

Coal Seam Gas - How it works and Regional Groundwater Impact Management

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9th & 10th October 2013

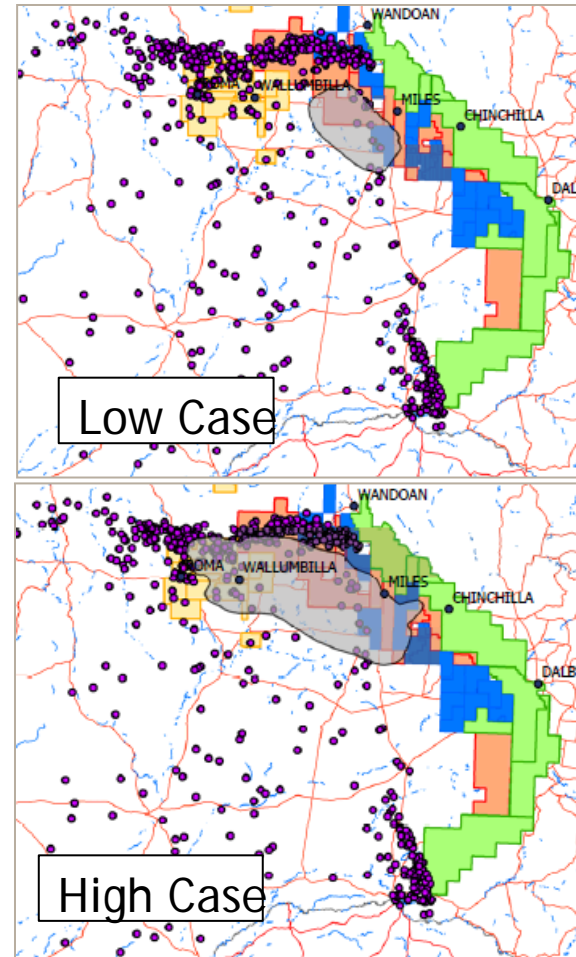




Regional Groundwater Impact Management

How are impacts being estimated?

- Each proponent has modelled the groundwater impacts of its own project, and sometimes cumulative impacts as well.
- Cumulative impacts were also estimated by a joint industry study which combined individual model results.
- The Office of Groundwater Impacts Assessment now has the cumulative model with the best available information from all operators to meet State and Federal conditioning requirements.

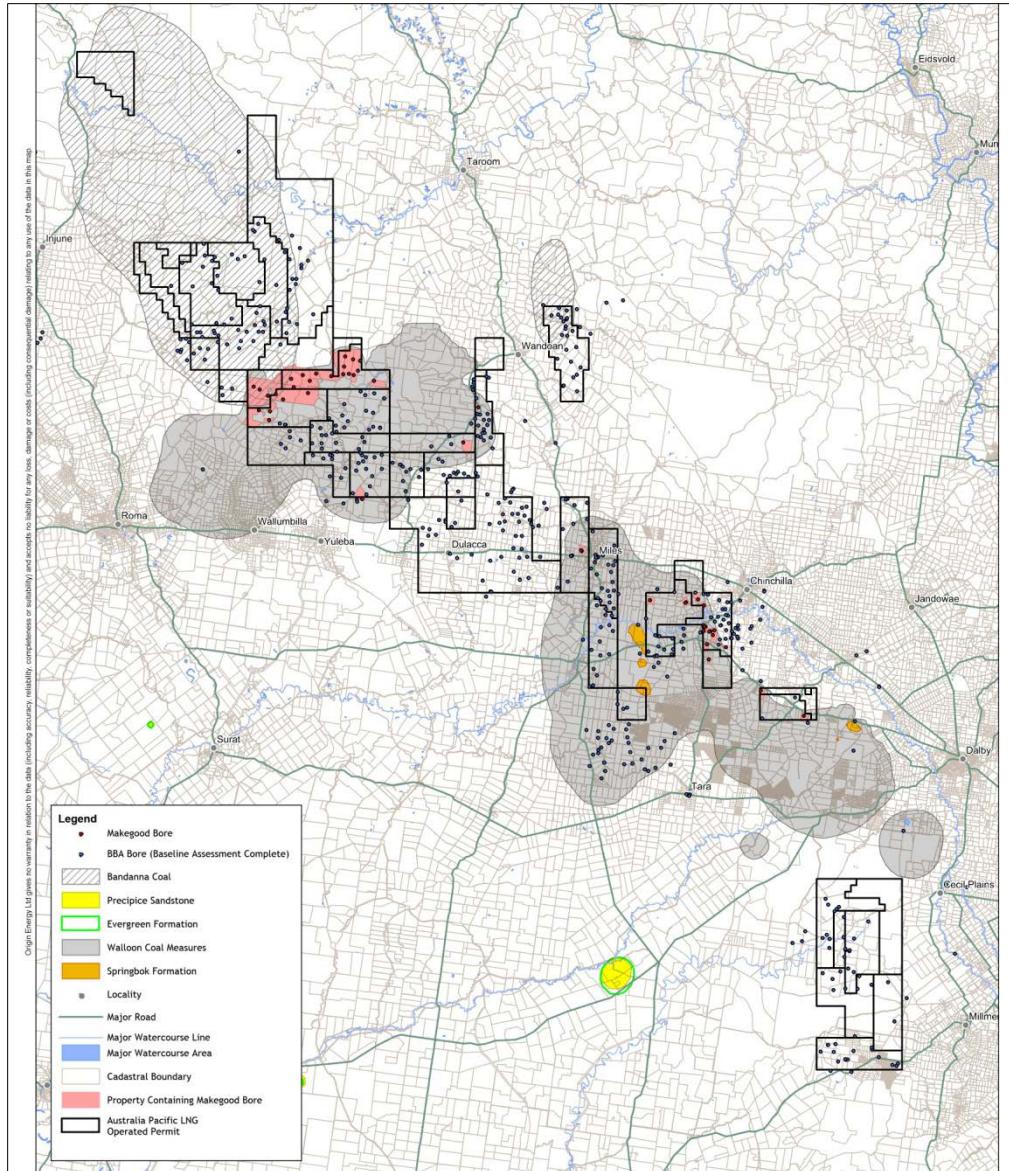


How much faith is being placed in modelling?

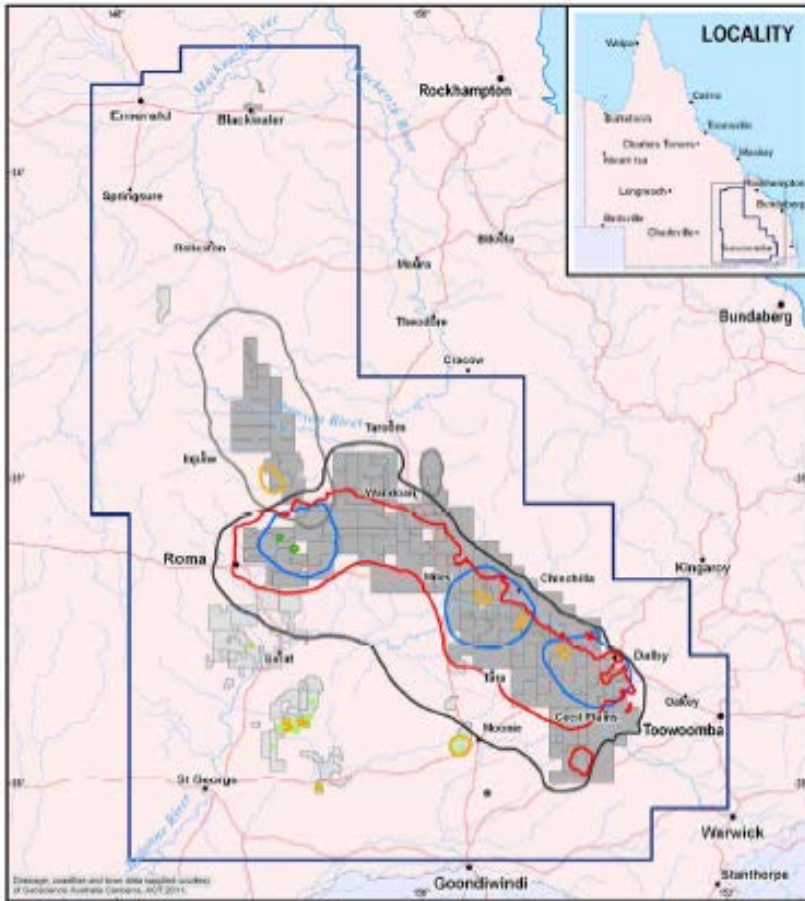


- **Modelling is only used as a tool to plan future groundwater management.**
- **'On-ground' management will be guided by monitoring.**
- **Extensive monitoring bore networks are being installed, and all landholders bores are being surveyed (more detail in upcoming presentations).**
- **Monitoring has been in place for some gas fields that have been operating for up to five years in the Surat Basin, and almost 10 years in the Bowen Basin.**
- **No CSG impacts monitored outside the coal measures to date, which is in-line or better than modelling predictions.**
- **Impacts are subject to make-good provisions, and are addressed pro-actively on a three year cycle through the Queensland Water Commission's modelling and Underground Water Impact Reporting regime.**

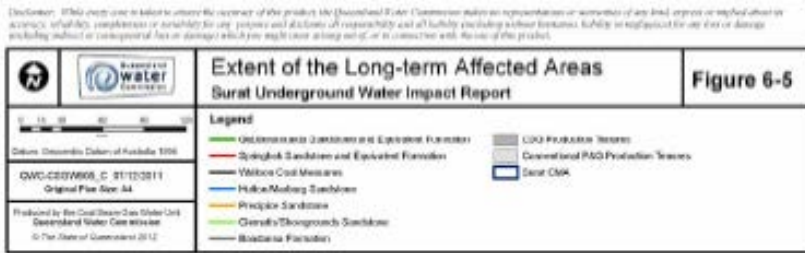
Immediately Affected Areas (IAA)



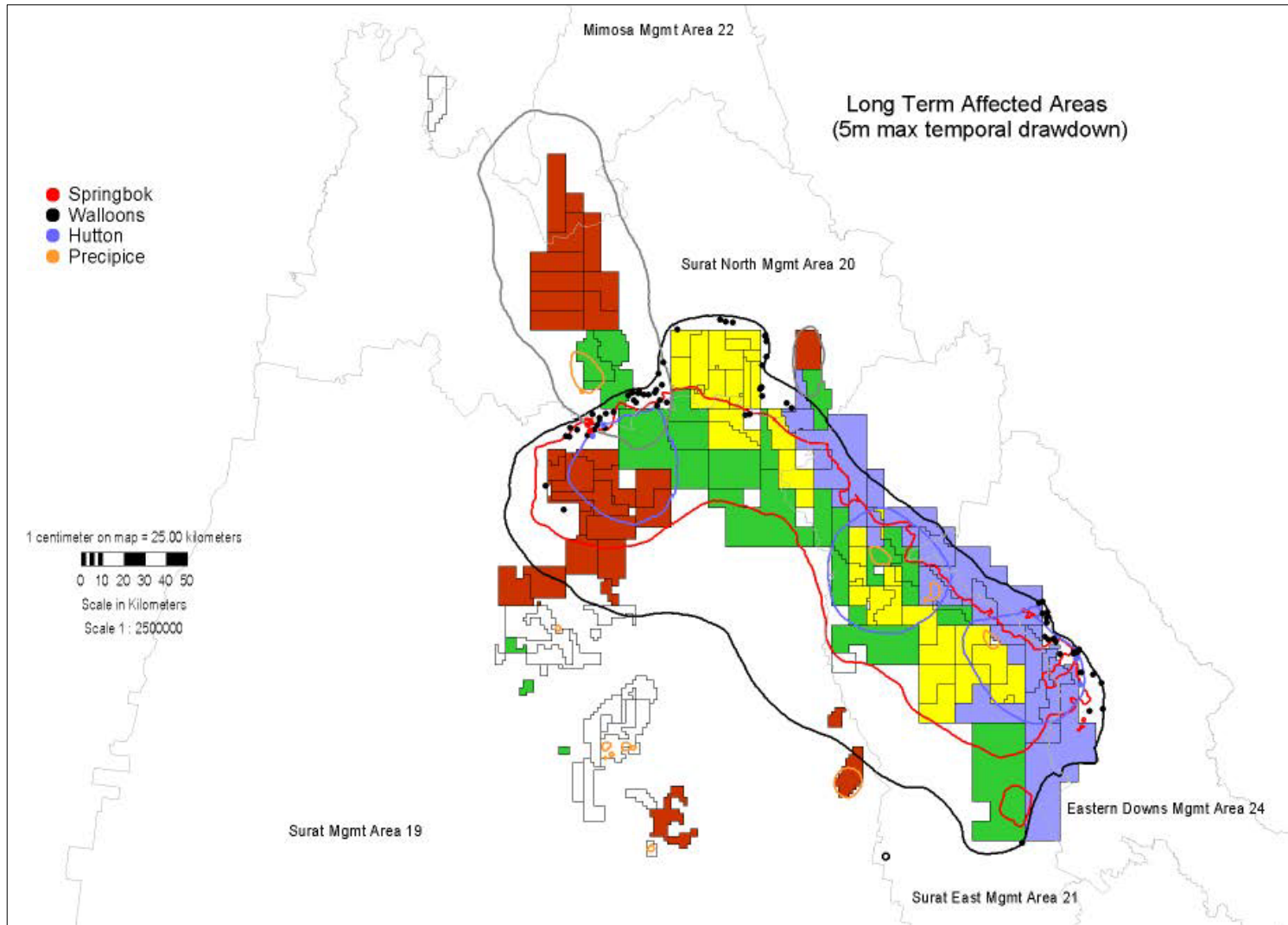
Predicted Impacts - Existing Users

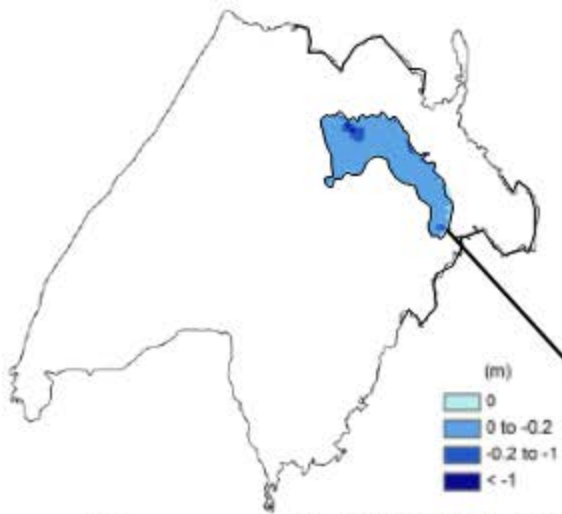


- Old Water Commission modelling estimates 528 bores exceeding 5m drawdown (make good assessment trigger) over life of the projects
- 80% of the affected bores directly target the Walloons
- The remaining affected 126 bores equates to 0.6% of the bores in the management area.

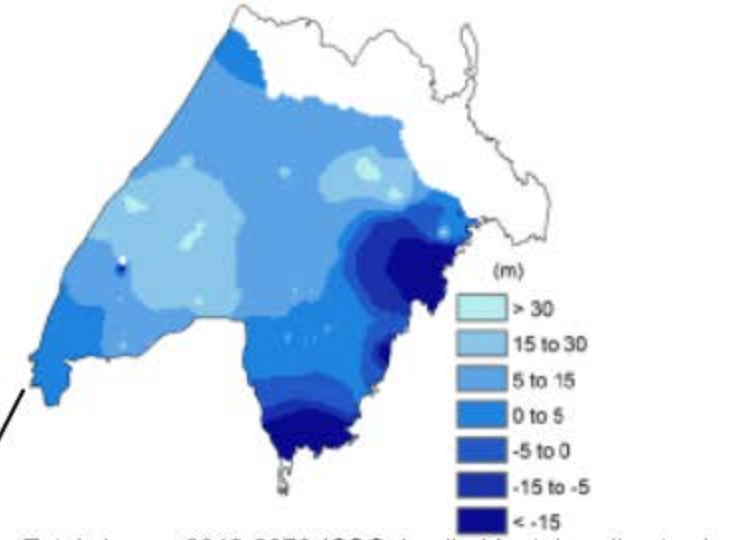


Long-term Affected Areas (LAA)





Change as a result of CSG 2010 to 2070

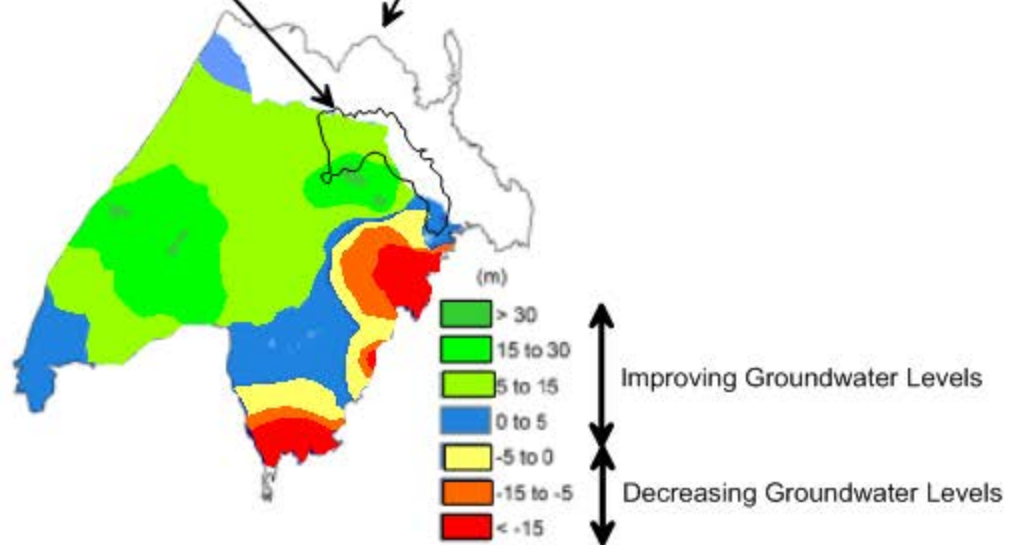


Total change 2010-2070 (CSG, landholder take, climate change)

National Research
FLAGSHIPS
Water for a Healthy Country CSIRO

Water resource assessment for the Great Artesian Basin
Synopsis of a report to the Australian Government from the CSIRO Great Artesian Basin Water Resource Assessment.
Smeaton GD, Marston PJ and Hanley TR
31 December 2012

Australian Government
Department of Sustainability, Environment, Water, Population and Communities
National Water Commission



Predicted Impacts – Holistic

Aquifer Interconnectivity Studies



Really about regional aquitard or seal efficiency under large pressure differentials, which has rarely been studied.

- Multi-aquifer groundwater monitoring, pressure profiling, and cross-aquitard monitoring of test pumping and development.
- Aquitard coring and laboratory testing including centrifuge permeameter - spins core samples at up to 300 times the force of gravity to allow the measurement of permeability in very low permeability rock which has never before been achievable.
- Aquitard monitoring bores and extensometers.

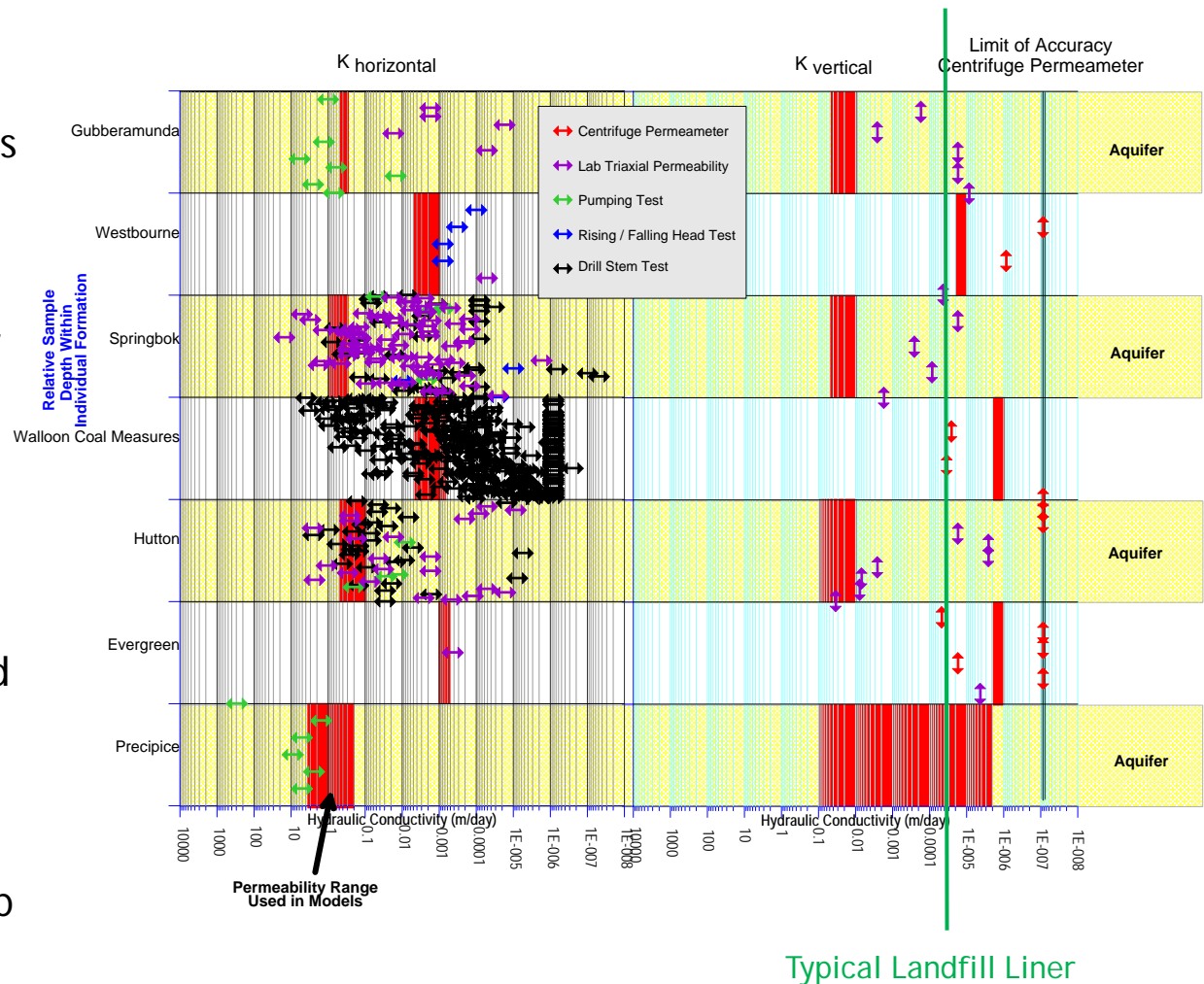


- Isotope and hydrochemical characterisation to fingerprint and determine cross-flow.
- Extensometer monitoring facilities.
- Quartz helium diffusion - with time, helium partitions between quartz and inclusions, and measuring the equilibrium can be used to estimate the helium concentration that was in the pore water. This technique can be used to determine the insitu basin-scale geo-historical vertical groundwater flow velocity across aquitards, and is again an Australian first for this application.

Progress Results - Permeability Distributions



- Vertical permeabilities generally 1 to +3 orders of magnitude less than modelled.
- Horizontal permeabilities very variable, however tests representative of broader formation characteristics generally close to or within 1 to 2 orders of magnitude of modelled parameters.
- EXCEPTION - Springbok Sandstone more aquitard than aquifer.
- No clear cut depth/permeability relationship (except coals).



Summary



- CSG projects cover a very small proportion of the GAB
- Government review of the project has confirmed that CSG extraction is relatively small compared to the larger recharge of the Surat Sub-Basin.
- Estimates of CSG-related groundwater production are decreasing with more detailed investigations, testing and monitoring of production.
- CSG production's main groundwater impacts are confined to naturally isolated coal seams which are little-used by landowners.
- Modelling indicates that impacts to other aquifers are manageable.
- Management of impacts will be directed by the monitoring of extensive monitoring bore networks currently being installed.
- Monitoring has been in place for some existing operations for up to 10 years, with no discernable impacts measured to date.



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Thank you
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