CSIRO Submission 09/365

Inquiry into the impacts of mining in the Murray Darling Basin

Senate Standing Committee on Environment, Communications and the Arts

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Summary

The Senate Standing Committee on Environment, Communication and the Arts is holding an inquiry into the impacts of mining in the Murray Darling Basin.

CSIRO's submission describes the mining potential of the Murray Darling Basin as significant and impacts on water resources will vary depending on the type of mining operation.

- The north of the Murray Darling Basin is dominated by fossil fuel and gas operations.
- The south is dominated by mineral sand operations.
- Mining operations in the Murray Darling Basin have significant capacity for growth.
- Considerable research on both the Murray Darling Basin and mining impacts has been completed by CSIRO and other agencies.
- Mining impacts on water can be managed, however the impacts are mine-site specific and as such it is difficult to apply general and uniform rules.
- The cumulative impacts of a range of mining activities operating over a significant period of time are less well understood and represent a gap in available research.

CSIRO Expertise

CSIRO has significant expertise to bring to bear on the integrative considerations raised by the Senate Inquiry.

1. A 2006 report from CSIRO and Monash University the cost of water could rise tenfold by 2032. In response to these kind of figures, CSIRO has developed both a strong focus on techniques that can optimize water use and management in the minerals sector (see Earthmatters Magazine Issue No 11: Living and working with Water, July/August 2006[1]),
2. CSIRO was a contributor to the May 2008 report released by the Department of Resources Energy and Tourism titled "Water management - leading practice sustainable development program for the mining industry"[2]. This publication was developed in consultation with industry, government, research and non-government organisations. This report provides general information on sustainable water management practices for the mining sector rather than attributing the impacts of mining on water within a particular region.
3. In addition, CSIRO launched a National Research Flagship, Water for a Healthy Country, to provide scientific solutions to sustaining our freshwater resources.
4. CSIRO has life cycle assessment (LCA) tools that have been used to look at the water efficiency of different mineral commodities and processing technologies, concluding that the economic value of water consumed by the minerals industry exceeds that of the agricultural and industrial sectors, supporting the view that allocating water to the minerals industry has a strong underlying economic basis (see Norgate and Jahanshahi, Assessing the sustainability of minerals and metals using Life Cycle Analysis; Minerals Council of Australia Sustainable Development Conference 2008).

[1] http://www.csiro.au/resources/earthmatters11.html
[2] http://www.ret.gov.au/resources/Documents/LPSDP/LPSDP-WaterHandbook.pdf

5. Through its sustainable yields projects[3], CSIRO is undertaking a comprehensive scientific assessment of current and future water availability in all major water systems across Australia to allow a consistent framework for future water policy decisions. The Water for a Healthy Country Flagship is developing knowledge and tools to assist catchment management agencies and governments review and improve their natural resource plans in the Lower Murray region[4] and mineral exploration technology is being employed to enhance and protect the environment of the River Murray and its floodplains (R D Gee, K Lawrie and T Munday **"Regolith to the Rescue",** Feb 2005[5], available through the CRC on Landscape Environments and Mineral Exploration website).

From this background, the following points are submitted in response to the specific questions raised by the Standing Committee

Introduction

The Murray Darling Basin represents a huge surface area. A range of different geological environments underlie the basin, giving rise to numerous different forms, types and occurrences of mineralisation. To the north of the basin, significant fossil fuel deposits occur which are currently being actively developed to extract coal and coal seam gas. In these areas, significant growth in operations is anticipated. To the south and west, there are a number of mature mineral sands mining operations, some polymetallic mining operations (copper, lead, zinc and gold) and the occurrence of uranium in association with sedimentary deposits to the west of the basin.

This variability, of landscape, geology and type of mining, makes it difficult to offer detailed responses that comprehensively address the full geographical extent of the Murray Darling Basin. Our submission therefore addresses both generalities related to the inquiry and then presents more specific examples of data or research relevant to the specific questions raised by the Inquiry.

a) The potential impacts of current and projected mining operations on all environmental values in the Murray-Darling Basin and, in particular the potential impacts upon surficial and groundwater flows and quality in the alluvial flood plains at its headwaters in the Namoi Valley and the Darling Downs catchments;

Mineral Sand operations dominate environmental impacts in the south of the basin

The cumulative environmental impacts in the Murray Darling Basin are substantially different in the south of the basin to those in the north. To the south, numerous mineral sand operations exist and the potential for further exploitation of these unconsolidated sediments is significant. The main environmental impacts of these operations are the effects of dewatering and the potential for changes in groundwater quality as a result of the chemical composition of the mineral sand deposits. A range

[3] http://www.csiro.au/partnerships/SYP.html
[4] http://www.csiro.au/science/psl8.html
[5] http://crcleme.org.au/Pubs/Articles%20and%20papers/Regolith%20to%20the%20Rescue100205.pdf

of studies are available for specific deposits in and around Wimmera and in the Mallee area of Victoria. For example, Environmental Impact Statements such as those prepared by Iluka Resources[6]

More specifically, the traditional mining method for mineral sands is to flood the mineralised area with water and wet dredging. This creates the danger of dissolving associated salt and contaminating underground water systems and changing the surface ecology. The mining industry is aware of this fact and a few years ago RZM Mining had to apply dry mining technique to mine the Wemen deposit near Ouyen.

The salinity associated with mineral sands deposits and their extraction creates the possibility for salt harvesting in the south of the Murray Darling basin. There are a series of reports relating to the activities of Murray River Salt (or SunSalt) at Lake Mourquong and Spectacle Lake near Mildura and Ouyen respectively and Pyramid Salt near Swan Hill.

Additionally, in 2004, CSIRO assessed the economical potential of the saline waters stored in minerals ands disposal basins for the then Murray Darling Basin Commission[7]. This work looked (amongst other things) at the radium levels of the groundwaters and found radium anomalies at Lake Tyrrell, and various locations outside the basin in S.A. and WA. These anomalies were all associated with high salinity and low pH (acidic) waters. It was concluded that it is unlikely radium poses any problems during the operation of salt interception schemes along the River Murray although mineral sands contain small amounts of radioactive thorium-rare earth mineral monazite.

Fossil fuel and gas operations dominate groundwater and surface water impacts in the north of the basin

In the north of the basin, straddling the border between Queensland and New South Wales the geology and terrain lend themselves to fossil fuel deposits. Here the southern extension of the coal beds that make up the Bowen Basin in Central Queensland dive down underneath a more recent sedimentary sequence that includes the coal seams that occur in the Surat Basin. Coal mining, coal seam gas extraction and underground coal gasification are all highly potential in this area and development projects in this area are growing exponentially. According to the Queensland Government, the number of coal seam gas wells drilled annually increased from a low number of 10 in the early 1990s (corresponding to about 4 Pj of energy) to a record high of approximately 600 in 2007–08 (133 Pj).

The environmental impacts of fossil fuel and gas extraction in the north of the Murray Darling basin relate primarily to the potential for the dewatering of groundwater reserves during coal seam extraction, associated salinity issues and groundwater contamination with polycyclic aromatic hydrocarbon derivatives of coal reserves. An

[6] http://www.dse.vic.gov.au/dse/nrenpl.nsf/linkview/9016655d9884f5b9ca256d480003cf2792fbc7c133a6f520ca2572da007fab8b

[7] http://www.mdbc.gov.au/__data/page/334/MDBCApp7.pdf, http://www.mdbc.gov.au/__data/page/334/Appendix2.pdf

additional potential geotechnical impacts arises from the introduction of underground coal gasification in the area, whereby coal seams are combusted *in situ* to create a synthetic gas product that is collected through a borehole.

CSIRO has developed an integrated approach to evaluating extraction operations using site hydrogeological characterisation, site ground water monitoring during mining, and numerical modelling to assess mining effects on ground water. This new integrated approach has been applied to underground coal mine ground water flow assessments with a significant early success of an accurate prediction of ground water inflow from the surrounding aquifers into a longwall mine. CSIRO completed in 2007 a project with the Australian Coal Association Research Program (ACARP) entitled "Hydrogeological Response to Longwall Mining". Recently, we commenced another ACARP project entitled "Reducing the Impact of Longwall Extraction on Groundwater Systems". The work to date has focused on physical aspects of the mining impacts on ground water systems, such as mining-induced overburden fractures, permeability changes, pore pressure changes in aquifers of the overburden, and the spatial extent of these changes.

Similar modelling studies were used by CSIRO in 2005 (in conjunction with novel risk assessment tools) to evaluate the potential environmental impact of underground coal gasification. Our research indicates that mining effects on ground water are mine-site specific and depend on variables such as overburden geological, geotechnical and hydrogeological conditions, characteristics of aquifers and aquitards involved, and mining layout and depth. However, a well managed operation is competitive with Integrated Gasification Combined Cycle in terms of greenhouse emissions and is highly amenable to geosequestration . The environmental impacts of the operation primarily relate to the need for a supply of groundwater during operation and localised affects on the groundwater supply post operation. Modelling suggests that groundwater quality can be maintained within acceptable standards by the use of various operational techniques, such as, maintaining an underpressure in the extraction zone and carefully monitoring water volumes and quality.

There does not seem to be general and uniform rules describing quantitative impacts of mining on aquifers. Hence, effects of mining on aquifers must be assessed on a case-by-case basis using site specific conditions.

Cumulative environmental impacts from mining have received relatively little attention.

The impacts of mining tend to be studied on a case by case, region by region or operation by operation basis. The results are initially encapsulated in Environmental Impact Assessments which are available at initiation for both existing and known projected mining operations. Additionally, many of the mine operators in the Murray Darling Basin will be producing annual sustainability reports utilising the Global Reporting Initiative reporting framework which will provide minesite data on environmental values such as:

- Materials (usage by weight or volume and percentage of recycleable materials)
- Energy consumption (direct and indirect)
- Water withdrawal by source
- Biodiversity (size of land owned and description of impacts on biodiversity)

- Emissions, effluents and wastes (greenhouse gases, ozone depleting substances, Sox and Nox, discharge water quality and destination, waste quantities and destinations. Spills)
- Products and Services (initiatives to mitigate environmental impacts)

These sustainability reports represent a valuable source of information on the potential and actual impacts of individual mining operations. However, there has been relatively little quantitative assessment of the cumulative impacts represented by these data. This is an increasing topic for discussion amongst the research community and was most recently aired at the biannual international conference on sustainable development indicators in the mineral industry (SDIMI) held recently on the Gold Coast.

Impacts on water flows in the Namoi Valley and Darling Downs region

The CRC for Sustainable Resource Processing, in which CSIRO is a partner, published in 2007 a report on "Water Issues and Sustainable Resource Processing" which outlines the impacts of mining on water in a generic sense. This provides quantitative information typical of water consumption and demand for different mining operations but does not attempt to analyse the scale of impact at a regional level. The key issues in terms of cumulative impact will centre around how individual operations combine over time and over a large region to affect: water availability and variability; impacts on biodiversity; land and groundwater contamination; local and regional dewatering.

Under the Water Act (2007) and Amendment (2008), the Murray Darling Basin Authority (MDBA) has been charged with the responsibility of setting Sustainable Diversion Limits for water resource planning areas. These Diversion limits will apply to both surface and groundwater supplies. For groundwater, this will be based on the outcome of research into the definition of spatial units relevant to the setting of diversion limits, the definition of resource conditions that can be regarded as "acceptable" and the modelling/simulation of how resource conditions within the defined spatial units will evolve under different scenarios for the future. Within this context, it should be possible to undertake a more rigorous analysis of the quantitative impact of current and proposed mining operations on water sources and flows in the Namoi Valley and Darling Downs region.

b) Evaluation of the potential impacts in the context of the Murray Darling Plan and agricultural productivity

No comment is offered against this aspect of the inquiry, although CSIRO welcomes and strongly endorses the integrated approach to planning and regional development implied by the nature of the Inquiry. In relation to this integrated approach, the inquiry is referred to the CSIRO report to the Australian Government "Water Availability in the Murray Darling Basin" (October 2008).[8]

[8] http://www.csiro.au/files/files/po0n.pdf