Water conflicts, causes and solutions in the Australian resource sector.

Dr Sue Vink
Director,
Centre for Water in the Minerals Industry
Sustainable Minerals Institute
University of Queensland
Outline

• Causes of conflict
• Case Studies
  – Drought : Cadia Valley, Fitzroy Basin
  – Floods: Fitzroy Basin
  – Agriculture and mining coexistence
  – Agriculture and mining/Coal seam gas conflicts
• Concluding Remarks
Causes of Conflict

- Mining requires water
- Water Scarcity
- Water Excess
- Climate variability
  - Droughts, floods and everything in between
- Increased scrutiny
  - regulators, communities, NGO’s, investors
- Agriculture and Mining
Rainfall

- 80% of continent receives < 500 mm rain annually
PILBARA CLIMATE
(Flooding desert)
El Nino – Southern Oscillation

- ~ 3-10 year cycle El Nino (Drought) / La Nina (Floods)
- Moderated by Interdecadal Pacific Oscillation
- 12 years drought
- 2010/11 strongest La Nina on record, largest recorded floods in Queensland
Variability and extreme events

- A challenge for long term rational management
Variability and extreme events

~ 3-10 yr Drought / Rain Cycles

~20-30 yr Flood events

Maintaining corporate memory over long term for both government and mining is challenging
CADIA VALLEY MINE
Cadia Valley Mine

Water Scarcity

• Severe drought (12 yrs) reduced water supply.
• Mine closure threatened due to lack of water.
• Negotiated with town to use treated sewerage effluent as alternate water supply.
• Mine continued operations
FITZROY BASIN COAL MINING

Balancing extreme climate variability with sustainable water use and ecosystem protection
Fitzroy Basin Coal Mines
Reducing Water Consumption in Drought

• During drought mines reduced freshwater consumption by increased water re-use

• Consequences
  - Re-use = increased salinity of water in stores
  - Increased risk of non-compliant discharge
Flooding several mines
Pits had to be pumped out into rivers.
Regulator delayed decision
Fitzroy Basin Coal Mining

- Mine discharge increased river salinity
- Public concern over decreased water quality for drinking and river ecosystems
Regulator Response

- Regulator restricted discharge by imposing flow and salinity conditions

But,

- Streams are ephemeral, few opportunities for discharge
  - Dry 8-9 months year

- Water accumulated on mine sites for two years
2010/2011 FLOODS

• Strongest El Nino on record resulted in largest recorded flooding
  – Average rainfall 600 mm; 2010/2011 > 1100mm
• Mine pits and dams full of salty water required emergency releases to restart coal production and ensure safety
• Mine water releases restricted
• Government Response
  – Companies required to undertake river monitoring
  – Revised regulation for discharge

• Water is still accumulating!
Fitzroy Monitoring

• Ongoing community concern over water quality
• Fitzroy Partnership for River Health
  – Partnership of community, minesites, scientists, government

• River water quality monitoring network
  – Improve monitoring, extends existing network, independent presentation and analysis
  – Produce annual river health report cards
Adaptive management

Ongoing monitoring and review

Rainfall record
Seasonal Rainfall Forecasts (avg)
Probability/Exceedance Forecasts

Site Water Balance Model

Model Parameterisation

Model Output

Volume

Time

Monitoring Data

Volume

Time

Monitoring Data

Rainfall record: Chance of at least 300 mm during September to November 2011

Centre for Water in the Minerals Industry
HUNTER RIVER SALINITY TRADING SCHEME
The Hunter Catchment

- 22,000 km²
- Newcastle (250 km north of Sydney) world’s largest coal export port
- Coal industry
- Power generation
- Irrigation
- Wine production
- Thoroughbred breeding
Water Quality Issue

- Salinity in the Hunter River gradually increasing over time
- Baseflow is saline due to groundwater
- Coal mine and power station discharges contributing to salinity

- In 1995 a market based cap and trade system was introduced to regulate salinity

- In 2000 results were assessed and scheme revised
Hunter River Salinity Trading Scheme

AIMs:

• Manage saline water discharge from point-sources to minimise impact on irrigation and other water uses, and the environment

• To achieve this at least cost to the community, in an equitable and flexible way

• Keep salinity below set limits at key sites
Technical aspects of the HRSTS

- 21 monitoring sites (flow, salinity)
- Radio and telephone links - Hunter Integrated Telemetry System (HITS/Waterinfo)
- Flow and salinity model (operated by State Water)
- Announcements made to authorise discharges
- Monitoring and reporting

- Requires cooperation of regulator and mines
How it works

• Based on dilution principle

• HRSTS in ‘rest’ mode until rainfall event occurs

• Total Allowable Discharge (TAD) calculated

• River Register issued – gives authorisation to discharge
Calculation of salt discharges

- Total Allowable Discharge (TAD, in tonnes salt) calculated from HRSTS model
- TAD apportioned to licensed dischargers according to salinity credit holdings
- River Register is posted authorising discharge
- Participants calculate flows from their share of the TAD
- Participants can trade salinity credits at any time, through an on-line share register.
- The public has visibility of this via website
Hunter River Salinity Trading Scheme

Working together to protect river water quality and sustain economic development

The NSW Government's Hunter River Salinity Trading Scheme leads the world in using economic instruments for the effective protection of waterways. The scheme has been designed to minimise the risks associated with the abstraction of Hunter River water, and to ensure that the river is now as fresh as many bottled mineral waters.

The scheme is a huge win for the entire Hunter River community. Agriculture benefits from fresh irrigation water while mines and electricity generators can make controlled discharges of excess water.

The scheme protects the region's most precious natural resource, provides for diverse interests to work together, and allows continued economic development, ensuring a secure future for the region.

This is achieved by:
- extensive and continuous real-time monitoring of environmental conditions and discharges (see Scheme successes)
- scheduling saline industrial discharges at times of high river flows and low background salinity levels so that salinity targets are not exceeded because of the discharges (see How the scheme works)
- sharing the total allowable discharge according to the tradeable salinity credits held by dischargers (see Allocating credits)
Salinity Credit Auctions

- Every two years, 20% of salinity credits ‘retired’, and 200 new credits auctioned
- Steadily increasing price for salinity credits
- Money raised re-invested in the HRSTS
Success ?
HRSTS Essential Features

- Market-based instruments (‘Cap and trade’) work, when there is good knowledge of what is happening (flow, salt)
- Good quality, consistent, accessible real-time data is crucial to HRSTS operation
- Trust (transparency, confidence in the technology and accountability) is critical
- Access/visibility by all stakeholders to data is essential
COAL SEAM GAS INDUSTRY

A new challenge
Coal Seam Gas Production in Queensland

Shallow coal-bearing regions in Queensland

Legend
- Shallow coal locations
- Surat basin
- Bowen basin
- Clarence-Moreton Basin
- Galilee Basin

Bowen and Surat Basin CSG Wells & Leases

Legend
- Coal seam gas wells
- Surat basin
- Bowen basin
- EPP and PL grants
Social unrest

What is the role of lack of information and deliberate misinformation?
Multiple Issues

- No fossil fuels
  - renewables leap frogging
  - Measurement of CSG CO$_2$e emissions
- Agricultural land and open cut coal mining
- Farming lifestyles / culture
  - Assumed rights
  - Noise
  - Traffic
  - Strangers
  - Employment
- Fragmentation
  - biodiversity
  - farming practices
- Water
CSG Production in Queensland

- Domestic gas supply began 2000
- Cumulative production 2000-2007 = 646 PJ (17,248 Mm$^3$)
- Annual production 2007-2008 = 133 PJ (3558 Mm$^3$)
- 1500 wells
- Next 5-10 years industry growth to supply 6-8 LNG plants
  - 49,812 Mm$^3$ pa; 1,759 bcf
  - 20,000-40,000 wells

US fields Annual Production 2008
- Powder River Basin = 435 bcf
- San Juan Basin = 1210 bcf
Current CSG Water production =18 GL/yr

Consensus emerging that ~150Gl/yr dewatered from the coal seams of the basins

Water extracted from Surat Basin aquifers for stock and domestic use ~74 GL/yr

Condamine groundwater irrigation ~40 GL/yr
The Underlying Issue(s) - Uncertainty

• Scientific/Technical
  Lack of fundamental understanding to enable prediction of:
  – Aquifer interactions and impacts
    • Water availability (quantity and quality)
    • Hydraulic fracturing, natural fractures and faults
    • Reinjection feasibility and options
    • Baseline conditions groundwater depth, quality
    • Impacts on GDE’s
The Underlying Issue(s) - Uncertainty

- Impact Assessment Framework
  - Cumulative impacts assessment
  - Methods for characterising and evaluating impacts and significance
  - Data sharing
Long Term Affected Area (QWC)

- Drawdown > 5m expected
- Total bores affected 528
  Mostly s+d
Summary and Conclusions

• Mining can use lower quality water than many other users
• Opportunities to save freshwater
• Critical that companies and government understand the regional water balance context, especially long term cycles
• Communities, government and companies must be part of monitoring dialog
  – Trust, understanding, transparency
• Cumulative impacts must be assessed not company by company