THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Dr Ian Holland
Committee Secretary
Senate Standing Committee on Environment, Communications and the Arts
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17 September 2009
Our Ref: 09C-115

Dear Dr Holland

I am writing to provide a submission to the Senate inquiry into the impacts of mining in the Murray Darling Basin.

The Sustainable Minerals Institute (SMI) at the University of Queensland is the world's only research institute dedicated to finding knowledge-based solutions to the sustainability challenges of the global minerals industry. The SMI is unique because of its inter-disciplinary approach, which is grounded in disciplinary expertise in engineering, science and the social sciences. The purpose of the SMI centres is to develop practical solutions to the challenges of operational implementation of sustainable development in the resources sector. The Institute's work covers all facets of the life of mine from geology, to minerals extraction, water management issues, minerals processing, workplace health and safety, mine rehabilitation and community engagement.

While mining has long been important in the Murray-Darling Basin, the current contribution of the Murray-Darling Basin to Australia's mining industry is relatively small. However, this is not a fair reflection of its historical significance or of its importance at a number of locations in the Basin. More importantly, whilst some mining operations will inevitably close, the potential for expansion is considerable, both from known mineral deposits and as a result of continuing exploration in all parts of the Basin.

The Institute has undertaken substantial research work in the areas of cumulative impacts of mining and their management, particularly in relation to social and environmental impacts, which are detailed in the enclosed submission. This work is very relevant to the inquiry, especially for the Namoi Valley, Darling Downs and Surat Basin.

I understand that submissions become Committee documents and I am aware that the submission is made public after a decision by the Committee. Thank you for this opportunity to provide a submission into this very important enquiry.

Yours sincerely

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Submission to the

Senate Enquiry

Impacts of Mining
in the Murray Darling Basin

September 2009

Sustainable Minerals Institute

University of Queensland

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www.smi.uq.edu.au

1.0 Introduction

The Sustainable Minerals Institute (SMI) is the world's only research institute dedicated to finding knowledge-based solutions to the sustainability challenges of the global minerals industry. The SMI is unique because of its inter-disciplinary approach, which is grounded in disciplinary expertise in engineering, science and the social sciences. The purpose of the SMI centres is to develop practical solutions to the challenges of operational implementation of sustainable development in the resources sector. The Institute's work covers all facets of the life of mine from geology, to minerals extraction, water management issues, minerals processing, workplace health and safety, mine rehabilitation and community engagement.

Since its formation, the Sustainable Minerals Institute has built a strong reputation for responding to knowledge needs of industry and government in areas relevant to minerals industry sustainability. The Institute has a number of high profile research programs whose focus is to significantly improve the operational efficiency of a mine site. Typical examples include reducing water consumption, e.g., evaporation control, or becoming more energy efficient by using new technology, e.g., HPGR or reducing waste, e.g., reducing tailings volume by pre-sorting below-grade "ore components". The underlying philosophy of this research is that overall efficiency will be improved by becoming more efficient in each piece of the system.

Increasingly, the Institute is focused on research in integrated methods that will create a new definition of sustainability to forecast the performance of one or more sites. This method of research integrates all aspects of site workforce and engineering management (human capital, skills), resources (ore, natural capital water energy and infrastructure) and community (social capital). It develops tools for life-of-mine optimisation ensuring that business decision-making is supported by sound and comprehensible mechanisms for investment in sustainability. These tools provide a new capacity for step change strategic capability and help management cope with the massive data flows associated with emerging mining systems. By linking data sources to fundamental understanding and new human interfaces, constraints from introduction of new automation, remote mining, natural hazards and operational challenges can be overcome.

Around the Murray-Darling Basin (and elsewhere in Australia) there is an increase in opportunities to co-develop multiple resources in one place. High quality reserves of traditional non-renewable resources of coal, gold, base metals and nutrients have become depleted. Therefore, there is increasing pressure to develop the reserves which coincide with conventional renewable natural resources, e.g. soil and water driving agriculture and forestry. Further, "new" resources such as coal seam gas, underground coal gasification, geothermal energy extraction and shale oil are raising questions because of their frequent co-location with economically attractive renewable natural resources activities.

2.0 Current research & applications

Within the SMI, significant research programs in the existing Centres have risk management themes that apply to this Senate Enquiry on the potential impacts of current and projected mining operations on all environmental values in the Murray-Darling Basin. These research programs are detailed by centres below.

2.1 Centre for Water in Mining Industry (CWiMI)

Water accounting

Access to water is one of the most critical business imperatives for the minerals industry, arguably second only to land access in terms of the natural resource requirements for some projects. The ability to demonstrate that water is being used in an efficient and appropriate manner is essential in securing continued access. CWiMI has undertaken a review of water metrics within the Australian minerals industry in collaboration with the Minerals Council of Australia. The project objectives are to develop: a suite of metrics representing key components of an operation's water balance; key terms and definitions for water metrics for use in the Australian minerals industry that are consistent with the wider water sector and which can be applied in a nationally consistent manner; a possible methodology for calculation of metrics including guidance and explanation on how to interpret and consistently apply defined water metrics; and a water metrics reporting protocol for nationally consistent application. This review can be used by mining companies to standardise their approach to water accounting consistent with National Water Accounting Standards.

Strategic view of regional water management by the mining industry

Access to land and water resources is a necessary condition for continued growth of the mining industry and generation of the economic wealth it provides. Since 2002, the mining industry in Australia has promoted the strategic management of water resources to meet increasingly rigorous environmental responsibilities regarding water acquisition, use and discharge and to ensure crucial future access to water supply for operations.

Energy derived from coal currently contributes ~25% of world primary energy supply with world consumption expected to increase by 36% in 2030 (IEA 2008). This demand for raw materials, the long term decline in ore grade and greater throughput and processing of more refractory ore is leading to more extensive mine areas, increasing waste rock production and greater demand for water resources by mining both in Australia and worldwide. There is also an accelerating demand for non-renewable resources and energy. The intersection of these demands is the source of competition for land, water, soil etc. Water related environmental problems do not exist in isolation of other issues such as biodiversity preservation, degradation of soil condition, sediment transport, vegetation clearing and habitat loss.

Solutions to these issues will require a complete and thorough understanding of the benefits and trade-offs that occur when water issues are considered in the wider environmental sustainability context. Although different sectors of society regard them as separate issues, it is helpful to think of access to energy, land and water as different sides of the same issue (IUCN 2008). Any change in land use that impacts on hydrology invariably limit water availability (e.g. establishment of reforestation projects). All of these drivers impact on the feasibility of mining operations. SMI's research is aimed at identifying the multiple environmental benefits that accrue from consideration of key ecosystems services associated water, carbon and biodiversity as an interlinked system.

It is therefore becoming increasingly important for the mining industry to collectively address the cumulative environmental impacts at regional scales because actions and responses at this scale have a major influence on public perception of industry responsibilities. In the long-term, these perceptions feedback on to shareholder choices and the legislative and policy frameworks developed by government. Perceptions about unjustifiable or profligate use of water, over-zealous competition for scarce water resources, over-allocation of limited surface and ground water supplies or cumulative impacts of mining on water supply and quality is a major threat to mine expansion.

2.2 Centre for Mined Land Rehabilitation (CMLR)

Water and Rehabilitation

The extraction of natural gas and oil results in surface expression of formation associated waters which often contain salts and toxic elements such as boron, fluoride and heavy metals. Due to regional geology, the produced formation water can be sodic in nature and uncontrolled release or long term infiltration may result in a loss of clay structure and degradation of soil texture and hydraulic conductivity. In 2004, CMLR initiated a research program in collaboration with Beach Petroleum which began with studying the extent of the contribution of produced water to the salinity of the lands surrounding two production sites.

The current focus of the rehabilitation research addresses issues of soil sodification in semi-arid/ arid landscapes. The capacity for soil to bind fluoride and the conditions under which it may be released are also being investigated in order to assess the risk posed to agriculture or grazing by exposure of soil to associated formation water and also to explore innovative ways for reducing plant-available fluoride. An extension of this work examines the potential to mitigate sodicity through gypsum addition concurrent with water release to slow or prevent further soil degradation. Current research is located in the Eyre Basin although the results of this work are applicable to areas where sustained interaction between formation waters and surface soils are anticipated and has special significance for enhanced pasture production systems.

Soils and Rehabilitation

In recent decades there has been an increasing demand for agricultural products to support a growing (world) population. The ongoing increase of housing developments and infrastructure also asserts pressure on land that otherwise would be usable for farming. Hence, large areas of productive soils are irrevocably lost each year. Increasing evidence of global warming and changing climates have some predicting a shortage of agricultural products, both locally and globally, with the consequence that arable regions of today are likely to become less fertile and result in a decline in agricultural production.

Soils are a result of weathering and translocation processes over long periods of time and the resultant soil horizons formed are defined by distinctive properties which determine the possible landuse and productivity from an agricultural point of view.

Mining activities, in particular open-cut mining, leads to a removal of topsoil and subsoil material. The general practice is separation of soil from overburden, and storage for future rehabilitation purposes. Successful rehabilitation requires the re-building of soils according to their initial stratification. The more successful a soil profile can be re-constructed, the more likely the soil will retain its previous functions. There are some known impediments that limit successful soil rehabilitation. One main factor is soil compaction. Heavy machinery, primarily designed for excavation purposes, is typically used for rebuilding landforms and soils. Clay-rich soils similar to those in the Murray-Darling Basin are very susceptible to compaction and have to be rebuilt very carefully to avoid such negative impacts. Compaction not only restricts root growth, but it also reduces the amount of plant-available water, plant nutrient uptake because of a less aerated state, and infiltration and permeation of water to deeper depths (and eventually groundwater).

There is only very limited experience in Australia in the rehabilitation of agricultural soils. To ensure a successful re-use of rehabilitated land for agriculture, the re-building of (mined) soils has to be well understood and tested. Thorough and detailed rehabilitation research programs will be required to demonstrate that mining prime agricultural land is only a temporary cessation to agricultural production and that disturbed landscapes and soils can be re-constructed to pre-mine capability and productivity.

2.3 Centre for Social Responsibility in Mining (CSRM)

SMI has specific relevant capability in areas of community-focused research methodologies; socio-economic impact analysis, at the regional and local level; management of multi-stakeholder engagement and dialogue processes; and analysis of cumulative impacts. Applicable research projects are outlined below.

Cumulative impacts of Mining: a Hunter Valley case study
This project developed a general methodology and conceptual framework for identifying and assessing the cumulative impacts of mining at a local and regional level. The focus of the study was Muswellbrook Shire in the Upper Hunter. Key impact areas examined were: visual amenity, water quality, social change and cohesion and economic development and employment.

Developing good practice in Managing Cumulative impacts
This current project involves developing a good practice guide for industry and policymakers on the assessment and management of cumulative impacts: environmental, social and economic. The guide will provide practical examples and methodologies on how best to deal with multi-mine impacts. It will include advice on the management of cumulative impacts in new resource regions, with the Gunnedah Basin being used as one of the case studies.

Mining Towns Investment Tool
This current project involves developing a structured process to support decision-making around the post-mining future of mining-associated towns. It includes guidance on assessing the capacity of towns to withstand the 'shock' of mine closure and strategies for building resilience.

Ravensthorpe Sustainability Indicators Project
This project established an indicator framework to monitor the impacts and contributions of BHP Billiton's Ravensthorpe Nickel operation in Western Australia to the sustainable development of local communities and the surrounding region. Notwithstanding the premature closure of that operation, the framework and underpinning methodology has considerable applicability to mining operations in other agricultural regions.

Leading Practice Strategies for Mitigating and Managing the Social and Economic Impacts and Benefits of Resource Developments
The Queensland Government's Sustainable Resource Communities (SRC) policy is designed to both maximise the opportunities presented by developments in Queensland resource provinces and mitigate and avoid adverse impacts in areas such as, social infrastructure, employment, housing, community services, amenity, quality of life, health and education. The policy responds to the cumulative and regional impacts that may be experienced by Queensland communities, economies and environments as a result of multiple, concurrent and overlapping proposals for resource development. The policy strengthens the Queensland Government's co-ordination role, introduces a social impact assessment (SIA) function, improves state-wide and regional coordination through the formation of a partnership group and local leadership groups, emphasises greater links to regional planning, and introduces social impact plans (SIPs) to outline the forecast changes to communities, the agreed strategies for mitigation, avoidance and enhancement of impacts, and the responsibility of various parties in relation to management.

CSRM has been contracted by the State Government to review, analyse and synthesise the key success factors, gaps, failures, and context of leading practice social impact assessment and management strategies in other jurisdictions to inform the development of SIPs, and the SRC policy more generally, in Queensland.

3.0 A new approach for Australian landscape management

Around the Murray-Darling Basin (and elsewhere in Australia) there is an increase in opportunities to co-develop multiple resources in one place. For this to occur, the apparent impasses between renewable and non-renewable resources management in and around the Murray-Darling Basin needs to be addressed using new approaches and in an integrated fashion.

There have been two broad approaches to landscape science for planning:

1. *Land capability/suitability assessment*: Individual land parcels are allocated to predefined land suitability classes, which indicate their capability for one activity or another.
2. *Change modelling based on multi-criteria decision making tools*. In this approach the various options for each area are traded off against one another based on pre-defined criteria and/or preference choices expressed by various stakeholders.

Neither of these approaches is well-suited to planning where multiple activities can be undertaken in one location at one time. The landscape paradigm in most parts of Australia is that of patchwork of independent forestry, agriculture and environmental stewardship regions of one type or another, e.g., national parks, with more intensive activities, e.g., feedlots, paper mills, power generation etc "superimposed" upon these foundation activities. However, this is not a strong economic or environmental paradigm because it has become apparent in all complex systems that advantages are found at the interfaces between co-managed and planned activities. A more integrated approach is needed.

Whilst catchment management planning provides a partial solution, such plans are not prescriptive over a region. Further, integration through central planning is not compatible with Australian land tenure or commodity production and marketing systems. A different approach that respects land and water property rights with a view to harmonising economic productivity and maintaining or enhancing environmental values is needed. In general, communities evolve in response to changing employment and lifestyle opportunities presented by various resource development activities. Insight into potential community impacts of decisions for resource development options should be seen as part of the decisions rather than just a contingent consequence.

The legacies of industrial activities in the landscape are often viewed only through the lens of negative outcomes. Regulation is targeted at the operator to ensure minimisation of consequences and maximisation of the internalisation of potential externalities. Conversely, the negative consequences of long term agriculture and forestry activities, e.g., river sedimentation, land salinisation, soil acidification, are view as externalities for which society as a whole should take responsibility and therefore contribute to their remediation. This imbalance can be corrected.

The mining industry has a strong history of business planning and decision-making supported by formal risk assessment processes. Risk assessments regularly take into account social, environmental and economic issues. However, they are generally dealt with as independent issues, occasionally they are linked but they are rarely, if ever, integrated.

There is also an emerging risk management culture in Australian natural resources and water management. Risk management in natural resource science has, to date, taken a too narrow approach to economic elements of landscapes and their implications, e.g., mining, power generation, gas extraction. However, government policy and landscape planning is as yet not well supported by mature research outputs that can be applied to policy formulation with confidence. Successfully management of land and water resources where there are multiple contemporaneous resource utilisation activities being undertaken will require a new level of integration.

Risk mapping and dynamic risk management offers the necessary disciplinary foundation upon which such management can be based. A risk-based approach can be used to highlight, quantify and map threats and opportunities associated with various integrated landscape management options. A formal and well-developed risk-based approach can assist to develop landscapes where integrated views are created of intermingled economic, social and environmental activities.

The key to success is to bring together a core group of scientists who comprehend the main resource utilisation activities, who cover the social, environmental and economic domains and have in common experience with risk-based resource and business management. This group should be mirrored by a complementary group of policy makers from national, state and regional levels. Such a process offers the possibility of development of the necessary creativity required to support resource management where multiple resources co-exist.

The Sustainable Minerals Institute has the research experience, people, industry engagement and collaborative linkages to develop and lead such an initiative.