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Mining and the Environment

by

Stewart Smith

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SUMMARY

Mining makes a significant contribution to the Australian and NSW economy. This paper briefly places the contribution of mining into the context of the wider economy. It then focuses on the impact of coal mining on both natural and agricultural areas of NSW. The environmental regulatory regime that mining must operate under is reviewed, and the environmental impact of coal mining is presented for both underground and open cut mines.

NSW produces a diverse range of minerals including coal, metals, industrial minerals and construction materials. The total value of this production in 2007-08 was over $14 billion. Coal production contributed the greatest proportion of this value, with an estimated worth of over $10 billion (70% of total). The minerals industry is NSW's largest export industry, accounting for export revenue of $11.1 billion in 2006-07, which is 39% of total NSW exports. Coal accounts for 56% of the total of NSW mineral and metal exports. The NSW minerals industry is based on:

- 60 coal mines (29 underground, 31 open cut);
- 12 major metalliferous mines;
- 11 significant industrial minerals operations;
- a large number of smaller metallic and industrial mineral mines and numerous construction materials operations.

In regards to the environment, there are two main legislative provisions that relate to the regulation of mining. These are the:

- *Environmental Planning and Assessment Act 1979*, which covers the assessment and approval of new mines and the extension of existing ones.
- *Mining Act 1992*. This was significantly amended in 2008, incorporating key environmental provisions.

Proposed mining operations, like other development, must be approved via the *Environmental Planning and Assessment Act 1979*. This Act has two environmental planning instruments that may apply (depending on the size of proposed development).

The first of these is the State Environmental Planning Policy (Major Projects) 2005. The aim of this Policy is to identify development to which the development assessment and approval process under Part 3A of the Act applies. Under this part of the Act, the determination of a development application is removed from the local consent authority to the Minister for Planning. Under the Policy, coal mining is subject to Ministerial determination.

The second relevant planning instrument is State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007. The SEPP highlights some key natural resource and environmental management issues that must be addressed when assessing new mining, petroleum production and extractive industries proposals.

The *Mining Act 1992* was widely amended by the *Mining Amendment Act 2008*.

However, many of the provisions in the amending Act have yet to commence. The Amendment Act included a rewrite of the objects of the Act to include reference to ecologically sustainable development, and in particular to:

(a) to recognise and foster the significant social and economic benefits to New South Wales that result from the efficient development of mineral resources.

The Act includes provisions for the regulation of mineral exploration and mining leases, including environmental management and rehabilitation.

The Environmental Impact of Mining

The environmental impact of mining is dependent on several factors, including the extraction technique and where the mine is situated. For instance, in regards to coal mining, underground mining has different impacts compared to open cut mines. This paper looks at both of these extraction methods and reviews their environmental impact.

Coal resources in the Southern Coalfield, located in the Illawarra region of NSW, is extracted using the technique of longwall mining. This is a method of underground coal mining whereby blocks of coal, known as ‘panels’, are extracted from a coal seam by a shearer moving along the face of the panel. As mining progresses along the length of the panel, the overlying strata collapses behind the advancing longwall face. Subsidence, or the lowering of the land surface is an unavoidable consequence.

There has been significant community concern about the impact of coal mining on the natural features of the Southern Coal Fields. The NSW Department of Environment and Climate Change noted that longwall mining subsidence is frequently associated with cracking of valley floors and creeklines with subsequent effects on surface and groundwater hydrology. Of particular concern is the potential for longwall mining to affect upland swamps on the Woronora Plateau. Upland swamps, particularly peat swamps, are important to catchment hydrology and ecology because they absorb water and allow runoff for long periods after rainfall has ceased.

The Sydney Catchment Authority has noted the lack of scientific data to help assess the precise nature and extent of the damage from subsidence to groundwater systems. Groundwater may play a crucial role in maintaining stream flows during periods of severe drought, and subsidence impacts on system water yield are not well understood.

In regard to the environmental impact of underground mining, the NSW Minerals Council noted that:

- Subsidence from underground mining will have some environmental effects – as do most kinds of development. The question that needs to be answered is one of the acceptability of impacts.
- Environmental impacts may be insignificant in a regional context. The impacts of mining may be localized or temporary, and not as relevant when considered in the context of other land uses in the region.

- The Government must make decisions on the acceptability of impacts by assessing a project's net benefit or cost to society by taking into account all economic, social and environmental factors.

To help inform it in late 2006 the NSW Government established an Independent Review of Coal Mining in the Southern Coalfield. The Review concluded that with few exceptions, at depths of cover greater than about 200 m coal cannot be mined economically by any mining method without causing some degree of surface subsidence. If mining of hard coking coal in the Southern Coalfield is to continue, then a certain level of subsidence impact must be accepted as a necessary outcome of that mining. In terms of planning approvals for new or extension of existing mines, the Review concluded that the key role of the Part 3A approval under the *Environmental Planning and Assessment Act 1979* should be to clearly define required environmental outcomes and to set appropriate performance standards. The subsequent role of the Subsidence Management Plan should be one of management.

On 22 June 2009 the Minister for Planning Hon Kristina Keneally MP made her first Ministerial determination on a Southern Coalfield mine since the release of the Southern Coalfields Review. The Metropolitan Colliery Project approval provided for specific environmental conditions, expressed in terms of performance measures.

The impact of mining on agricultural areas has been the focus of much recent attention. These concerns have arisen due to the granting of coal exploration licences in the in the Gunnedah Coal Field. For instance, in April 2006 the NSW Government issued BHP Billiton a five-year coal exploration licence covering 344 square kms at Caroona in the Liverpool Plains region of NSW. In August 2008 the Government granted an exploration licence to the China Shenhua Energy Company for the Watermark area near Gunnedah for a period of five years.

A major concern of the Liverpool Plains community is the impact of coal exploration and mining on underground and water resources. These concerns are not restricted to this region alone, so it is potentially illuminating to see what restrictions or guidelines on the coal industry have been applied in another major agricultural region, the Hunter Valley.

Open cut mining is the main extraction method in the Hunter Valley. This involves scraping off overburden and digging out a pit to recover the coal. This can result in a whole different set of environmental impacts compared to underground mining.

Open cut mining can have major impacts on streams, alluvial aquifers and alluvial soils. Mining which removes alluvium to reach coal beneath has an obvious impact on an alluvial aquifer, requiring it to be dewatered during mining, and with very little probability of successful restoration afterwards.

Salt occurs naturally in many of the rocks and soils of the Hunter Valley. Some of this salt is leached into groundwater and nearby rivers. During coal mining, salty

water collects in mine pits, and has to be pumped out to allow mining to continue. What to do with this saline water is a major management problem for many coal mines.

Underground coal mining close to or beneath alluvial aquifers, or open cut mining close to alluvial aquifers may lead to fracturing of the hard rock layers that confine the ground water. The result is that any significant degree of fracturing will establish additional conduits for increased movement of saline groundwater into the alluvial aquifers, and to surface water features.

In response to these concerns, Government agencies operate under an informal policy that no further open cut mining should take place within the Hunter River's alluvial floodplain and its prime alluvial aquifer. There has also been a guideline on the management of stream and aquifer systems in the Hunter Valley, which provides for 40m setbacks in the case of underground mines to alluvial aquifers, and a 150m setback for an open cut mine.

On the 14th May 2009 the Hon Lee Rhiannon MLC introduced a Private Members Bill into the Legislative Council. The *Mining Amendment (Safeguarding Agricultural Land And Water) Bill 2009* sought to amend the *Mining Act* to protect prime agricultural land and water sources that feed it from mining operations and mining exploration. The Bill, whilst supported by the Coalition Opposition, was negatived at the Second Reading Speech stage on June 4th 2009. One of the disputed points was how to define and identify prime agricultural land.

In response to community concerns about the impact of mining exploration on the water resources of the Namoi River catchment, the Minister for Primary Industries Hon Ian Macdonald MLC established a water study working group in August 2008. Chaired by former Member the Hon Pam Allan, the Minister told Parliament on 4th June 2009 that the working group had finalised and agreed to a draft terms of reference for an initial water study in the Namoi catchment.

Mining contributes enormously to the Australian and NSW economy. The minerals industry is NSW's largest export industry, accounting for export revenue of $11.1 billion in 2006-07, which is 39% of total NSW exports. However, this is not without cost. Environmental groups and some sectors of the community would like to see greater environmental protection of natural features from the environmental impacts of coal mining, particularly subsidence. Similarly, the potential impact of mining on water resources of the State has created conflict in agricultural communities. With estimated Australian coal reserves of some 200 years, this debate seems far from over.

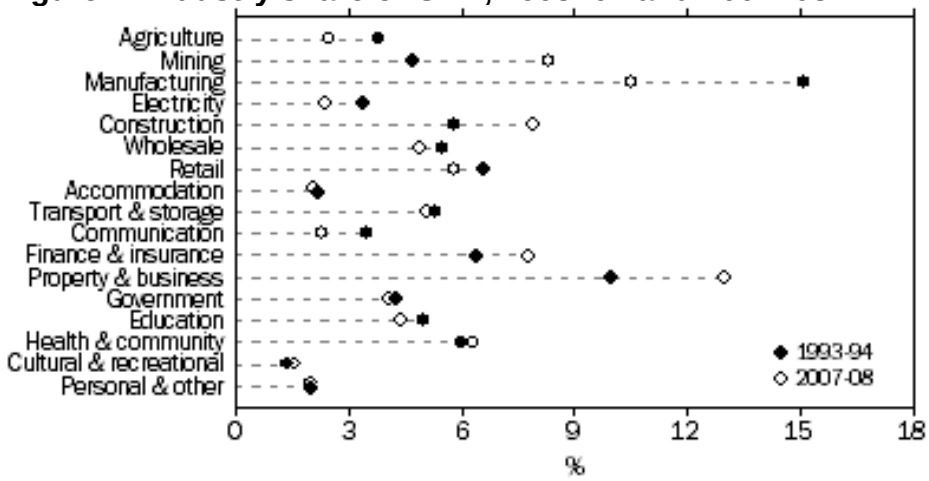
1.0 INTRODUCTION

Mining makes a significant contribution to the Australian and NSW economy. This paper briefly places the contribution of mining into the context of the wider economy. It then focuses on the impact of coal mining on both natural and agricultural areas of NSW. The environmental regulatory regime that mining must operate under is reviewed, and the environmental impact of coal mining is presented for both underground and open cut mines.

2.0 THE ECONOMIC CONTRIBUTION OF MINING TO AUSTRALIA AND NSW

Contemporary Australia has an economy based on services. Figure 1 shows the industry share of Gross Domestic Product (at basic prices excluding ownership of dwellings) for the main sectors of the economy, both for 1993-94 and 2007-08. It shows that Mining has increased its share over the period from around four percent of the GDP to eight percent. Over the same time, Manufacturing has shrunk considerably, and the share of Agriculture has reduced from around four percent to less than three percent.

Figure 1: Industry share of GVA, 1993- 94 and 2007- 08



Industry GVA at basic prices as a proportion of total GVA at basic prices.

Source: ABS, Australian System of National Accounts, 2007-08 Cat No 5204.0, 31/10/2008.

The ABS reports that Mining industry profits increased by 160% between 2002–03 and 2007–08. Over the same period the investment undertaken by Mining increased by 212%. However, over the same period Mining gross value added in volume terms increased by only 12%, with the significant increase in profits driven by growth in the prices of mining commodities.[1]

2.1 NSW Mineral Production

NSW produces a diverse range of minerals including coal, metals, industrial

[1] ABS, Australian System of National Accounts, 2007-08 Cat No 5204.0, 31/10/2008.

minerals and construction materials. The total value of this production in 2007-08 was over $14 billion. Coal production contributed the greatest proportion of this value, with an estimated worth of over $10 billion (70% of total).[2] The minerals industry is NSW's largest export industry, accounting for export revenue of $11.1 billion in 2006-07, which is 39% of total NSW exports. Coal accounts for 56% of the total of NSW mineral and metal exports. The NSW minerals industry is based on:

- 60 coal mines (29 underground, 31 open cut);
- 12 major metalliferous mines;
- 11 significant industrial minerals operations;
- a large number of smaller metallic and industrial mineral mines and numerous construction materials operations.[3]

Coal mining is mainly concentrated in the Sydney – Gunnedah Basin within the State's five coalfields: Hunter; Newcastle; Gunnedah; Western; and Southern, as shown in Figure 2. Metallic mining operations are concentrated in three main areas of the State: Broken Hill; Orange and Cobar.

In 2007– 08 the NSW Government approved a number of new coal and other mineral projects along with extensions to existing mines, including the:

- $405 million Moolarben coal mine near Ulan in the Western Coalfield.
- $140 million stage one of the Narrabri North coal mine in the Gunnedah Coalfield;
- $35 million Belmont coal mine (recently renamed Rocglen), also in the Gunnedah Coalfield;
- $105 million Snapper mineral sands project in the Murray Basin.
- Extensions to the Bengalla, Bulga, Drayton, Invincible, Liddell, Mt Arthur and Mt Owen (Glendell extension) coal mines.[4]

At the end of 2007-08 it was reported that there are more than 40 coal and mineral projects and mine extensions proposed for development over the next decade in NSW. If all were to proceed the cumulative investment in NSW would be more than $7 billion.[5] In particular, higher coal prices have stimulated investment in the NSW coal industry, which has triggered a community response in certain areas.

Total NSW mining royalties in 2007-08 was around $573.57 million, of which coal royalties contributed $494.39 million (86%).

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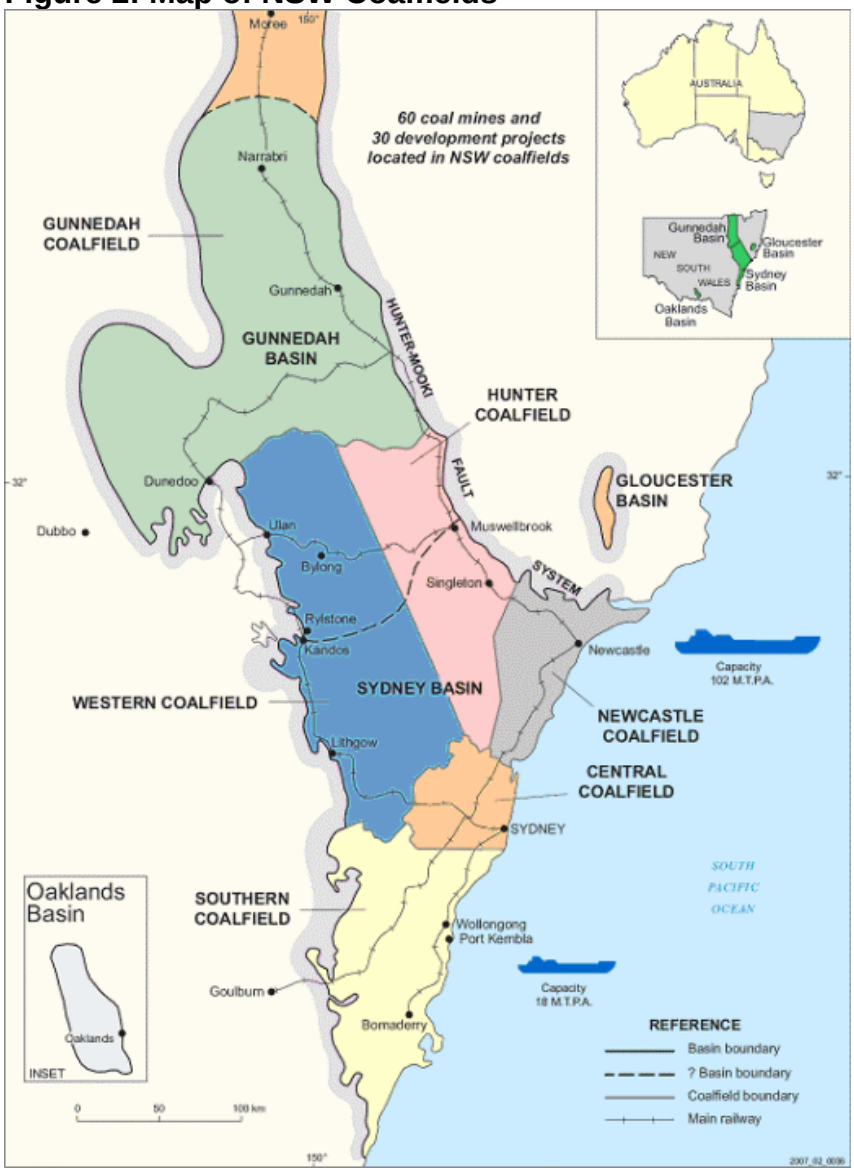
2 NSW Department of Primary Industries, *Annual Report 2007-08*.

3 NSW Department of Primary Industries, *2008 New South Wales Minerals Industry Annual*. 2008.

4 NSW Department of Primary Industries, *Annual Report 2007-08*.

5 NSW Department of Primary Industries, *Annual Report 2007-08*.

Figure 2: Map of NSW Coalfields



Source: NSW Department of Primary Industries, *2008 New South Wales Minerals Industry Annual*. 2008.

3.0 THE MINING REGULATORY REGIME

In regards to the environment, there are two main legislative provisions that relate to the regulation of mining. These are the:

- *Environmental Planning and Assessment Act 1979*, which covers the assessment and approval of new mines and the extension of existing ones.
- *Mining Act 1992*. This was significantly amended in 2008, incorporating key environmental provisions.

Both of these legislative provisions in the context of mining are outlined below.

3.1 The Environmental Planning and Assessment Act 1979

Proposed mining operations, like other development, must be approved via the *Environmental Planning and Assessment Act 1979*. This Act has two environmental planning instruments that may apply (depending on the size of proposed development). The first of these is the State Environmental Planning Policy (Major Projects) 2005 and the second is SEPP (Mining, Petroleum Production and Extractive Industries) 2007. The impact of these SEPPs and how they relate to the Environmental Planning and Assessment Act in relation to the mining regulatory regime is reviewed below.

State Environmental Planning Policy (Major Projects) 2005

The aim of this Policy is to identify development to which the development assessment and approval process under Part 3A of the Act applies. Under this part of the Act, the determination of a development application is removed from the local consent authority to the Minister for Planning.

Mining development where Part 3A applies:
(a)is coal or mineral sands mining, or
(b)is in an environmentally sensitive area of State significance, or
(c)has a capital investment value of more than $30 million or employs 100 or more people.
(2)Extracts a bulk sample as part of resource appraisal or a trial mine comprising the extraction of more than 20,000 tonnes of coal or of any mineral ore.
(3)Development for the purpose of mining related works (including primary processing plants or facilities for storage, loading or transporting any mineral, ore or waste material) that:
(a)is ancillary to or an extension of another Part 3A project, or
(b)has a capital investment value of more than $30 million or employs 100 or more people.

From 2010 all proposed extensions to underground coal mining operations will require approval under Part 3A of the *Environmental Planning and Assessment Act 1979*.[6]

Similar provisions apply to petroleum (oil, gas and coal seam methane) development. Extractive industries included under Part 3A are those that:
(a)extract more than 200,000 tonnes of extractive materials per year, or
(b)extract from a total resource of more than 5 million tonnes, or
(c)extract from an environmentally sensitive area of State significance.

Any development for the geosequestration of carbon dioxide will be assessed under Part 3A of the Act.

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6 NSW Government, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield. Strategic Review*, July 2008.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

This SEPP was gazetted in February 2007, and consolidated previous provisions and introduced new provisions with the aim to ensure that potential environmental and social impacts are adequately addressed during the assessment and determination of these development proposals.

The Policy includes provisions for:

- Prohibited development;
- Permissible development;
- Complying development;
- Exempt development.

The SEPP highlights some key natural resource and environmental management issues that must be addressed when assessing new mining, petroleum production and extractive industries proposals, including:

- Impacts on significant water resources, including surface and groundwater resources;
- Impacts on biodiversity including threatened species;
- Greenhouse gas emissions (including downstream emissions) having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.

An assessment of land-use compatibility is now required as part of an application for a new mine, quarry or petroleum production facility. In addition, a land-use compatibility assessment will also be required for any proposed development adjacent to an existing mine, quarry or petroleum production facility or development on land identified as containing minerals, extractive materials or petroleum resources. The assessment will be used to determine the potential for land-use conflict and land-use constraint in respect to adjacent land uses.

3.2 The Mining Act 1992

The *Mining Act 1992* was widely amended by the *Mining Amendment Act 2008*. However, many of the provisions in the amending Act have yet to commence.

The Amendment Act included a rewrite of the objects of the Act as follows:

The objects of this Act are to encourage and facilitate the discovery and development of mineral resources in New South Wales, having regard to the need to encourage ecologically sustainable development, and in particular:

(a) to recognise and foster the significant social and economic benefits to New South Wales that result from the efficient development of mineral resources, and
(b) to provide an integrated framework for the effective regulation of authorisations for prospecting and mining operations, and
(c) to provide a framework for compensation to landholders for loss or damage resulting from such operations, and
(d) to ensure an appropriate return to the State from mineral resources, and

(e) to require the payment of security to provide for the rehabilitation of mine sites, and
(f) to ensure effective rehabilitation of disturbed land and water, and
(g) to ensure mineral resources are identified and developed in ways that minimise impacts on the environment.

The Act includes provisions for the regulation of mineral exploration and mining leases, including environmental management and rehabilitation.

As discussed later in the paper, subsidence of land forms due to underground mining is a key regulatory issue. Under the enforcement powers of the *Mining Act 1992*, the NSW Government introduced a new subsidence management policy and approvals process in March 2004. As part of these reforms, Subsidence Management Plans (SMP) are now a requirement of all underground coal mines, whether they are new or expanding projects. Plans must be based on a full land use description and impact assessment. Physical landforms and surface infrastructure must be addressed, along with ecosystems and items of potential heritage or archaeological significance. The onus is on the company to demonstrate how it proposes to manage any subsidence which may be caused by underground mining.[7]

A Subsidence Management Plan is first assessed by an internal Department of Primary Industries review committee, which reviews the technical merits and adequacy of the Plan regarding the potential impacts of subsidence. This committee may request amendments, or refer the Plan to an interagency committee comprising representatives from DPI, the Department of Environment and Climate Change (DECC), the Department of Planning (DoP), and the Mine Subsidence Board. Representatives from other agencies (such as the Sydney Catchment Authority, Dam Safety Committee, Roads and Traffic Authority and Heritage Office) are also involved where appropriate.

The committee develops conditions of approval and makes recommendations to the approval authority, which is the Director-General of DPI. These approvals are restricted to a maximum period of 7 years and are subject to annual review.[8]

In the case of new coal mines, the key approval remains the development consent process in the *Environmental Planning and Assessment Act*. The Department of Primary Industries states that subsidence impacts are primarily considered as part of the consent process. Subsidence and its impacts must be addressed within the necessary environmental impact statement. The preparation and approval of a Subsidence Management Plan in compliance with this process will then be required as a condition of consent. Approval of the Plan is necessary prior to

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7 NSW Department of Primary Industries, *Subsidence Management Plans a way forward*. 30 March 2005.

8 NSW Department of Primary Industries, *Mine Subsidence*, Prime Fact No 21. February 2006.

mining commencing.[9]

4.0 THE ENVIRONMENTAL IMPACT OF MINING

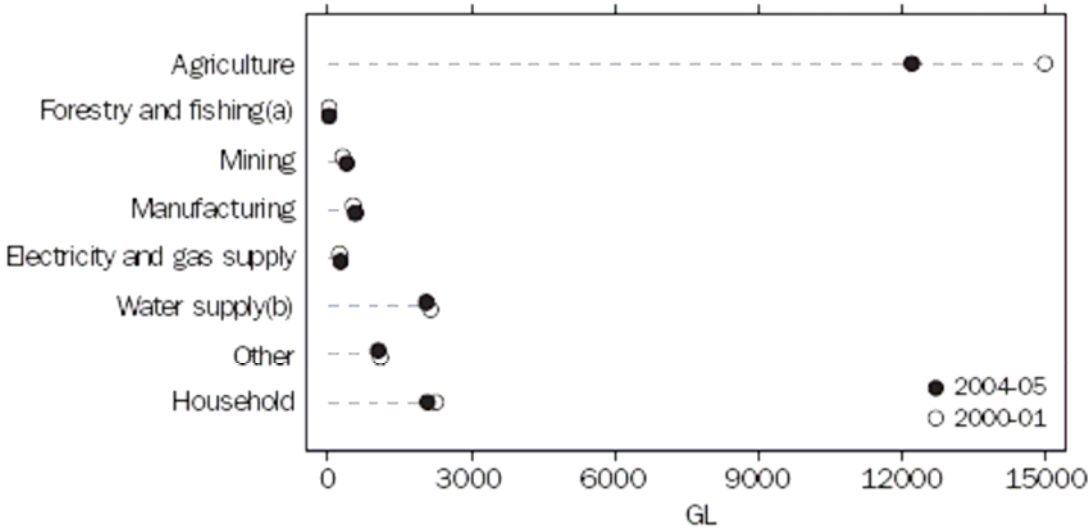
The environmental impact of mining is dependent on several factors, including the extraction technique and where the mine is situated. For instance, in regards to coal mining, underground mining has different impacts compared to open cut mines. This section of the paper first looks at the issue of water supply and mining, and the balance looks at the wider environmental impact of coal mining.

4.1 Water consumption by sector

A major criticism of mining operations has been their use of water, especially in the face of drought, climate change and other uses, principally agriculture. Hence it is pertinent to look at industry sector water use.

The Australian Bureau of Statistics publishes Water Account Australia, with the latest release 2004-05. Water consumption in Australia for 2004-05 was 18,767 gigalitres (GL), a decrease of 14% from 2000-01. In 2004-05, the agriculture industry had the highest water use, accounting for 65% of total water consumption – see Figure 3.

Figure 3: Australian water consumption by sector 2004-05 and 2000-01

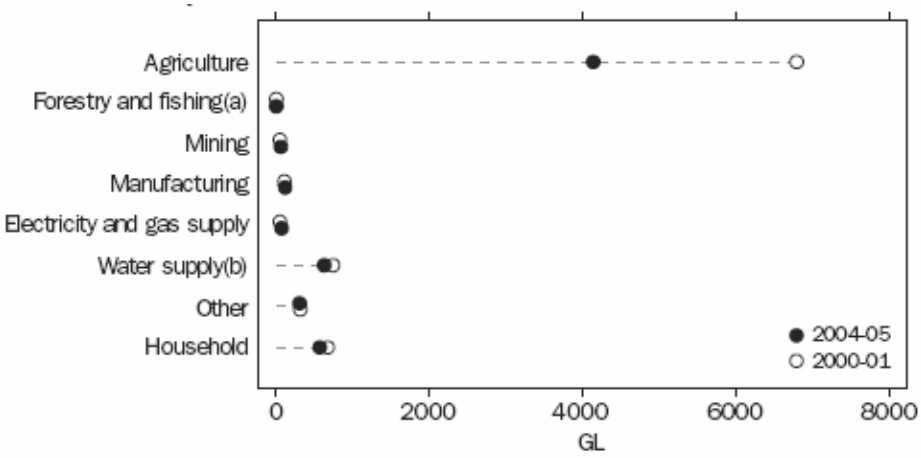


Source: ABS, Water Account Australia, 2004-05, Catalogue No. 4610.0.

In New South Wales and the ACT combined, water consumption was 5,978 GL during 2004–05. Again the highest consumer was the agriculture industry with 4,134 GL or 69% of water consumption – see Figure 4.

[9] NSW Department of Primary Industries, *New Approval Process For Management Of Coal Mining Subsidence. Policy.* 2003.

Figure 4: Water consumption by sector – NSW / ACT combined 2004-05 and 2000-01.



(a) Includes Services to agriculture; hunting and trapping.
(b) Includes Sewerage and drainage services.

Source: ABS, Water Account Australia, 2004-05, Catalogue No. 4610.0.

Table 2 summarises water consumption of the agricultural and mining sectors for 2004-05. There has been considerable community debate about the impact of coal mining on agricultural areas, and in particular access to water resources. The data in Table 2 shows that in NSW coal mining uses two percent of the water used by livestock agriculture. Total mining consumes 1.5 percent of the water used by total agriculture.

Table 2: NSW Water Consumption by sector 2004-05

	Water Consumption ML
Agriculture	
Dairy farming	262,547
Vegetables	68,692
Sugar	531
Fruit	133,540
Grapes	171,450
Cotton	964,306
Rice	624,422
Livestock	259,177
Pasture	693,508
Grains	838,321
Other	116,042
Total Livestock	1,907,048
Total Agriculture	4,132,536
Mining	
Coal mining	39,289
Oil and gas extraction	
Metal ore mining	14,702
Other mining	8,877
Total mining	62,868

Source: ABS, Water Account Australia, 2004-05, Catalogue No. 4610.0.

However, whilst mining may consume a small percentage of total water use, critics of mining identify the detrimental environmental impact of mining on water resources such as aquifers and surface streams as a concern. The next section of the Paper expands on this issue and looks at the wider environmental impact of mining.

4.2 The Wider Environmental Impact of Coal Mining

In recognition of the strategic role of coal mining to the NSW economy and its potential impact on the environment and communities, the NSW Government has commissioned a variety of reviews to assist environmental assessment of proposed mines. For instance:

- In January 2004 the Government granted approval for a 25,000 tonne bulk sample of coal from Bickham in the Upper Hunter Valley, which generated significant community concern. In tandem with this approval, the Government also announced a strategic investigation into the implications of extending coal mining in that region.[10]
- On 6 December 2006 the NSW Government established an independent inquiry into underground coal mining in the Southern Coalfield.[11]
- On 5 February 2007 the NSW Government appointed an Independent Expert Panel to conduct a strategic inquiry into potential coal mining impacts in the Wyong Local Government Area. The Inquiry was established by the Minister for Planning due to concerns held by the community over potential future mining-related impacts on the Central Coast.[12]
- In 2009 the Department of Planning commissioned an independent review of the cumulative impacts of coal mining on the village of Camberwell in the Upper Hunter Valley.[13] The Department has engaged independent experts to undertake this review.

4.3 The Environment and Mining in the Southern Coalfields

The Southern Coalfield extends along the Illawarra Escarpment to the south of Sydney and southwest to Bargo and Berrima. Coal mining has occurred in the Illawarra for more than 150 years. One of the miners in the area, BHP Billiton, has

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10 NSW Government, *Coal Mining Potential in the Upper Hunter Valley. Strategic Assessment*. December 2005.

11 NSW Government, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield.* Strategic Review, July 2008.

12 NSW Government, *Impacts of Potential Underground Coal Mining in the Wyong Local Government Area Strategic Review,* July 2008.

13 See: http://www.planning.nsw.gov.au/planningsystem/pdf/irp_camberwell_advert_publicmeeting.pdf

estimated that extractable coal reserves utilising current technology would see a viable industry continuing for at least another 30 years.[14]

The primary method of coal extraction in the Southern Coalfield is longwall mining. This is a method of underground coal mining whereby blocks of coal, known as 'panels', are extracted from a coal seam by a shearer moving along the face of the panel. As mining progresses along the length of the panel, the overlying strata collapses behind the advancing longwall face. Subsidence, or the lowering of the land surface is an unavoidable consequence of any mining method that extracts large proportions of the coal resource, such as longwall mining. The coal miners operating in the Southern Coalfields state that longwalls are the most efficient, safest and economically viable method to extract coal in that area.[15]

The extent to which subsidence occurs in a particular location depends upon the width and height of the coal extracted, its depth from the surface, and the rock types found in the overlying strata.[16] The NSW Scientific Committee has listed 'alteration of habitat following subsidence due to longwall mining' as a key threatening process under the *Threatened Species Conservation Act 1995*. The Minister for the Environment has determined that the current Subsidence Management Plan process addresses this key threatening process and that the development of a Threat Abatement Plan would be unnecessary.[17]

The Southern Coalfield contains significant natural features including rivers, associated sandstone river gorges, major cliff lines and upland swamps. It also contains important flora, fauna and aquatic ecosystems; many listed threatened species, populations and endangered ecological communities and a significant number of Aboriginal heritage sites. The major land use includes water supply catchment for the Sydney and Illawarra Regions and associated dams and other major water storage infrastructure.[18]

There has been significant community concern about the impact of coal mining on the natural features of the Southern Coal Fields. For instance, the Board of the Environment Protection Authority noted:

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14 BHP Billiton, *Illawarra Coal, Submission to the Independent Inquiry into NSW Southern Coalfield.* July 2007.

15 BHP Billiton, *Illawarra Coal, Submission to the Independent Inquiry into NSW Southern Coalfield.* July 2007.

16 Mine Subsidence Board, *Mine Subsidence – A Community Guide*. 2007.

17 NSW Department of Primary Industries, *Mine Subsidence*, Prime Fact No 21. February 2006.

18 NSW Government, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield.* *Strategic Review*, July 2008.

> There is significant evidence of the impacts resulting from current operations in the Southern Coalfields including extensive and irreversible damage in some areas that has been well documented. It is imperative that impacts resulting from existing or future operations be avoided in sensitive areas.[19]

The NSW Department of Environment and Climate Change noted that longwall mining subsidence is frequently associated with cracking of valley floors and creeklines with subsequent effects on surface and groundwater hydrology. Of particular concern is the potential for longwall mining to affect upland swamps on the Woronora Plateau. Upland swamps, particularly peat swamps, are important to catchment hydrology and ecology because they absorb water and allow runoff for long periods after rainfall has ceased. Surface cracking as a result of longwall mining subsidence can have a variety of impacts on riverine features or attributes. These include:

- Loss of surface flows or water levels;
- Loss of aquatic or instream habitats. Complete drying of river pools or wetlands has occurred. The loss of these surface features is potentially irreversible in some cases;
- Loss of connectivity between pools as surface water is lost to subsurface flows;
- Loss of water quality (Increased iron oxides, manganese, sulphides and electrical conductivity, and lower dissolved oxygen).
- Simplification of remaining instream habitat due to the growth of iron-oxidising bacteria which can also be seen as a rusty-coloured mass in the water.
- Release of gas into the water column.[20]

The Department of Environment and Climate Change (DECC) considered that much of the impact / damage to natural features from longwall mining is unacceptable as many are irreversible and contrary to the principles of ecologically sustainable development. Of key concern to DECC is that subsidence due to longwall mining has had significant impacts on:

1. River health and water dependent ecosystems, including threatened species and endangered ecological communities;
2. Aboriginal culture and heritage.[21]

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19 NSW EPA Board, *Inquiry into NSW Southern Coalfield. NSW EPA Board Submission*. 2007.

20 NSW Department of Environment and Climate Change, Scientific Services Report, *Ecological Impacts of Longwall Mining in the Southern Coalfields of NSW – A Review.* July 2007.

21 NSW Department of Environment and Climate Change, *Submission on the strategic review of the impacts of underground mining in the Southern Coalfield*, July 2007.

4.3.1 Longwall Mining in Water Catchment Areas

The Sydney Catchment Authority (SCA) manages greater Sydney's drinking water catchment areas. To ensure quality raw water, land around some of the Authority's dams has been declared 'Special Area'. These areas are managed by the SCA and Department of Environment and Climate Change. A long-standing regulatory framework excludes access and limits activities inside Special Areas to certain essential services such as water monitoring. Other significant activities in Special Areas are associated with the surface workings related to underground longwall mining.

The Upper Nepean and Woronora catchments south of Sydney include the catchments of the Cataract, Cordeaux, Avon, Nepean and Woronora rivers. The entire Upper Nepean catchment is declared a Special Area, known as the Metropolitan Special Area. The Woronora Catchment is also a declared Special Area.

Underground longwall mining in the Southern Coalfields occurs under much of the Metropolitan Special Area. Mining occurs mainly under the Cataract, Cordeaux and Woronora dam catchments which form part of the Upper Nepean and Woronora water supply systems. Around 20 per cent of the water supplied by the Sydney Catchment Authority is sourced from these catchments. The Authority estimates that within the next 20 years, 91 percent of the Special Areas will have been undermined by either longwall or bord and pillar coal extraction methods.

In their submission to the Southern Coalfields Review, the Sydney Catchment Authority highlighted the lack of scientific data to help assess the precise nature and extent of the damage from subsidence to groundwater systems. Groundwater may play a crucial role in maintaining stream flows during periods of severe drought, and subsidence impacts on system water yield are not well understood.

4.3.2 Case study on Waratah Rivulet

The Metropolitan Mine operation began in 1995 and the extraction of coal from the planned 17 longwalls is expected to be completed by 2009. Longwalls 10 to 14 are 158 metres wide and run adjacent to and under the Waratah Rivulet. These longwalls resulted in subsidence of approximately 1.3 metres and upsidence of approximately 150mm. The impacts from this subsidence and upsidence on Waratah Rivulet included:

- loss of flows for approximately two kilometers of the rivulet from fracturing of river bed and rock bars;
- changed groundwater flow direction with increased fracture permeability and porosity of aquifer and surface water – groundwater interaction (the extent, direction and permanence of water loss remains unknown);
- water quality affected by mineralisation produced from rock fracturing;
- significant changes to aquatic ecology from loss of water and changes to water quality.[22]

[22] Sydney Catchment Authority, *Submission to Inquiry into the NSW Southern Coalfields*. July 2007.

Figure 5: Subsidence Impacts at Waratah Rivulet

Note cracking of stream bed and no water flow.
Source: Sydney Catchment Authority, *Submission to Inquiry into the NSW Southern Coalfields*. July 2007.

In contrast to these environmental perspectives, the NSW Minerals Council noted that:

- Subsidence from underground mining will have some environmental effects – as do most kinds of development. The question that needs to be answered is one of the acceptability of impacts.
- Environmental impacts may be insignificant in a regional context. The impacts of mining may be localized or temporary, and not as relevant when considered in the context of other land uses in the region.
- The Government must make decisions on the acceptability of impacts by assessing a project's net benefit or cost to society by taking into account all economic, social and environmental factors.[23]

The Southern Coalfields Review concluded that with few exceptions, at depths of cover greater than about 200 m coal cannot be mined economically by any mining method without causing some degree of surface subsidence. If mining of hard coking coal in the Southern Coalfield is to continue, then a certain level of subsidence impact must be accepted as a necessary outcome of that mining.[24]

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23 NSW Minerals Council, *Submission to the Independent Expert Panel into Underground Mining in the Southern Coalfield*. July 2007.

24 NSW Government, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield. Strategic Review*, July 2008.

4.3.3 Best Practice Assessment and Regulatory Processes

There were a range of views presented to the Southern Coalfields Review of whether the current mining approval process is adequate. For instance, the EPA Board is of the view that there are significant issues with the mining planning approval and regulatory process. It argued that:

- There is insufficient assessment of underground mining impacts at the approval stage. The approvals process needs an effective whole of government approach which would allow all the expertise available to Government to be focused on the issues;
- The present Subsidence Management Plan approach does not appear to be adequate, as it occurs after the mining strategy has already been planned and is too late in the process to properly address impacts and influence mine planning;
- Environmental matters are not adequately addressed in the Subsidence Management Plan process. Environmental issues should be identified and resolved prior to the approval of plans. Furthermore, the ability of government agencies to adequately assess the Subsidence Management Plan process is impaired by short timeframes and insufficient expertise or resources on often highly technical issues.[25]

The Sydney Catchment Authority submitted that past decisions on mining approvals have not fully considered the potential impacts of diminished groundwater reserves and the maintenance of surface flows. Nor have they considered the potential impacts on aquifers, in terms of either their interconnectedness or their capacity to recover lost resources.

In the absence of such confidence the Authority concluded that it can be difficult to determine whether some impacts are so serious as to call into question the viability of the proposed activity or whether, as is often the case, the impacts can be managed through imposing a range of conditions. In addition, very little is known about the long term effectiveness of current remediation techniques in natural systems. The SCA defined three fundamental questions that need to be addressed in any consideration of the management of water resources. These were:

> 1. What are the medium-term and long-term impacts of mining-related subsidence on water resources and related ecosystems?
>
> 2. What are the risks to groundwater and aquifers from subsidence? Where does the water go and how long will it take to restore natural water systems?
>
> 3. Is remediation of the impacts of mining-related subsidence possible?[26]

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25 NSW EPA Board, *Inquiry into NSW Southern Coalfield. NSW EPA Board Submission*. 2007.

26 Sydney Catchment Authority, *Submission to Inquiry into the NSW Southern Coalfields*. July 2007.

The NSW Minerals Council stated that each mining proposal should be assessed on its own merits. It noted that geology, subsidence behaviour and the nature of impacts and the receiving environment all vary both within and between mining regions. The economic value of coal reserves also varies between different areas. Hence this case by case approach to assessment should continue to ensure informed decision making.

The Minerals Council strongly argued that mandated setback zones to prevent longwall mining under significant natural features are inappropriate and illogical. It considered that the extent and magnitude of subsidence related movements are related to many factors including depths of cover and coal seam characteristics.[27]

Illawarra Coal (a division of BHP Billiton) noted that the imposition of a single environmental standard for natural features in the Southern Coal field would impose considerable costs on the company. For instance, a 1 km buffer to streams would result in the majority of the Southern Coalfield's coal resources being lost.[28]

Illawarra Coal considered that the current risk management framework and approval processes are effective and that interest group concerns revolve around their view of acceptability rather than a whole of community perspective. It also recommended an extension of the current approval process to consider the economic trade-off of different levels of environmental restrictions, including no restriction. In Illawarra Coal's opinion, this economic trade-off should be the primary consideration of government.[29]

4.4.4 The Southern Coalfields Review Response

The Southern Coalfields Review considered these range of views and how the approval and regulatory process works. It concluded that the key role of the Part 3A approval under the *Environmental Planning and Assessment Act 1979* should be to clearly define required environmental outcomes and to set appropriate performance standards. The subsequent role of the Subsidence Management Plan should be one of management. Subsidence Management Plans should demonstrate how the required environmental outcomes will be achieved, what monitoring will occur and how deviations and contingencies will be addressed.

The Review concluded that the acceptability of impacts under Part 3A should be determined within a framework of risk-based decision-making, using a combination of environmental, economic and social values, risk assessment of potential environmental impacts, consultation with relevant stakeholders and consideration of sustainability issues.

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27 NSW Minerals Council, *Submission to the Independent Expert Panel into Underground Mining in the Southern Coalfield*. July 2007.

28 BHP Billiton, *Illawarra Coal, Submission to the Independent Inquiry into NSW Southern Coalfield.* July 2007.

29 BHP Billiton, *Illawarra Coal, Submission to the Independent Inquiry into NSW Southern Coalfield.* July 2007.

In regard to the potential impact on significant natural features, the Review recommended the development of what it termed Risk Management Zones (RMZs). These zones should be identified for all significant environmental features which are sensitive to valley closure and upsidence, including rivers, significant streams, significant cliff lines and valley infill swamps.

The Review recommended that these zones should be defined from the outside extremity of the surface feature, either by a 40° angle from the vertical down to the coal seam which is proposed to be extracted, or by a surface lateral distance of 400 m, whichever is the greater.

The Review did not recommend that mining should not be allowed within these risk management zones. Instead, it stated that approved mining within identified RMZs should be subject to increased monitoring and assessment requirements that address subsidence effects, subsidence impacts and environmental consequences. The Review concluded that due to the extent of current knowledge gaps, a precautionary approach should be applied to mining that might unacceptably impact highly significant natural features. The approvals process should require a 'reverse onus of proof' from the mining company before any mining is permitted which might unacceptably impact highly significant natural features.

The Review concluded that the Government has a responsibility to provide improved guidance on which natural features are of significance and to what extent and what level of environmental risk is acceptable. This is in order to properly inform company risk management processes, community expectations and the approvals process. It found that currently there is a lack of clear guidance regarding which features are of what level of significance, and what level of protection is required for each. It concluded that longwall mining is a large scale, high productivity, capital intensive mining process with long lead times to establish extraction panels, and that consequently it needs timely approvals to facilitate continued production.[30]

In response to the publication of the Southern Coalfield Inquiry report, neither the mining nor conservation groups were satisfied with its recommendations. The NSW Minerals Council gave a "qualified response", noting that some of the recommendations had the potential to prejudice some future mining operations in the region.[31] The Total Environment Centre noted: "The Inquiry has been a major disappointment with the recommendations providing the industry the certainty it was demanding through long term approvals, while offering the upland swamps and river systems … no firm protection in return."[32]

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30 NSW Government, *Impacts of Underground Coal Mining on Natural Features in the Southern Coalfield. Strategic Review*, July 2008.

31 NSW Minerals Council, *Media Release* "Mining Industry Response To Southern Coalfield Panel Report". 10 July 2008.

32 Burgess, D. "Protection: not 'Risk Management' more longwall planned." In *Total Environment*, 2008, Issue 3.

4.4.5 The Metropolitan Coal Project Approval

Metropolitan Colliery is an underground coal mining operation located 30 kilometres north of Wollongong. It currently produces around 1.5 million tonnes of coal per annum. The colliery recently sought an extension of its mine to continue operating for another 25 years.

Project approval to continue mining for up to 23 years was granted by the Minister for Planning Hon Kristina Keneally MP on 22 June 2009. It is the first Ministerial determination for a coal mine in the region since the publication of the Southern Coalfields Review. Hence it provides some guidance on the Government's response to the Review.

The Southern Coalfields Review concluded that a key role of a Part 3A Ministerial determination should be to clearly define required environmental outcomes and to set appropriate performance standards. The Metropolitan Colliery Project approval did just this, and included specific environmental conditions expressed not in terms of setbacks or exclusion zones but in terms of performance measures. These are outlined in Table 3.

Table 3: Environment Performance Measures for the Metropolitan Colliery Approval

Catchment yield to the Woronora Reservoir	Negligible reduction to the quality or quantity of water resources reaching the Woronora Reservoir. No connective cracking between the surface and the mine.
Woronora Reservoir	Negligible leakage from the Woronora Reservoir. Negligible reduction in the water quality of Woronora Reservoir.
Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23 (upstream of Pool P).	Negligible environmental consequences (that is, no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining, and minimal gas releases).
Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26.	Negligible environmental consequences over at least 70% of the stream length (that is no diversion of flows, no change in the natural drainage behaviour of pools, minimal iron staining and minimal gas releases).
Threatened species, populations, or ecological communities	Negligible impact.
Cliffs	Less than 3% of the total length of cliffs (and associated overhangs) within the mining area experience mining induced rock fall.
Aboriginal heritage sites	Less than 10% of Aboriginal heritage

	sites within the mining area are affected by subsidence impacts.

The exception to this approach involves the protection of three identified swamps. In this case, the approval conditions stated that the Proponent shall not undermine the three swamps without the written approval of the Director-General. In seeking this approval, the Proponent needs to submit the following information:
(a) a comprehensive environmental assessment of the:

- potential subsidence impacts and environmental consequences of the proposed Extraction Plan;
- potential risks of adverse environmental consequences; and
- options for managing these risks;

(b) a description of the proposed performance measures and indicators for these swamps; and
(c) a description of the measures that would be implemented to manage the potential environmental consequences of the Extraction Plan on these swamps and comply with the proposed performance measures and indicators.[33]

4.4 The Environmental Impact of Mining on Agricultural Areas

The Southern Coalfields Review largely focussed on the impact of mining induced subsidence on natural features on the earth's surface. Mining in other coal fields can have impacts in their respective areas. For instance, the impact of mining on agricultural areas has been the focus of much recent attention.

These concerns have arisen due to the granting of coal exploration licences in the in the Gunnedah Coal Field. For instance, in April 2006 the NSW Government issued BHP Billiton a five-year coal exploration licence covering 344 square kms at Caroona in the Liverpool Plains region of NSW.[34]

In August 2008 the NSW Government granted an exploration licence to the China Shenhua Energy Company for the Watermark area near Gunnedah for a period of five years. The licence is for an area of about 190 sq km which is expected to contain shallow coal resources of domestic and export quality thermal coal. Open cut mining is the likely extraction method. As part of the bid China Shenhua Energy Company gave the following commitments:

- Up to $300 million in payments to the NSW Government;
- $1million annually for five years to a new regional community trust;
- Invest $175million for transport infrastructure;
- An additional $200 million if a mining lease is eventually granted.

The Minister reiterated that the licence is for exploration only, not mining, and stated: "There is strict environmental regulation, which ensures that exploration

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33 NSW Department of Planning, *Development Approval, Metropolitan Coal Project*. 22 June 2009.

34 BHP Billiton, *Exploration Licence 6505*.

does not have any significant impacts on aquifers."[35]

4.4.1 Coal Exploration and the Liverpool Plains

The Liverpool Plains is part of the Namoi River Catchment, which is a highly productive agricultural region of Australia. Ground water in the Namoi catchment supports an irrigation industry worth in excess of $380m as well as being the water supply for many towns and intensive industries such as feedlots. There are a total of 700 licence holders in the Namoi.[36] Figure 6 provides an aerial view of part of the plains around the town of Caroona. The extensively irrigated areas is evident from the image. Figure 7 provides an aerial view of open cut mines near the town of Camberwell in the Lower Hunter Valley. As noted in the introduction to this section of the Paper, the NSW Department of Planning has commissioned an independent study to look at the cumulative effects of coal mining on the town of Camberwell.

Figure 6: Irrigated fields surrounding the town of Caroona, Liverpool Plains

Source: Google Earth, accessed June 2009.

35 NSW Department of Primary Industries, *Media Release* "$300 million exploration licence to be granted near Gunnedah". 15 August 2008.

36 Namoi Catchment Management Authority, *Groundwater*.

Figure 7: Open Cut Coal Mines near the town of Camberwell, Hunter Valley.

Source: Google Earth, Accessed June 2009

In 2007 the National Centre for Groundwater Management reviewed the 'knowledge and gaps' of groundwater in the Namoi Catchment Area. Despite being one of the most studied catchments in Australia, it found considerable knowledge gaps. The review recognized that there is a growing interest in both gas and coal potential of the Gunnedah Basin, which underlies the alluvial sediments of the Liverpool Plains, and stated:

> The development of the Caroona Coal Exploration area has the potential to have significant effects on the local surface and ground water quality and quantity. Of larger concern is that this exploration is only the beginning of the expansion of the coal industry within the Namoi Catchment.[37]

Other leading researchers have also done a significant amount of work on the groundwater of the Namoi Valley. Scientists Timms and Acworth from the University of NSW stated that, based on the research that had been carried out in the past 10 years, they believe that coal mining on the Liverpool Plains will impact on the groundwater system used for irrigation, stock and domestic use if mining is carried out beneath the flat-lying plains. They noted that management strategies on the Liverpool Plains are currently addressing the adverse impacts that irrigation development has had on the groundwater system. If coal mining is to proceed, the additional impacts on groundwater recharge, groundwater levels and water quality

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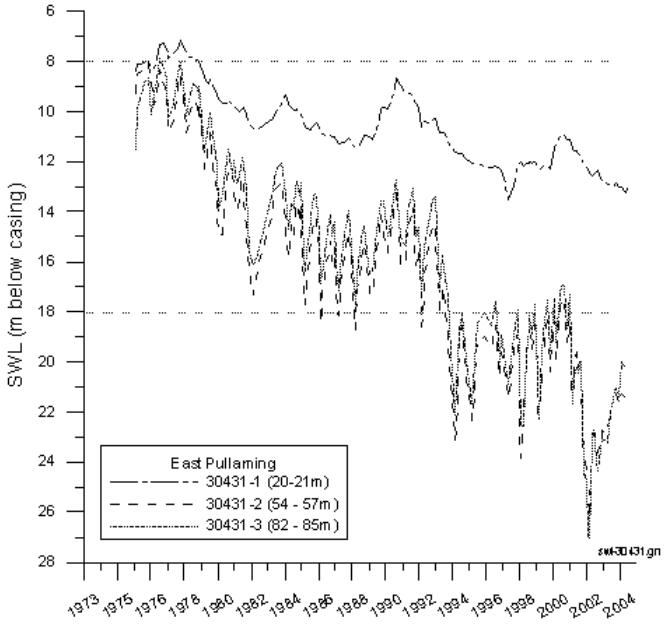
37 University of Technology, National Centre for Groundwater Management, *Groundwater Knowledge and Gaps in the Namoi Catchment Management Area*. March 2007.

will require careful investigation and management.[38]

Timms and Acworth note that the age of the groundwater in the Namoi Valley is of the order of tens of thousands of years. In parts of the region high levels of extraction have resulted in the reversal of the natural groundwater flow, and the result is that current pumping may effectively be mining the aquifer. Falling groundwater levels are clearly seen at some sites, as shown in Figure 8.[39]

Figure 8. Groundwater level declines since the 1970s at a monitoring site near Breeza, Namoi River Valley.



Source: Timms W. and Acworth I., **"**Coal mining and the Liverpool Plains: Aquifers and Aquitards" in *Plains Talk,* June 2006, No. 33

Initially in response to the granting of an exploration licence in the Caroona area, in 2006 a citizens action group (the Caroona Coal Action Group on the Liverpool Plains) was established. The group has the following platform:

> CCAG are pressing for an immediate moratorium on any kind of resource exploration on the Liverpool Plains so that an independent, catchment-wide water study can be performed to understand the interconnections and

38 Timms W. and Acworth I., **"**Coal mining and the Liverpool Plains: Aquifers and Aquitards" in *Plains Talk,* June 2006, No. 33

39 Timms W. and Acworth I., **"**Coal mining and the Liverpool Plains: Aquifers and Aquitards" in *Plains Talk,* June 2006, No. 33

intricacies of the aquifers beneath these prime agricultural rich soil plains.[40]

The action group states that it is not opposed to mining so long as it can be shown that any such mining would not pose unacceptable risks to the groundwater systems and environment of the region.

As part of their actions, but without success, landowners have pursued legal avenues in an attempt to prevent BHP Billiton drilling exploratory boreholes on their properties. Things came to a head in mid July 2008 when the local community set up a blockade to prevent BHP Billiton access to a landholder's property. Negotiations with BHP Billiton regarding land access are continuing. In October 2008 BHP Billiton released an interim exploration report which stated the following:

- BHP Billiton is not considering longwall mining underneath the floodplain of the Liverpool Plains;
- BHP Billiton is not considering longwall mining underneath the deep alluvial irrigation aquifers;
- BHP Billiton is not considering longwall mining underneath the Mooki River or the Quirindi Creek;
- BHP Billiton is not considering open cut mining on any part of the Caroona Exploration Licence Area;
- The company will complete its program of regional exploration drilling in the non-target area to further develop knowledge of deep alluvial irrigation aquifers and regional geology within the Exploration Licence Area;
- The targeted exploration area represents approximately 126 square kilometres of the 350 square kilometre Exploration Licence Area;
- BHP Billiton will focus future exploration on the ridge country away from high value agricultural land.[41]

A major concern of the Liverpool Plains community is the impact of mining on underground and water resources. These concerns are not restricted to this region alone, so it is potentially illuminating to see what restrictions or guidelines on coal mining have been applied in another major agricultural region, the Hunter Valley.

4.4.2 Coal Mining and Agriculture in the Hunter Coalfield

The Hunter Coalfield is currently the major coal producing region in NSW. This is due to its extensive coal reserves, known geology, and well developed transport and other supporting infrastructure.[42]

In 2005 the then Department of Infrastructure, Planning and Natural Resources released a strategic assessment of coal mining potential in the Upper Hunter

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40 Caroona Coal Action Group. About Us.

41 BHP Billiton, "BHP Billiton Announces Targeted Exploration Plans." In *Caroona Coal Project*, October 2008.

42 NSW Government, Department of Infrastructure, Planning and Natural Resources, *Coal Mining Potential in the Upper Hunter Valley Strategic Assessment*. March 2005.

Valley. The assessment noted the regionally significant prime agricultural lands in the Upper Hunter, with particular value to the equine, dairying, horticultural and cropping industries. It also noted the regional value of the Pages River catchment. Unlike the Southern Coalfield where all coal mining is from underground longwall extraction, coal mining in the Hunter and Gunnedah Coalfields can be by either open cut or longwall extraction, depending on the site characteristics of the resource. Longwall mining in the Hunter Valley can produce similar subsidence impacts as discussed for the Southern Coalfields. Open cut mining involves scraping off overburden and digging out a pit to recover the coal. This can result in a whole different set of environmental impacts.

Salt occurs naturally in many of the rocks and soils of the Hunter Valley. Some of this salt is leached into groundwater and nearby rivers. During coal mining, salty water collects in mine pits, and has to be pumped out to allow mining to continue. What to do with this saline water is a major management problem for many coal mines.

Underground coal mining close to or beneath alluvial aquifers, or open cut mining close to alluvial aquifers may lead to fracturing of the hard rock layers that confine the ground water. The result is that any significant degree of fracturing will establish additional conduits for increased movement of saline groundwater into the alluvial aquifers, and to surface water features.[43]

The Upper Hunter Strategic Review noted that open cut mining can clearly have major impacts on streams, alluvial aquifers and alluvial soils. Mining which removes alluvium to reach coal beneath has an obvious impact on an alluvial aquifer, requiring it to be dewatered during mining, and with very little probability of successful restoration afterwards.

In response to these concerns, Government agencies operate under an informal policy that no further open cut mining should take place within the Hunter River's alluvial floodplain and its prime alluvial aquifer. There has also been a guideline on the management of stream and aquifer systems in the Hunter Valley, which provides for 40m setbacks in the case of underground mines to alluvial aquifers, and a 150m setback for an open cut mine.

The Upper Hunter Strategic Review concluded:

> A formal policy should be developed to avoid or minimise potential impacts of coal mining on major streams and aquifers in the Hunter Valley and elsewhere in the State. Along with this, guidelines should be developed for the assessment of coal mine impacts on streams and aquifers in seeking approvals under Part 3A of the Ep&A Act.[44]

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43 NSW Government, Department of Infrastructure, Planning and Natural Resources, *Coal Mining Potential in the Upper Hunter Valley Strategic Assessment*. March 2005.

44 NSW Government, Department of Infrastructure, Planning and Natural Resources, *Coal Mining Potential in the Upper Hunter Valley Strategic Assessment*. March 2005, at 131.

Such a policy has not been developed. The Review noted that the application of such a policy would result in restricting coal mine development within or beneath the alluvium or alluvial aquifers of the Hunter River and its major tributaries.

The Centre for Social Sustainability in Mining monitors the impact of mining on communities. In 2004 it conducted a case study of Muswellbrook, and found the following:

- It is clear that most people in the community accept that the mining industry is a key driver of the local economy and that the fortunes of Muswellbrook are, to a considerable extent, tied to the future of the industry.
- The environmental impacts of mining – both on 'near neighbours' and the wider area – are an important issue for the Muswellbrook community. 'Near neighbours' have a range of specific issues that demand attention, although not all of these are amenable to resolution. The community more generally has concerns about dust, noise, visual impacts, water quality and the loss of farming land to mining. Most of these concerns relate not to the impact of any one operation, but to the overall – or 'cumulative' – impact that mining is having on the area.
- It is apparent that in Muswellbrook, as elsewhere, trust – or, rather, the lack of it - remains an issue for the industry. While most stakeholders acknowledged that the environmental and social performance of the local mining industry had generally improved in recent years, this was often attributed to stricter regulatory controls rather than to the industry's own efforts.
- Some stakeholders were prone to over-state the extent to which the mining industry and its practices had been the cause of social and environmental changes in the Muswellbrook area. For example, criticisms of the industry's water management practices tended to overlook the fact that the long term decline in water quality in the Hunter River is due largely to land degradation and agricultural practices over many decades.[45]

Two themes emerge from these studies reported above. These are water, the life-blood of agriculture, and the second is the cumulative impact of mines. The Upper Hunter Review noted the characteristics of the Pages River with its relatively high water quality and its importance to the community for a wide variety of users. The Review concluded that a priority was to protect this water source, and concluded that if a new mine could not provide sufficient assurance of sound life of mine water management (including management relating to mine closure and post-mining), then there is little point in a proponent preparing a full environmental assessment and entering the expensive and protracted project approval process.

The Review recommended that any application for coal mining within the Pages River Catchment contain a Water Resource Report and a draft life-of-mine Water

[45] Brereton D. and Forbes, P *Monitoring the Impact of Mining on Local Communities: A Hunter Valley Case Study*. Centre for Social Responsibility in Mining, University of Queensland. 2004.

Management Plan. In relation to the Bickham proposal (within the Pages River catchment) the Review stated that such a plan should:

i. Examine contained and surrounding aquifers, to confirm whether the low salinity groundwater found to date at Bickham is typical of the proposed mine site and its surroundings or represents a more localised anomaly;
ii. Model and assess groundwater responses to ongoing open cut de-watering and associated aquifer de-pressurisation;
iii. Examine connectivity between the Pages River, its alluvial aquifer and the hard rock aquifers, with particular reference to the G seam in the case of Bickham;
iv. Examine appropriate means of avoiding any significant inflow from the River or its aquifer to the mine, if required;
v. Examine means of minimising generation of mine wastewater, maximising use or re-use of mine wastewater, and options for the mine to achieve a 'nil discharge' status;
vi. Demonstrate that there is negligible residual risk to the River and its ecosystems … associated with mining;
vii. Discuss potential final void configurations, modelled groundwater inflow post mining, and post-mining management options and outcomes for any residual water resources impacts; and
viii. Report and discuss water resource concerns by the community.

The Review concluded:

> Mining should not proceed if it cannot be adequately demonstrated at an early stage that the River and its associated conservation values will not be significantly impacted.[46]

4.4.3 Coal Exploration in the Namoi Valley – Government Response

On the 14th May 2009 the Hon Lee Rhiannon MLC introduced a Private Members Bill into the Legislative Council. The *Mining Amendment (Safeguarding Agricultural Land And Water) Bill 2009* sought to amend the *Mining Act* to protect prime agricultural land and water sources that feed it from mining operations and mining exploration. The Bill, whilst supported by the Coalition Opposition, was negatived at the Second Reading Speech stage on June 4th 2009. One of the disputed points was how to define and identify prime agricultural land.

In response to community concerns about the impact of mining exploration on the water resources of the Namoi River catchment, the Minister for Primary Industries Hon Ian Macdonald MLC established a water study working group in August 2008. Chaired by former Member the Hon Pam Allan, the Minister told Parliament on 4th June 2009 that the working group had finalised and agreed to a draft terms of reference for an initial water study in the Namoi catchment. The Minister stated:

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46 NSW Government, Department of Infrastructure, Planning and Natural Resources, *Coal Mining Potential in the Upper Hunter Valley Strategic Assessment*. March 2005, at 131.

> Farmers and mining interests need to work together for the good of each other and the State. I firmly believe farming and mining can co-exist. Mining is the lifeblood of many regional towns while at the same time agriculture obviously makes a significant contribution to both the State and national economy. It puts the food on our tables. …
>
> The purpose of the water study is to collate quality data to assist in identifying the risks, if any, associated with mining and coal development on water resources. The scope of the study is to be the entire Namoi catchment. I also tell the House today that I am appointing Mr Mal Peters, former President of the New South Wales Farmers Association, to be the independent chair of the Ministerial Oversight Committee to progress the initial Namoi catchment water study. The committee … will be responsible for the tendering of the project, appointment of an independent expert and ongoing administration of the study. It will conduct a progress review at the start of each phase and undertake a review prior to the release of any information. It will also closely liaise with the stakeholder advisory group, who will keep the community, informed of the progress of the study. There will be an ongoing comprehensive stakeholder engagement process conducted throughout the study.[47]

5.0 CONCLUSION

Mining contributes enormously to the Australian and NSW economy. The minerals industry is NSW's largest export industry, accounting for export revenue of $11.1 billion in 2006-07, which is 39% of total NSW exports. However, this is not without cost. Environmental groups and some sectors of the community would like to see greater environmental protection of natural features from the environmental impacts of coal mining, particularly subsidence. Similarly, the potential impact of mining on water resources of the State has created conflict in agricultural communities. With estimated Australian coal reserves of some 200 years, this debate seems far from over.

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47 *NSWPD*, *Namoi Catchment Water Study*, 4th June 2009, at p.15741