat Cumulative Management Area.

As a general comment, BSA raises that whilst it is the environmental authority that essentially authorises environmental harm, the UWIMR to some degree predicts/allows for the extent of that environmental harm in the form of groundwater drawdown as it is predicted 3 yearly in advance and then ultimately at end of project. At this point in time, 85 bores are predicted to be impacted within 3 years, and 528 bores including the urban water supplies of Roma, Warra and Tara will be affected in the long-term.

BSA is concerned that a lack of knowledge of groundwater systems could undermine/ under-predict the likely impacts on groundwater resources. Under the Draft Report, the Great Artesian Basin Water resource appears now to be merely defined by the bores that tap it, as it is just the bores that have protection, not the aquifers, and the protection to bores only exists to the extent that mitigation measures fix harm not avoid it.

In light of this, and knowing also that at this point in time, the Department of Environment and Heritage Protection (DEHP) do not condition groundwater extraction in Environmental Authorities of petroleum tenure holder, BSA is concerned that the 3-Yearly Report will become a moving feast of "impacts" unable to be challenged because of the right that exists under s185 of the Petroleum and Gas Act (Production and Safety) Act 2004, giving petroleum tenure holders unrestricted take of water in the process of extracting gas.

BSA raises that it will be critical for the DEHP to have a process that assesses how much predicted impact identified through the Three Yearly Report, *is too much impact.* Whilst s312E of the Environmental Protection Act provides the mechanism to amend Environmental Authorities, BSA suggests that the DEHP also consider formally linking environmental performance and demonstrated capacity to mitigate predicted impacts (identified in the moving Report) to ongoing tenure renewal.

> *(Report section - pix) "Petroleum and gas operators have the right to extract groundwater in the process of producing petroleum and gas because the water and the gas are intimately connected.* ***The Surat Underground Water Impact Report forms part of the regulatory framework for managing the impacts of this groundwater extraction."***
>
> *"On approval, the report becomes a statutory instrument under the Water Act 2000.Obligations for individual petroleum tenure holders for activities arising from the Underground Water Impact Report will then become legally enforceable.* ***The Department of Environment and Heritage Protection will be responsible for ensuring petroleum tenure holders comply with their obligations."*** *(*bold added)*

With respect to the above, BSA raises that the Draft UWIMR does not address the capacity of petroleum and gas operators to mediate or rectify water drawdown impacts, nor assess that such measures are appropriate to mitigate impacts. However, BSA recognises that the UWIMR

will become a management tool for Department of Environment and Heritage Protection (DEHP) to condition petroleum and gas operators.

Therefore, it follows that sequential UWIMR will be used to manage mitigation measures conditioned by the DEHP. This will require calibration and monitoring to ensure that mitigation measures such as reinjection or substitution of licenses are having the desired effect on aquifer systems (re-pressurising, increasing water quantity without loss of water quality).

BSA recognises that reinjection of treated CSG water and the substitution of treated CSG water as an offset to surface and groundwater licences are proposed to be used as mitigation tools to remedy pressure loss and water drawdown in groundwater systems. However, BSA is concerned that there are a number of technical issues associated with these measures.

Firstly, BSA raises that issues with reinjection, include:

- adequate storage space in aquifer systems to take the water
- matching receiving water quality
- extra energy required to pump the water down
- increased bore maintenance
- cost of water treatment and reinjection
- mitigation may require a greater than a “one for one” offset
- local area impacted may not have capacity in the aquifer system to technically take the water

BSA is of the view that the extra energy, bore maintenance, and cost of water treatment and reinjection should not be a barrier to using reinjection, but should be borne by the petroleum tenure holder as part of the cost of doing business. If the company cannot afford to mitigate against predicted impacts, it should not be allowed to cause the harm in the first place.

BSA also raises that the following issues are associated with substitution of ground and surface water licences (virtual reinjection/virtual injection):

- If substitution of surface water licences is held up as a mitigation measure for groundwater impacts (*as per Arrow Energy’s Surat Gas Project EIS Section 5.6.4 Water and Brine Management Strategy*), then BSA exposes it for what it is and that is, a water disposal method and nothing more, as substituting treated CSG water for surface licence allocations will provide no mitigation to impact of the underground water resource. Further, surface water entitlements in the Upper Condamine have already been judged to be sustainable, so such substitution will provide little value to the sustainability of this system.
- The use of substitution of licences should be to mitigate impacts in advance; hence there is a critical need to have the capacity to appropriately assess impacts in advance and to measure the responsiveness of groundwater licence substitution to mitigate predicted impacts.
- Mitigation may require a greater than a “one for one” offset.

- Substitution of surface and groundwater licences is limited to high- use water users, who may not necessarily bear significant impact requiring mitigation.
- Petroleum tenure holders are proposing that the end user bears the physical and legal risk associated with the use of the substituted water (treated CSG water).
- There will be pipeline easements through third party properties who are not benefiting from the allocation substitution.
- Concerns exist around the timing and delivery of water.
- An appropriate mechanism for accountability of substitution of licenses is needed.
- For forced suspension of licences to facilitate allocation substitution, the water replaced would have to have the same supply security in terms of quantity, timeliness of supply and quality and the inherent value of the current licences would have to be maintained over time until they were returned. If the government mandated this process, then it would be the government, who would have to ultimately bear the liability for any adverse impact resulting from the use of that water. Landholders would not willingly surrender high security licence entitlements for an unproven water source.

Whilst the best option for the CSG water would be to put it back where it came from to return water pressure to systems, it is impractical for the petroleum and gas operator to reinject into the highly affected Walloon Coal Measures (WCM) until the gasfield is exhausted which could take 10-20 years. Technical issues, local community preference and the capacity to mitigate long term impacts will play a big part in the use of treated CSG water with BSA strongly of the belief that *mitigating impacts before any other use should be the first and major priority*.

BSA is very concerned that petroleum and gas operators will utilise least cost methods to dispose of CSG water that do nothing to mitigate against long term groundwater impacts from CSG extraction.

From the QWC Information sessions on the Draft Report, it is noted that there are 3 areas of water regulation:

- Manage impacts on water levels.
- Manage potential for pollution.
- Manage reuse of produced water.

Specifically, it was explained that the UWIMR addresses managing impacts on water levels only. BSA raises that the Draft Report in looking at water level impacts only is *deficit* by not addressing water quality impacts. The report gives the wrong impression to bore users by implying that water drawdown is the only adverse impact from coal seam gas extraction.

No-one can say that head pressure changes in many water aquifer systems will not cause water quality to change adversely. The general public sees 528 bores affected in the long term and thinks that this is an acceptable level of harm for CSG extraction, but many more bores could easily be affected by adverse water quality.

The report gives false impression that a relatively small number of water bores will have their quantity affected, yet the use of underground water is dependent on both its quantity/pressure and its ***quality***.

The quality of groundwater is characterised by its physical, chemical and biological parameters. To change one of these parameters is most likely to bring change in the others. For example, if water pressure changes, water flow and direction will change and waters of different pressure will mix.

Whilst BSA understands that the QWC was tasked with looking at water level impacts only, BSA believes that in doing so, there flaws may exist in both the Report and Chapter 3 of the Water Act.

BSA raises that it may be necessary to review Chapter 3 of the Water Act to ensure that the impacts on water quality are addressed.

> *(pxi)"The Queensland Water Commission developed a regional groundwater flow model to predict the impacts of groundwater extraction by the petroleum and gas activities. The groundwater flow model was developed using existing information about water bores and gas wells and other available information about the way water moves through rocks in the area. The Queensland Water Commission also obtained information from petroleum tenure holders about planned development over the life of the coal seam gas industry as an input to the model. The tenures on which production is planned comprise the 'production area' for the purposes of the report."*
>
> *(p12)* "*Most of the proposed expansion is planned for implementation over the next five to 10 years with a peak in 2014- 15. The typical life of a gas field is expected to be around 25 years. It is expected that substantial production will cease around 2050 although logistical limitations and other factors may result in development occurring over a longer period."*

BSA understands that:

- No new data was inputted into QWC model since 10-12 months ago.
- There is a need to improve knowledge in the model and there is need to have the capacity to add data to the model as wells are drilled and knowledge confirmed of underlying strata formation.
- The Mines Department already provide to QWC an overnight data feed of new drill log information as it comes available (once a drilling rig is released), however this information is not inputted into the model.
- It takes 9 months to rebuild the model based on point in time information.
- There are significant gaps in groundwater knowledge and in addition to this, a significant time lag in being able to use any knowledge that is acquired.
- In the 3 years from the draft UWIMR to the next one, there is expected to be upwards of 3-4000 new CSG wells drilled.

BSA is aware from a USQ Research Proposal *"Water, Agriculture and Mining: Regional Development outcomes for Groundwater in the Condamine Alluvial and Surat Basin Aquifers (March 2011),* that:

> *"The study found the conceptual geological models used by each company varied and there were significant differences in the hydraulic conductivity, specific storage and specific yield parameters adopted by each company.*
>
> *"In some cases the parameters varied by several orders of magnitude"*
>
> *"No company accounted for potential connections with overlying alluvial aquifers".*

These findings arose at the time that QWC stopped putting new data into the model. BSA is concerned that the QWC characterisation of layers in the model is still very limited and could change with new data over time, thereby giving predictions in the Draft Report a high level of uncertainty. Being a regional model, the ability of the QWC model to predict local impacts is limited because of a lack of knowledge around local parameters. Local discontinuities such as fissures and faults which may cause connection are unlikely to be picked up by the regional model.

It is suggested that the QWC should be clear in its disclaimer for website feedback on individual bores that the information is generalised in nature and a high level of uncertainty exists.

BSA would like to see capacity in the model to accept real time data as CSG wells are sequentially drilled, in order to gain greater predictive capacity and calibration in the model. This is critical given that model predictions could change significantly in the next 3-5 years as the industry ramps up significantly. If there is any discrepancy between model assumptions and actual data there could be some major changes in predictions and ramification for bore users. If real time data cannot be incorporated then perhaps the reworking of the UWIMR needs to be done in a shorter time frame, eg every one and a half years throughout the ramp up.

> *(pxv) Impacts in the Condamine Alluvium*
> *"It is predicted that the net change in flow from the Condamine Alluvium to the underlying Walloon Coal Measures will average 1,100 megalitres per year over a 100-year period."*

Adopting a 100 year averaging for losses from the Condamine Alluvium at 1100 ML per year (as quoted in the draft Report) equating to in excess of 100 000 ML requires clarification since over at least 60% of that period there is expected to be no CSG extraction (and therefore no groundwater extraction).

From the above the reader is left to assume that the induced flow from the Condamine Alluvium from changed pressure differential is still occurring some 60 years after CSG extraction ceases. Further, it is unknown whether natural recharge will offset some of this impact.

(pxv) It is predicted that there will be some leakage of water from the Condamine Alluvium but the resulting decline in water levels will be less than the trigger threshold of 2metres. Therefore there is no Immediately Affected Area or Long-term Affected Area for the Condamine Alluvium.

Whilst QWC modelling indicates that for the Condamine Alluvium, drawdown impacts of both an immediate or long term nature do not exceed adopted trigger threshold, the recently released draft EIS for the Arrow Energy Surat Gas Project does indicate drawdowns at or in excess of trigger threshold (2.0 metres) for the cumulative development scenario over part of that aquifer system (the modelled value is 2.5 metres).

Notwithstanding that the Arrow modelled drawdown exceeds trigger threshold for part of the Condamine Alluvium, the value of 2.5 metres is twice the maximum water level reduction determined in the QWC modelling of 1.2 metres. This is a significant difference in outcome that creates uncertainty in the veracity of both models.

In view of the different modelling results and the implications involved with respect whether or not trigger threshold for the Condamine Alluvium are approached or exceeded, it is critical that the Arrow modelling outcomes be reconciled with the QWC modelling and that such reconciliation be included through specific comment in the final QWC UWIR for the Surat Cumulative Management Area.

Also, In view of the different impact outcomes for the Condamine Alluvium based on 2 seemingly robust and current models and the required sensitivity associated with monitoring to discern not only the impact itself within the Condamine Alluvium but differentiation in terms of CSG water production and other influences such as background seasonal variation due to climate as well as, importantly, on-going groundwater extraction from the alluvium for a range of purposes, specific monitoring and assessment processes are required for the alluvium.

It is suggested that the QWC report should include more information on the respective monitoring programs having regard to a need for differentiation of the range of influences on water level performance within the Condamine Alluvium together with details of how this differentiation will be assessed and determined.

Further, it is noted that the QWC model has adopted lower permeability confining layers (Layers 9 & 11) above and below the main production zone within the Walloon Coal Measures with these layers extending across the whole of the modelled area. In respect of these layers there does not appear to be any comment in the Report regarding the thickness of these layers or the vertical hydraulic conductivity adopted for them in comparison to the production layer (Layer 10). It is also noted that the Coffey model for Arrow Energy did not adopt confining or aquitard layers within the Walloon Coal Measures despite an apparent exhaustive assessment by them of relevant hydro-stratigraphy.

With particular reference to the upper confining layer (Layer 9), it is noted that based on regional stratigraphy, the Walloon Coal Measures contains significant higher permeability coal

seams in the upper section of that Formation which suggests that some doubt exists for the justification of this layer to be applied in a universal manner across the modelled area.

It is suggested that the QWC Report contain discussion and data on the effect on model outputs that these confining layers have on drawdowns within aquifers above and below the Walloon Coal Measures. Should the layers moderate impacts on other aquifer systems due to the adoption of very low vertical hydraulic conductivity within these layers, the QWC Report should say this and further rationalise the reliability of the adopted approach particularly when the Report notes "There is very little data on the vertical permeability which has a direct influence on the connectivity with overlying and underlying aquifers" and the fact that Arrow's modelling work did not see the adoption of similar based layering.

Given the sensitivity of drawdown within the Condamine Alluvium as well as the difference in the modelling results in the two models (Arrow and QWC) relating to the magnitude of drawdown in the longer term, it is suggested that the QWC Report specifically addresses the extent of drawdown suppression in the alluvium resulting from the previously mentioned confining layers adopted in the QWC model.

(pxv)Timing of impacts

"For any affected aquifer, maximum impacts will occur at different times depending on the sequence of coal seam gas development and due to the slow movement of water.

Maximum impacts in the coal formations will occur toward the end of the life of the industry, and generally between 2030 and 2050. Maximum impacts in the Springbok Sandstone and Condamine Alluvium are expected to occur between 2060 and 2070. In the more remotely connected aquifers, where the predicted impacts are small, impacts will occur later."

It would assist greatly if the Report could identify the totals of volumetric losses in all aquifer systems up to the time of predicted maximum impact drawdowns as well as at the time of maximum water level reductions within the Walloon Coal Measures.

(pxvi)"For the regional monitoring network there will be 142 monitoring sites comprising 498 monitoring points. Of these monitoring points, 106 already exist and 392 will be newly constructed."

BSA raises that just 142 monitoring bores across a Cumulative Management Area of 160,000 square kilometres are inadequate.

For example, it is unlikely that a monitoring bore some 20km from a landholders bore will be predictive of timing of impacts on a landholders bore.

BSA is concerned that the network of monitoring bores will *not* provide enough data to verify that impacts are emerging as predicted by the regional groundwater flow model. Nor does BSA believe the monitoring data will provide information that will contribute to improving the understanding of the way in which water moves through and between aquifers. Quite simply, BSA feels there are not enough monitoring bores.

BSA is aware that the Environmental Protection Regulation (2008) S24AB was recently amended so that the UWIMR became a '***Prescribed circumstance for amending environmental authority (chapter 5A activities) Act, s 312E'.***

BSA is of the strong belief that if the UWIMR is '*part of the regulatory framework for managing the impacts of this groundwater extraction'* then the DEHP will need to condition monitoring as well as mitigation measures.

The irony around trying to understand CSG impacts on the groundwater resource is that in the case of putting water back into the groundwater system (i.e. reinjection) the DEHP want to know and measure the impact and specifically condition the petroleum holder to put in monitoring bores at certain zones to measure water level and quality, however, there is no specific conditioning of monitoring bores when the water is extracted in the first place.

BSA understands that in some cases petroleum tenure holders are required to submit a Groundwater Management Plan. However BSA is aware that these plans do not measure the impact of extraction on the groundwater resource, but rather they measure and manage seepage from surface ponds utilised by petroleum tenure holders. BSA is of the strong opinion that plans around measuring and monitor surface seepage ***do not*** constitute a groundwater management plan.

Given that the UWIMR "*will form part of the regulatory framework for managing the impacts of groundwater extraction"*, BSA has confidence that the DEHP will now have greater power to condition monitoring bores to measure the impact from groundwater extraction.

BSA asks that the QWC show how 142 monitoring bores are adequate to effectively manage the groundwater resource and how the spatial distribution of these bores are adequate.

Critically, BSA is concerned that the purpose of the QWC's Regional Monitoring Bore Network is to calibrate the model and is not adequate to manage local area make-good requirements.

BSA strongly believes that if the UWIMR "*forms part of the regulatory framework for managing the impacts of groundwater extraction*", then the Regional Monitoring Bore Network should have the capacity to manage make-good.

BSA requires clarification, specifically, is the QWC tasked with providing a framework for the management of make-good? And if this is not the case, what will the government rely on to manage make-good?

Specifically BSA asks:

- At what scale is monitoring needed to move away from predicting regional impacts and looking at local impacts?
- Are there enough monitoring bores to manage the water resource and make good?
- Are one or two monitoring bores per petroleum tenure gradicular block, monitoring the target CSG extraction zone and underlying and overlying aquifers with piezometer nest monitoring systems, a more realistic option to providing enough data to verify and understand impacts?
- Has the UWIM provided DEHP with the power to directly and specifically condition tenure holders to monitor the impact of CSG extraction on the groundwater resource?

BSA also raises concern with the Objectives of the Water Monitoring Strategy as proposed in the Draft Report.

Specifically;

> *(p60) Objective 3 – Identify changes in aquifer conditions near critical groundwater use*
>
> *There are areas where existing groundwater use is concentrated or of critical importance, for example, towns in the area that rely heavily on groundwater. Water pressure and water quality monitoring sites need to be located to ensure* ***early understanding of any unexpected impacts on water levels propagating toward these areas.****(*bold added)*

BSA raises that this objective is completely inadequate given that often towns and homes in rural areas rely on groundwater for drinking, domestic purposes and food production entering the food chain. The first part of the objective should include other areas of concentrated or critical importance. The second part of the objective should instead read:

> *Water pressure and water quality monitoring sites need to be located to ensure early understanding of any unexpected impacts on water levels* ***or water quality*** *propagating toward these areas.*

Further, BSA notes from Appendix G- Regional Monitoring Network that the monitoring frequency of water pressure is fortnightly yet the monitoring frequency of water quality is 6 monthly. BSA raises that this in inadequate and suggests that the quality monitoring should be increased to fortnightly around critical groundwater use (identified in Objective 3) and at the very least 3 monthly elsewhere.

In relation to monitoring objectives, it is suggested that the Report identifies the range of **potential** "unexpected impacts" and how these will be determined and managed.

BSA raises concern with respect to Interconnectivity.

(p28) 4.4 Interconnectivity

> *"Interconnectivity between two geologic formations in terms of groundwater movement is the ease or resistance to groundwater flow between the formations.* ***Where there is no discernable thickness*** *of separating material between formations, interconnectivity will depend on the difference in vertical permeability of the two formations. Where there is material separating the two formations, the connectivity will depend on the thickness as well as vertical permeability of separating material."*
>
> *A good hydraulic connection is not in itself sufficient to induce flow of groundwater between two formations.* ***A relative water level (or pressure) difference is needed between the formations****, that is, a hydraulic gradient needs to exist. While there will be no flow between well-connected formations if there is no hydraulic gradient between them, there will be flow between even poorly connected formations if there is a large hydraulic gradient between them. However, there could be a significant lag between the time when the gradient is created and the time when the flow rate between the formations reaches a maximum". (*bold added)*

BSA understands that at CSG well Myrtle 3, there is no aquitard between the Springbok Sandstone aquifer and the Walloon Coal Measures, and in fact at this point the Springbok Sandstone aquifer is erosional at its base. QWC would be aware of these formational characteristics also as no doubt the relevant tenure holder provided this information in the QWC data capture process before June 2011. In individual consultation at the QWC Information Session, a map was shown denoting a small area of impact on the Springbok Sandstone Aquifer in a neat little circle around the location of the Myrtle 3 well. In this region, BSA understands that the Walloon Coal Measures is expected to be drawn down by 300-400m creating significant hydraulic gradient.

Given that there is an absence of gas field development anywhere else in this area/region, how does the QWC have the confidence to limit predicted impact on the Springbok just to this area?

Specifically, what data is the QWC using that says an aquitard exists between the Springbok and Walloons everywhere else in this region, of significant separation, to restrict long term impact in the Springbok Sandstone Aquifer?

> *(p32)"The thickness of the aquitard layer between the productive coal seams of the Walloon Coal Measures and the Springbok Sandstone is typically about 15 m and it generally has a low permeability, although at some places the aquitard can be absent. Figure 4-7 shows the thickness distribution of this layer.*
>
> *The Springbok Sandstone is highly variable in nature. At some locations it is an important aquifer but in other places it is highly compacted and has very low permeability. The formation was deposited on the eroded surface of the Walloon Coal Measures. In parts of the north-eastern Surat Basin, the upper aquitard of the Walloon Coal Measures was completely eroded prior to the deposition of the Springbok*

Sandstone, and the formation is in contact with the productive coal seams (Scott et al, 2007). ***A higher degree of interconnectivity is expected in these areas****."(*bold added)*

BSA is concerned that in this instance strata formation knowledge is known at the site, yet it appears for the QWC to limit impact on the Springbok Sandstone Aquifer other data has been used to interpolate the regional impact. BSA is concerned that interpolating other data instead of using actual local knowledge could undermine predicted impacts and instead impacts could be much greater (drawdown) and across a much wider area.

BSA is concerned that the model incorrectly represents the strata formations and level of interconnectivity in the region of the Myrtle field and urges the QWC to assess the data used for the region to verify its applicability and explain how it has confidence in the data it has used for this region. If necessary, BSA suggests a rerun of the model with appropriate regional data.

Further, BSA notes:

(p32)"Due to the sedimentary structure of the aquitards the vertical permeability is likely to be at least one to three orders of magnitude lower. These values are based on textbook values for geologic materials and on drill stem tests conducted by petroleum tenure holders that provide local data. ***There is very little data on the vertical permeability which has a direct influence on connectivity with overlying and underlying aquifers****."(*bold added)*

From above, if vertical permeability has a direct influence on connectivity with overlying and underlying aquifers and there is little knowledge on the vertical permeability of the aquitards, how can the QWC be confident that induced flow from aquifers overlying and underlying the coal seam will not be greater than predicted?

Further, BSA is of the opinion that the Report should comment on whether or not the magnitude of volumetric losses in GAB aquifers above and below the Walloon Coal Measures associated with the CSG industry were contemplated in the preparation and directions of the Great Artesian Basin Water Resource Plan. For many impacted aquifers, very little or no General Reserve was identified for further development. Such a situation requires clarification. Furthermore, is the State Reserve affected by the modelling outcomes associated with the QWC study?

Within the QWC Report there are frequent references to "recovery" in terms of water level response post-cessation of CSG operations. It is unclear whether "recovery" in Reporting contexts is a re-balancing of heads and water levels, recharge or a combination of both. In respect of head or water level rebalance, it is suggested that this be described in the Report for what it is rather than an unsafe assumption that it is "recovery" in the normally adopted context. Head rebalancing will rely on a widening of head reductions at the edges of depressions for some considerable time in comparison to increasing rates of head rise within the areas of maximum head reduction impact within the depression areas.

(p52) "Optimal conditions for the flow of CSG are typically achieved when groundwater levels in the production wells are at 35 to 40m above the top of coal seams".

(p58) "The total amount of induced flow from the formations overlying and underlying the Walloon Coal Measures is expected to be about 50 per cent of the total water extracted for CSG production from the coal formations."

The statements above from the Draft Report implies that of all the water extracted from CSG half will come from aquifers above and below the coal seams and that a greater proportion will come from the above aquifers. These statements show that there is significant interconnection between the target formation and aquifers either side it.

If the QWC are able to determine that about half of the total water extracted for CSG production, will come from induced flow, then the QWC should be able to quantify the amount coming from overlying aquifers and the amount of induced flow from underlying aquifers.

Further, it is understood that initially the water will come mostly from the coal seam, yet over time induced flow from overlying and underlying aquifers will increase.

It would be beneficial if the report could show the predicted change in induced flow over time in both overlying and underlying aquifers. The draft report fails to quantify the extent of induced flow from overlying and underlying aquifers after water pumping ceases. BSA understands that induced flow from these zones will still occur due to the change in head pressure caused by the water extraction. If this induced flow after water extraction ceases could be predicted (which it should be able to) then the QWC would have a greater understanding of the extent of mitigation required to '*manage groundwater impacts from the extraction*' .

If the QWC is able to determine the amount of induced flow from aquifers above and below the target coal seam based on pressure differentials (which it has done p58), then the QWC should be able to ascertain the length of time that will be needed to equalise induced pressure imbalances from CSG extraction above and below the coal seam.

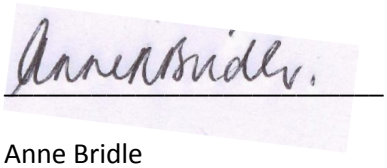
Simply, the legacy of drawdown impact on overlying and underlying aquifers from CSG extraction is likely to be incurred for tens to hundreds of years. The QWC model should have the capacity to predict both the length of time and the water loss in these aquifers to reach equilibrium after CSG extraction ceases? As noted before with predicted short and long term impacts, this knowledge will change with sequential reports as more knowledge is gained across the cumulative management area. Yet with this knowledge, the DEHP should have the capacity to develop a process to determine how much impact is too much impact and also to assess a petroleum tenure holder's capacity to manage groundwater impacts and meet make good obligations.

Other:

At the time of writing this submission a government investigation is ongoing into the methane bubbling in a 5km stretch of the Condamine River. BSA understands that in this area the Walloon Coal Measures are relatively shallow, gassy and possibly in some areas naturally venting to formations above. BSA is concerned that gasfield dewatering may exacerbate natural gas venting as pressure differentials change and that water quality may be adversely affected as a result.

BSA suggests that water quality and water level monitoring needs to be increased in this area and in similar such gasfield production areas where the Walloon Coal Measures is relatively shallow. Further, BSA suggests that specific scenario modelling be done in these regions to predict worst case impact scenarios with a view to determining mitigation measures in advance.

Yours sincerely,



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