WATERMARK
COAL PROJECT
ENVIRONMENTAL IMPACT STATEMENT
February 2013

AF
Economic Impact Assessment

Watermark Coal Project

Economic Impact Assessment

Prepared for

Shenhua Watermark Coal Pty Ltd
C/- Hansen Bailey Pty Limited

By

Gillespie Economics
Email: gillecon@bigpond.net.au

October 2012

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EXECUTIVE SUMMARY

Gillespie Economics was commissioned by Hansen Bailey Environmental Consultants, on behalf of Shenhua Watermark Coal Pty Ltd to complete an economic impact assessment for the Watermark Coal Project. The purpose of the assessment is to form part of an Environmental Impact Statement (EIS) being prepared to support an application for State Significant Development Consent for the Project under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project seeks approval to extract up to 10 million tonnes per annum (Mtpa) of Run-Of-Mine (ROM) coal over a period of 30 years.

From an economic perspective there are two important aspects of the Project that can be considered:

- the economic efficiency of the Project (i.e. consideration of economic costs and benefits of the Project); and
- the economic impacts of the Project (i.e. the economic activity that the Project would provide to the local, regional and NSW economy).

A Benefit Cost Analysis (BCA) of the Project indicated that it would have net production benefits to Australia of $1,321M. Provided the residual environmental, social and cultural impacts of the Project that accrue to Australia are considered to be valued at less than $1,321M, the Project can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

Instead of leaving the environmental, cultural and social impacts unquantified, an attempt was made to quantify them. The main quantifiable environmental impacts of the Project that have not already been incorporated into the estimate of net production benefits, relate to greenhouse gas emissions, road transport impacts and surface water and groundwater impacts. These impacts are estimated at $93M globally or $6M to Australia, considerably less than the estimated net production benefits of the Project. There may also be some non-market benefits of employment provided by the Project which are estimated to be in the order of $324M. Overall, the Project is estimated to have net social benefits to Australia of between $1,315M and $1,639M and hence is desirable and justified from an economic efficiency perspective.

While the BCA is primarily concerned with the aggregate costs and benefits of the Project to Australia, the costs and benefits may be distributed among a number of different stakeholder groups at the local, state, National and global level. The total net production benefit will be distributed amongst a range of stakeholders including:

- Shenhua Watermark shareholders in the form of after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of any Company tax payable ($745M present value) or Minerals Resource Rent Tax from the Project, which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the local and regional area;
- the NSW Government via royalties ($565M present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the local and regional area; and
- the local and regional community in the form of voluntary contributions to community infrastructure and services ($11M present value).

The environmental, cultural and social impacts of the Project may potentially accrue to a number of different stakeholder groups at the local, State, National and global level, however, are largely internalised into the production costs of Shenhua Watermark.

Noise costs, air quality costs and agricultural production costs will occur at a local level. These have been incorporated into the estimation of net production benefits via acquisition costs for affected properties and mitigation costs. As such, the bearers of these costs are compensated. Road transport impacts would also occur at the local level with the costs of road works included in the estimate of net production benefits. Residual road transport impacts have been estimated and found to be insignificant. Similarly, surface water and groundwater effects will occur at the local level, but have been incorporated into the analysis via inclusion of the costs of acquisition of Water Access Licences and the opportunity cost of reduced flows in rivers. Greenhouse gas costs will occur at the national and global level and will be internalised through payment of the Commonwealth Government's carbon tax. The economic costs associated with the clearing of native vegetation will occur at the State level and would be counterbalanced by the Project biodiversity offsets. Similarly Aboriginal heritage impacts will potentially occur to Aboriginal people and NSW households[1], however, these economic costs would be counterbalanced by the Project Aboriginal Heritage Offsets Areas and mitigation strategies. The cost of providing biodiversity and Aboriginal heritage offsets is included in the estimation of net production benefits. Visual impacts will occur at the local level and will be internalised by Shenhua Watermark through the funding of visual mitigation measures. All of these measures mean that those who experience costs have them either mitigated or compensated. Other potential environmental impacts would largely occur at the local level and were found to be insignificant. Any non-market benefits associated with employment provided by the Project would largely accrue at the local or State level[2].

The non-market costs that accrue to NSW are estimated at less than $6M. These are less than the net production benefits (and potential non-market employment benefits) that directly accrue to NSW. Consequently, as well as resulting in net benefits to Australia, the Project would result in net benefits to NSW.

For this study, economic impacts have been estimated for three regions:

- The local economy comprising the Local Government Areas (LGAs) of Gunnedah, Tamworth and Liverpool Plains;
- The regional economy comprising the LGAs of Gunnedah, Tamworth, Liverpool Plains, Narrabri and Upper Hunter; and
- The NSW economy.

The economic impact analysis, using input-output analysis, found that the operation of the Project is estimated to make up to the following contribution to the local economy:

- $902M in annual direct and indirect regional output or business turnover;
- $493M in annual direct and indirect regional value added;
- $80M in annual direct and indirect household income; and
- 908 direct and indirect jobs.

The impact of the Project operation on the regional economy is estimated at up to:

- $913M in annual direct and indirect regional output or business turnover;
- $507M in annual direct and indirect regional value added;
- $91M in annual direct and indirect household income; and

[1] Non-market valuation studies that have surveyed NSW households have found that they value the conservation of highly significant Aboriginal heritage (Gillespie Economics 2008, 2009a, 2009b).

[2] It should be noted that the study from which the employment values were transferred, surveyed NSW households only.

- 1,015 direct and indirect jobs.

For the NSW economy, the operation of the Project is estimated to make up to the following contribution:

- $1,554M in annual direct and indirect regional output or business turnover;
- $802M in annual direct and indirect regional value added;
- $276M in annual direct and indirect household income; and
- 3,260 direct and indirect jobs.

Cessation of the Project operation may lead to a reduction in economic activity. The significance of these Project cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Project cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

1 INTRODUCTION

1.1 ECONOMIC ASSESSMENT

Gillespie Economics was commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Shenhua Watermark Coal Pty Ltd (Shenhua Watermark) to complete an economic impact assessment for the Watermark Coal Project (the Project). The purpose of the assessment is to form part of an Environmental Impact Statement (EIS) being prepared to support an application for State Significant Development Consent for the Project under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The scope of work completed by Gillespie Economics for this assessment included addressing the Director-General's Environmental Assessment Requirements (EARs) relating to economics, issued on 19 April 2012. These indicate that an economic assessment is required as part of the EIS including:

- a detailed assessment of the potential direct and indirect economic benefits of the project for local and regional communities and the State;
- a description of the measures that would be implemented to minimise the adverse social and economic impacts of the Project, including any infrastructure improvements or contributions and/or voluntary planning agreement or similar mechanism[3]; and
- a detailed assessment of the costs and benefits of the development as a whole, and whether it would result in a net benefit for the NSW community.

In this respect, consideration was given to the relevant aspects of the Department of Planning and Infrastructure's (DP&I) (James and Gillespie, 2002) *Draft Guideline for Economic Effects and Evaluation in EIA*).

From an economic perspective there are two important aspects of the Project that can be considered:

- The economic efficiency of the Project (i.e. consideration of the economic costs and benefits of the Project); and
- The economic impacts of the Project (i.e. the economic activity that the Project will provide to the local, regional or NSW economy).

The DP&I's draft guideline (James and Gillespie, 2002) identifies economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The draft guideline (James and Gillespie, 2002) identifies BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

The above draft guideline indicates that economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic stimulus to the local, regional and NSW economy can be estimated using input-output modelling (economic impact assessment).

It is important not to confuse the results of the economic impact assessment, which focuses on indicators of economic activity i.e. direct and indirect output (expenditure/revenue), value-added, income and employment, in a specific region, with the results of BCA which is concerned with the net benefits from the Project.

[3] This EAR is mainly addressed in the Social Impact Assessment. Mitigation measures that will be implemented to minimise the adverse environmental externalities of the Project (that are considered in this economic impact assessment) are addressed in the respective specialist reports.

This study relates to the preparation of each of the following types of analyses:

- A BCA of the Project (Section 2); and
- An economic impact assessment of the Project (Section 3) for three regions:
  - The local economy comprising the Local Government Areas (LGAs) of Gunnedah, Tamworth and Liverpool Plains;
  - The regional economy comprising the LGAs of Gunnedah, Tamworth, Liverpool Plains, Narrabri and Upper Hunter; and
  - The NSW economy.

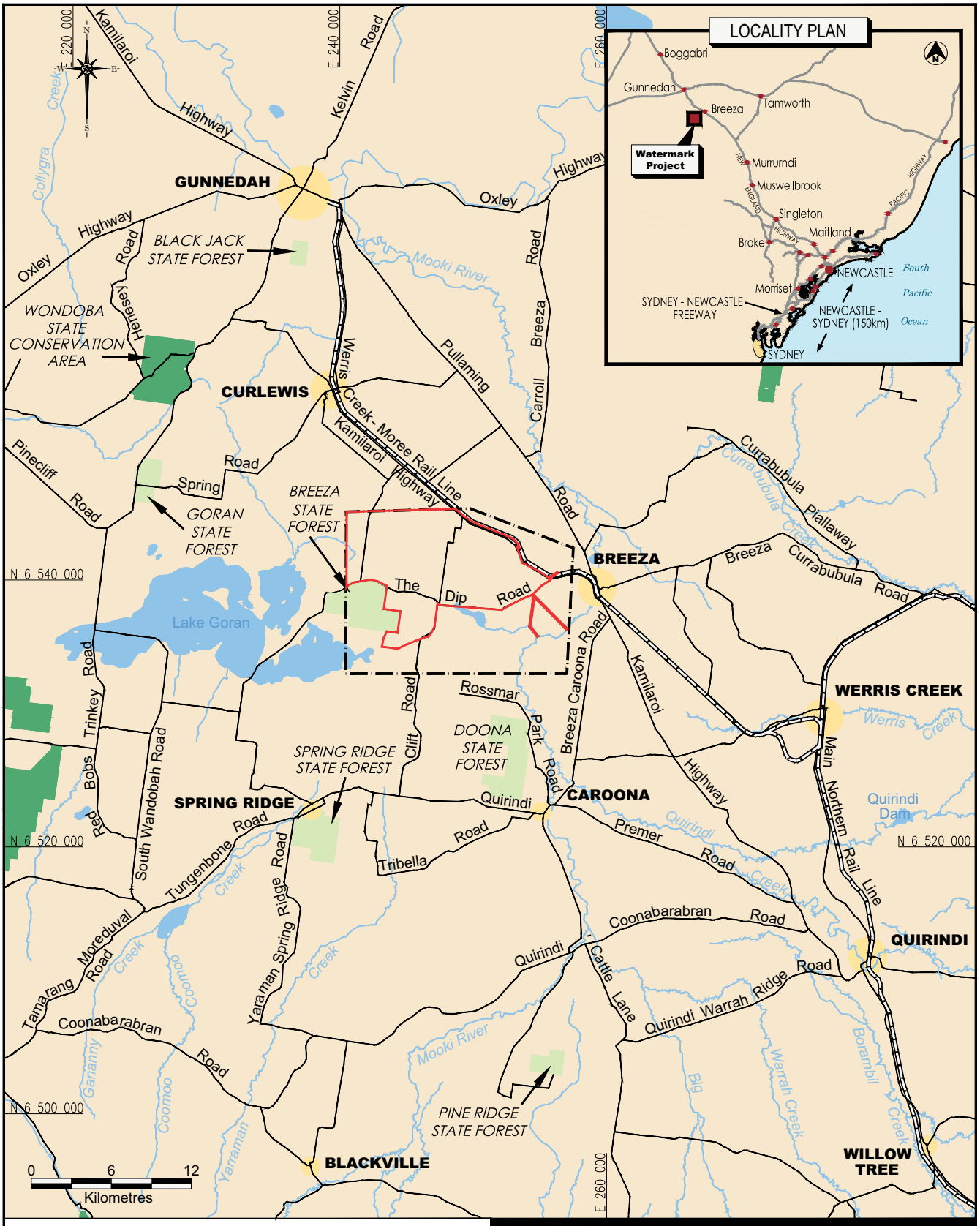
1.2 PROJECT DESCRIPTION

In October 2008, following a competitive tender process, Shenhua Watermark was granted EL 7223 by the Minister for Mineral Resources. The Project is located entirely within EL 7223, approximately 25 km south south-east of the township of Gunnedah and to the immediate west of the village of Breeza, within the Gunnedah Local Government Area (LGA). The Project is approximately 282 km by rail from the export Port of Newcastle.
Figure **1**.1 illustrates the regional locality of the Project in relation to the nearest town centres of Breeza, Curlewis and Gunnedah.

The Project generally comprises:

- The construction and operation of an open cut mining operation extracting up to 10 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for a 30 year period;
- An open cut mining fleet of excavators and shovels, supported by haul trucks, dozers, graders, drill rigs and water carts;
- Progressive rehabilitation of all disturbed areas;
- The construction and operation of a Coal Handling and Preparation Plant (CHPP) with a throughput of 10 Mtpa ROM coal;
- The co-disposal of tailings and coarse reject within the Overburden Emplacement Areas (OEA);
- The construction and operation of a rail spur, rail loop, Kamilaroi Highway rail overpass, associated load out facility and connection to the Werris Creek - Moree Railway Line;
- The construction and operation of a Mine Access Road;
- The construction and operation of administration, workshop and related facilities;
- The construction and operation of ground and surface water management and reticulation infrastructure including pipelines, pumping stations and associated infrastructure for access to water from groundwater aquifers, the Mooki River and private dams to the north-east of the Project Boundary;
- The installation of communications and electricity reticulation infrastructure; and
- A workforce of up to approximately 600 full-time equivalent employees during construction and up to 600 full-time equivalent employees during the operation of the Project.

The conceptual layout of the Project is shown in Figure 1.2.

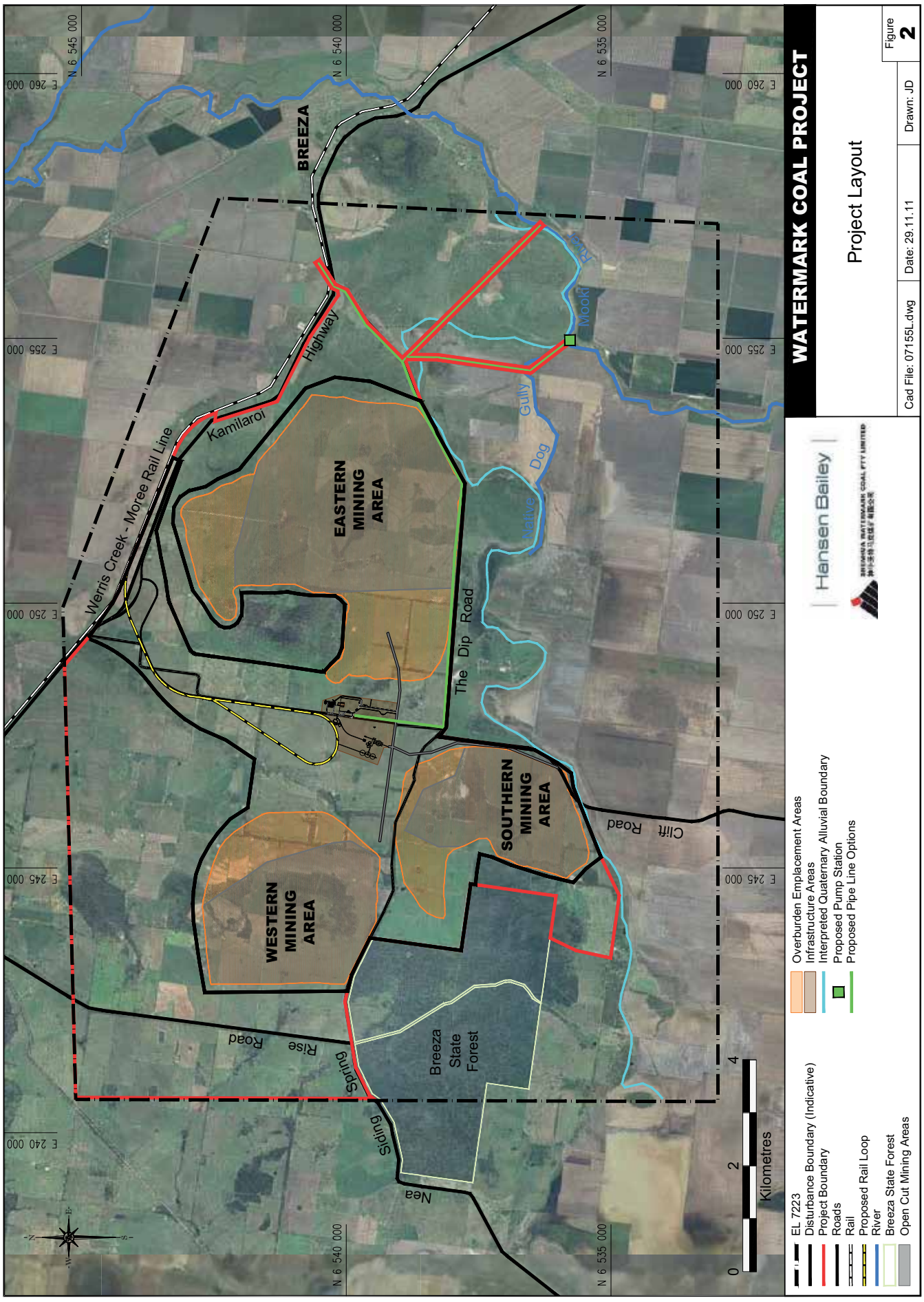


WATERMARK COAL PROJECT

Regional Locality

Cad File: 07152E.dwg	Date: 02.03.11	Drawn: JD	Figure 1

Gillespie Economics


WATERMARK COAL PROJECT
Project Layout
Figure 2
Cad File: 07155L.dwg
Date: 29.11.11
Drawn: JD
Hansen Bailey
BREEZA
Werris Creek - Moree Rail Line
Kamilaroi Highway
EASTERN MINING AREA
WESTERN MINING AREA
SOUTHERN MINING AREA
The Dip Road
Native Dog Gully
Mooki River
Cliff Road
Rise Road
Spring
Breeza State Forest
Nea
Siding
N 6 545 000
N 6 540 000
N 6 535 000
E 260 000
E 255 000
E 250 000
E 245 000
E 240 000
0
2
4
Kilometres
EL 7223
Disturbance Boundary (Indicative)
Project Boundary
Roads
Rail
Proposed Rail Loop
River
Breeza State Forest
Open Cut Mining Areas
Overburden Emplacement Areas
Infrastructure Areas
Interpreted Quaternary Alluvial Boundary
Proposed Pump Station
Proposed Pipe Line Options

2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

Introduction to BCA

BCA has its theoretical underpinnings in neoclassical welfare economics. Applications in NSW are guided by these theoretical foundations as well as the NSW Treasury (2007). BCA applications within the NSW environmental assessment framework are further guided by NSW DP&I *Draft Guidelines for Economic Effects and Evaluation in EIA* (James and Gillespie 2002).

BCA is primarily concerned with comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the economic welfare of society and hence is desirable from an economic efficiency perspective.

BCA is not primarily concerned with distributional considerations. Nevertheless, the distribution of the costs and benefits of a Project can provide additional information that may be of assistance to decision-makers.

Definition of Society

As a tool of investment appraisal for the public sector, BCA can potentially be applied across different definitions of society. Depending on agency jurisdiction and the geographical spread of benefits and costs, this could range from the population of a Council area through to the whole world. However, most applications of BCA are at the national level. This national focus extends the analysis beyond that which is strictly relevant to a NSW government planning authority. However, the interconnected nature of the Australian economy and society creates significant spillovers between States. These include transfers between States associated with the tax system and the movement of resources over state boundaries.

Nevertheless, as identified by Boardman et al (2001), “where major impacts spill over national borders, then the BCA should be undertaken from the global as well as the national perspective”.

Adopting a sub-national perspective is not recommended (Boardman et al 2001), as it can result in a range of costs and benefits from a Project being excluded, making BCA a less valuable tool for decision-makers. This is particularly the case for major projects which involve the use of resources drawn from across the nation as well as internationally and which generate benefits that are enjoyed by people who are resident in NSW and beyond.

The BCA for this Project is undertaken from a global and national level perspective. Initially, all the benefits and costs of the Project, whomever they accrue to are included in the BCA. The BCA is then truncated to include only those benefits and costs of the Project that accrue to Australia.

Definition of the Project Scope

This raises the important issue of Project scope. The Project scope is as defined in Section 1.2. It includes the construction and operation of an open cut mining operation extracting up to 10 Mtpa of ROM coal for a 30 year period and delivery of coal to port.

This definition of the Project for which approval is being sought has important implications for the identification of the costs and benefits of the Project. Even when a BCA is undertaken from a global perspective and includes costs and benefits of a Project that accrue outside the national border, only the costs and benefits associated with the defined Project, are relevant. Put simply, only the costs and benefits from the mining of the coal from the Project and its delivery to Port are relevant.

In this regard, it is important to recognise that while coal is an intermediate good (i.e. it is used as an input into the production of other goods and services), it is not appropriate to include the costs and benefits associated with the downstream use of coal. BCA is a form of partial equilibrium analysis that attempts to isolate the marginal impacts of a particular project, holding all other things equal, including in this case the levels of downstream use of coal. The downstream use of the Project coal constitutes a different project[4], that itself can be subject to BCA. For instance, if the coal is exported to China, its potential uses are different projects that each have their own sets of costs and benefits. If the coal is proposed to be used for coal-fired electricity generation then the costs associated with that project would include the cost of coal, labour, land and capital inputs, electricity distribution and environmental impacts, such as greenhouse gas generation. The benefits associated with an electricity generation project would include the Chinese community's willingness to pay for electricity. There may also be externality benefits of electricity for economic development, education, and medical care. All of these costs and benefits are relevant considerations at this next stage of the production process.

Steps in BCA

BCA of the Project involves the following key steps:

- identification of the base case;
- identification of the Project and its implications;
- identification and valuation of the incremental benefits and costs;
- consolidation of value estimates using discounting to account for temporal differences;
- application of decision criteria;
- sensitivity testing; and
- consideration of non-quantified benefits and costs.

What follows is a BCA of the Project based on financial, technical and environmental advice provided by Shenhua Watermark and its' specialist consultants.

2.2 IDENTIFICATION OF THE BASE CASE AND THE PROJECT

Identification of the "base case" or "without" Project scenario is required in order to facilitate the identification and estimation of the incremental economic benefits and costs of the Project.

Under the base case, the land required for the Project would continue to be used for rural and other purposes. In contrast, the Project (as described in Section 1.2) is open-cut mining up to 10 Mtpa of ROM coal for a period of 30 years, and delivery of coal to Port for export.

At the end of the Project it is assumed that the residual value of capital equipment and land would be realised through sale or alternative use.

[4] As identified by NSW Treasury (2007), Projects or programs may contain a range of elements related to one another and the point at which a discrete project can be identified will require careful judgement. In this respect, NSW Treasury (2007) cautions against excessive aggregation in project scope i.e. inclusion of activities in the project scope that can themselves be considered to be separate projects.

BCA is primarily concerned with the evaluation of a project relative to the counterfactual of no project. Where there are a number of alternatives to a project then these can also be evaluated using BCA. However, alternatives need to be feasible to the proponent and to this end a number of alternatives to the Project were considered by Shenhua Watermark in the development of the Project description. Section 3 in the Main Volume of the EIS and Appendix C (Mine Justification Report) provides more detail on the consideration of Project alternatives.

The Project assessed in the EIS and evaluated in the BCA is considered by Shenhua Watermark to be the most feasible alternative for minimising environmental and social impacts whilst maximising resource recovery and operational efficiency. It is therefore this alternative that is proposed by Shenhua Watermark and was subject to detailed economic analysis.

2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or "without" Project scenario, the Project may have the potential incremental economic benefits and costs shown in Table 2.1. The main potential economic benefit is the producer surplus (net production benefits) generated by the Project and any non-market employment benefits it provides, while the main potential economic costs relate to any environmental, social and cultural costs.

Table 2.1 - Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits	Opportunity costs of capital equipment Opportunity cost of land[1] Development costs including labour, capital equipment and acquisition costs for impacted properties and offsets[1] Operating costs of mine including labour and mitigation measures Rehabilitation and decommissioning costs at end of the Project life	Value of coal production Residual value of capital equipment and land at end of Project life
Potential environmental, social and cultural impacts	Greenhouse gas impacts Noise impacts Blasting impacts Air quality impacts Surface water impacts Groundwater impacts Ecology impacts Road transport impacts Aboriginal heritage impacts Non-Aboriginal heritage impacts Visual impacts	Any non-market benefits of employment Value of ecological offsets Value of Aboriginal heritage offsets

[1] The value of foregone agricultural production is included in the value of land.

It should be noted that the potential environmental, social and cultural costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community well-being through direct use of resources by individuals or non-use. If the potential impacts do not occur or are mitigated to the extent where community wellbeing is insignificantly affected (i.e. those bearing the costs are fully compensated), then no environmental, social or cultural economic costs should be included in the Project BCA.

2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

Consistent with NSW Treasury (2007) guidelines, the analysis has been undertaken in real values with discounting at 7 percent (%) and sensitivity testing at 4% and 10%. The analysis period is 31 years. Where competitive market prices are available, they have generally been used as an indicator of economic values. Environmental, cultural and social impacts have been initially been left unquantified and interpreted using the threshold value method[5]. An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[6].

2.4.1 *Production Costs and Benefits*[7]

Production Costs

Opportunity Cost of Land and Capital

All of the land required for the Project is owned by Shenhua Watermark. There is an opportunity cost associated with using this land for the Project instead of its next best use (i.e. rural production). An indication of the opportunity cost of this land can be gained from its market value, estimated at $168M. The market value of land reflects among other things, the present value of the expected stream of profits from the next best alternative land use (agriculture).

No capital equipment that is already owned by Shenhua Watermark will be brought forward into the Project and hence there are no opportunity costs of capital apart from that which is reflected in the prices paid for machinery purchased for the project and thus reflected in the development and operating costs of the Project.

Development Cost of the Project

Development costs of the Project are associated with the purchase of mining equipment, development of the Coal Handling and Preparation Plant, associated conveyors and stockpile areas, development of the mine infrastructure area, provision of services, engineering costs, land acquisitions, site decommissioning and rehabilitation costs, purchase of water allocations, realignment of the Kamilaroi Highway and the development of a road over rail overpass of the Kamilaroi Highway. These costs include labour costs during the development of the Project, which reflect the value of labour resources in their next best use.

These incremental development costs over the life of the mine are estimated at $2 billion (B). These development costs include an allowance for acquisition of land for properties adversely affected by noise/dust/vibration and ecological offsets. Development costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Project

The operating costs of the Project include those associated with mine operation (including top soil and overburden stripping, ROM coal mining and haulage and rehabilitation), plant and infrastructure operations (including CHPP operation), coal delivery (rail freight and Port handling and loading) and general costs (including overheads and administration, marketing and the research levy). These costs include labour costs, which reflect the value of labour resources in their next best use. Average annual

[5] The threshold value method uses the value of quantified net production benefits as the amount that unquantified environmental, social and cultural costs would need to exceed to make a project questionable from an economic efficiency perspective.
[6] Benefit transfer refers to borrowing economic values that have been determined for other study sites.
[7] All values reported in this section are undiscounted Australian dollars unless otherwise specified.

operating costs (excluding depreciation and royalties) are estimated at approximately $332M per annum for the 30 year period.

While royalties are a cost to Shenhua Watermark, they are part of the overall net production benefit of the mining activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project. Nevertheless, it should be noted that the Project would generate total royalties in the order of $1,548M ($565M present value).

Depreciation has also been omitted from the estimation of operating costs since depreciation is an accounting means of allocating the cost of a capital asset over the years of its estimated useful life. The economic capital costs are included in the years in which they occur.

Rehabilitation and Decommissioning Costs

Annual rehabilitation costs are included in the operating costs for the Project reported above. A provision for final void rehabilitation works of $42M has also been included in the development costs of the Project.

Production Benefits

Value of Coal

Total ROM coal production is estimated at 268 Mt with peak production at 10 Mtpa ROM. Product coal is a combination of low ash semi-soft coking coal and high ash thermal coal, for export.

Both demand for and supply of coal influences current and projected prices.

Projected prices for the Project product thermal coal were provided by Shenhua Watermark and averaged AUD$142/tonne for coking coal and AUD$99 for thermal coal[8]. There is uncertainty around future coal prices (valued in USD) as well as the AUD/USD exchange rate and hence assumed coal prices have been subjected to sensitivity testing (see Section 2.6).

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land (excluding offsets) may have some residual value that could be realised by sale or alternative use. This residual value is incorporated into the development costs above.

2.4.2 *Environmental, Social and Cultural Costs and Benefits*

Greenhouse Gases

The Project is predicted to generate in the order of 7.7 Mt of direct carbon dioxide equivalent (CO_2-e) emissions associated with mining (Scope 1 emissions) over the lifetime of the Project (PAE Holmes 2012). Approximately 0.7 Mt of indirect (Scope 2) CO_2-e emissions associated with on-site electricity consumption and 1.6 Mt of indirect (Scope 3) CO_2-e emissions associated with the transport of product coal to Newcastle and on-site diesel and electricity use would also be generated over the lifetime of the Project (PAE Holmes 2012). The economic analysis has included these emissions as a potential environmental cost of the Project.

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required that reflects its global social costs. The global social cost of CO_2-e is the present value of additional economic damages now and in the future caused by an additional tonne of CO_2-e emissions. There is great

[8] Prices varied slightly from year to year but were essentially held constant over the life of the Project.

uncertainty around the global social cost of CO_2-e with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the global damage costs of CO_2-e is to examine the price of CO_2-e credits/taxes. Again, however, there is a wide range of prices. For this analysis, a shadow price of AUD$23/t CO_2-e rising at 2.5 per cent per year in real terms for three years and then remaining constant, was used. Sensitivity testing assuming a shadow price from AUD$8/t CO_2-e to AUD$40/t CO_2-e was also undertaken (refer to Attachment 1).

This represents the global social cost of carbon i.e. the cost of carbon emissions to the population of the whole world. In the absence of any studies that have focused on the social damage cost of carbon emissions to Australians, some means of apportioning global damage costs borne by Australians is required. For the purpose of the economic assessment this has been undertaken using Australia's share of global GDP (around 1%). An alternative approach would be Australia's share of world population which is considerably less than 1%.

Agricultural Production

The present value of foregone agricultural production is reflected in land prices. The value of foregone agricultural production, as a result of the Project, has therefore been incorporated in the BCA through inclusion of the full land value (opportunity cost) of affected properties.

Operational Noise

Mining

Construction noise levels are expected to be acceptable at all potentially affected residences, with the exception of one property that is in the noise zone of acquisition for the Project operation (Bridges Acoustics 2012).

During Project operation there are 13 properties (including 7 vacant properties) predicted as being significantly impacted by noise. A further 26 properties (including 9 vacant properties) will be moderately & mildly impacted by noise and fall with the noise management zone for the Project (Bridges Acoustics 2012).

The impact of Project noise on nearby properties can potentially be valued using the property value method, where the change in property value as a result of the noise impacts are estimated. It is expected that the owners of the property would be granted the opportunity to be acquired via conditions of the Development Consent. Instead of incorporating the partial property value impact on these properties the full cost of acquiring the affected property has been incorporated into the development costs associated with the Project[9]. This value is expected to be an over-estimate of the cost of noise caused by the Project.

Contemporary Development Consent conditions for residences in the moderate noise management zone typically require proponents to provide at receiver noise mitigation on request. The costs of these mitigation impacts are included in the development costs of the Project, reported above. It is recognised that to the extent that any residual noise impacts occur, after mitigation, noise costs of the Project included in the BCA will be understated.

[9] It is noted that there may also be some consumer surplus losses to these property owners above and beyond changes in property values. Iinclusion of the full cost of acquisition is considered likely to more than allow for these consumer surplus losses. Sensitivity testing on capital cost assumptions is also undertaken to determine the impact of changes in assumptions regarding noise impacts.

Road and Rail Noise

Noise from road traffic associated with construction activities and ongoing operation of the Project is predicted to remain within relevant traffic noise criteria for all receivers (Bridges Acoustics 2012). Consequently, no economic effects have been included in the BCA.

Existing and future background rail traffic noise levels, in the absence of the Project, are expected to exceed relevant noise criteria for two receivers in Breeza. Additional rail traffic noise associated with the Project would increase average rail traffic noise levels by approximately 0.6 to 0.7 dBA at potentially affected receivers. This is considered insignificant (Bridges Acoustics 2012). Consequently, no economic costs have been included in the BCA for rail noise impacts.

Blasting

Blasting at the Project has the potential to cause structural damage or human discomfort at properties surrounding the Project. However, blasting associated with the Project is expected to produce acceptable ground vibration and overpressure levels at all privately owned receivers and at all identified heritage structures. Consequently, no economic costs have been included in the BCA for blasting impacts.

Air Quality

12 properties (including 7 vacant properties) are predicted to experience exceedances of the various air quality criteria and so will be included into the air quality zone of acquisition.

The impacts on these properties can potentially be valued using the property value method, where the change in property value as a result of the air quality impacts are estimated. However, all of these properties are also adversely affected be noise and are included in the noise zone of acquisition.

Instead of incorporating the partial property value impact on these properties (from noise and air quality impacts), the full cost of acquiring the affected property has been incorporated into the development costs associated with the Project[10].

Surface Water

The Project is estimated to require approximately 660ML / year of makeup water from external sources for operation, which will obtained under appropriate Water Access Licences. The Project will also result in a temporary reduction in the catchment area draining to receiving watercourses of up to 760 ML due to the capture of runoff from the disturbed catchment area (WRM Water and Environment Pty Ltd 2012). Both of these impacts have been included in the BCA by applying an estimated market value of water of $2,000/ML.

Groundwater

Groundwater drawdown as a result of the Project could potentialyl result in a change in surface water flows and groundwater users in the surrounding region. It is estimated that the Project will result in an average of 16.3ML/year over the 30-year mine life flowing from the Mooki River to the underlying aquifer (Australasian Groundwater and Environmental Consultants Pty Ltd 2012). This impact has been included in the BCA by applying an estimated market value of water of $2,000/ML.

[10] It is noted that there may also be some consumer surplus losses to these property owners above and beyond changes in property values. However, inclusion of the full cost of acquisition is considered likely to more than allow for these consumer surplus losses. Sensitivity testing on capital cost assumptions is also undertaken to determine the impact of changes in assumptions.

Shenhua Watermark already hold approximately 206 units of groundwater licences under the Upper and Lower Namoi Water Sharing Plan but will require an additional 90 units under this Plan, 53 units under the Water Sharing Plan for the Phillips Creek, Mooki River, Quirindi Creek and Warrah Creek Water Sources and 940 ML/year under the NSW Murray Darling Basin Porous Rock Groundwater Sources Water Sharing Plan (Australasian Groundwater and Environmental Consultants Pty Ltd 2012). The opportunity cost of existing licences and the value of additional licences requirements are included in the BCA at $2,000/ML.

The predicted zone of depressurisation due to the Project will result in some reduction in the water level in nearby bores. However, mining is estimated to reduce water levels by less than 1% at the majority of impacted bores with only four bores estimated to experience water levels change of between 1% and 7.4%. This change is considered unlikely to noticeably reduce the pumping yield from any bore (Australasian Groundwater and Environmental Consultants Pty Ltd 2012). Consequently, no economic effects are included in the BCA.

Ecology

The Project Disturbance Boundary will result in the clearing of native vegetation including:

- 818.01 ha of state and Commonwealth-listed Box-Gum Woodland (comprising 728.20 ha of woodland and 72.54 ha of derived native grassland);
- 99.06 ha of other state-listed Endangered Ecological Communities (EEC);
- 283.62 ha of other native vegetation not listed under legislation; and
- 4,328.12 ha of grassland not listed under legislation (Cumberland Ecology 2012).

In addition, there will potentially be impacts on the following flora and fauna species that have been recorded within the Project Boundary during surveys:

- one threatened flora species, *Bothriochloa biloba* (Lobed Blue Grass) (Vulnerable under the EPBC Act).
- one fauna species, the Koala (Vulnerable under both the EPBC Act and TSC Act); and.
- nine threatened fauna species listed under only the TSC Act; and
- one Migratory bird species listed under the EPBC Act (Cumberland Ecology 2012).

A Biodiversity Offset Package (BOP) is proposed that will protect 4,686 ha of remnant woodland and derived grassland, revegetate 6,425 ha of woodland and derived grassland and rehabilitate 2,386 ha of woodland. This includes a total of 6,719 ha of Box Gum Woodland and Derived Native Grassland. The BOP includes significant areas of known and potential habitat for the suite of species predicted to be impacted by the Project. The BOP will also restore habitat for the Koala (Cumberland Ecology 2012).

Land opportunity costs and operational expenditure associated with the biodiversity offset areas have been included in the development and operating costs of the Project. To the extent that the community values for impacted vegetation are counterbalanced by the proposed offset strategy no significant further economic cost would arise that would warrant inclusion in the BCA.

Road Transport

The traffic impact assessment found that the traffic generated by the construction and operation phase of the Project would not have any significant impact on the road network due to the substantial spare capacity available in the network (DC Traffic Engineering Pty Ltd 2012). Consequently, no consequences arise in relation to traffic that would warrant inclusion in the BCA.

Shenhua Watermark will develop a road over rail overpass for the Kamilaroi Highway and also realign the section of the Kamilaroi Highway where the Mine Access Road will intersect (DC Traffic Engineering Pty Ltd 2012). The cost of these works has been included in the construction cost of the Project.

The Project would result in the permanent closure of a number of public roads. The closure of Court Lane would result in minimal impact as this road would no longer require local access due to properties being acquired as part of the Project. However, it is recognised that residences to the south of the Project use Court Lane as a thoroughfare and as such would have increased travel times and associated potential vehicle operating costs and vehicle accident costs (DC Traffic Engineering Pty Ltd 2012). These impacts have been estimated at $0.2M present value at 7% discount rate.

The closure of part of The Dip Road would be required in year 15 of the mine plan. This would require an alternative route via Cull Road, Werner Road and Clift Road to be developed in consultation with Gunnedah Shire Council (DC Traffic Engineering Pty Ltd 2012). The cost of this alternative route has been included in the develpoment costs of the Project. Nevertheless, the alternative route would result in increased travel times and associated potential vehicle operating costs and vehicle accident costs. These impacts have been estimated at $0.05M present value at 7% discount rate.

Aboriginal Heritage

The Project Aboriginal archaeology assessment identified 29 sites that will be impacted by the Project including two open artefact sites of moderate to high scientific significance and two grinding groove sites of high scientific significance that will be relocated (AECOM Australia Pty Ltd 2012a).

Any impacts on Aboriginal heritage sites after mitigation by Shenhua Watermark may impact the well-being of the Aboriginal community and the broader community. To mitigate these impacts, Shenhua Watermark proposes the development of an Aboriginal Heritage Offsets Area, along with other mitigation strategies developed and agreed with the local Aboriginal stakeholders. The cost of these offset areas and mitigation strategies has been included in the development costs of the Project. To the extent that Aboriginal and community values for impacted sites are counterbalanced by the proposed offset and mitigation strategies, no significant further economic cost would arise that would warrant inclusion in the BCA.

Non-Aboriginal Heritage

Ten items of historical (non-Aboriginal) were identified to be impacted by the Project (AECOM Australia Pty Ltd 2012b). All of these sites have identified as being of low significance at a local level and therefore no significant economic effects would arise with respect to non-Aboriginal heritage that would warrant inclusion in the BCA.

Visual Impacts

There are a number of residences that for periods of time during the Project life may experience moderate to high visual impacts as a result of the Project (JVP Visual Planning & Design 2012).

Visual intrusion to surrounding landholders can potentially impact their property value[11]. However, high levels of visual intrusion are only likely to be short term in nature. The costs of offsite mitigation measures such as tree screening have been included in the development costs of the Project. However, it is recognised that to the extent that any significant residual visual impacts occur, after mitigation, costs of the Project included in the BCA will be understated.

[11] And potentially consumer surplus.

Non-market Value of Employment

Historically employment benefits of projects that are enjoyed by people other than those who are employed, have tended to be omitted from BCA on the implicit assumption that labour resources used in a proposal would otherwise be employed elsewhere and that there are no costs associated with transferring from one job to another. Where this is not the case and labour resources would otherwise be unemployed for some period of time, Boardman et al (2001) identifies that these labour resources should be valued in a BCA at their opportunity cost (e.g. wages less social security payments and income tax) rather than the wage rate. Adopting this approach would have the effect of increasing the net production benefits of the proposal. In addition, there may be social costs of unemployment that require the estimation of employees' willingness to pay to avoid the trauma created by unemployment (Streeting and Hamilton, 199112). These values have not been included in the Project BCA and so the net social benefits of the Project may be underestimated.

Although employees' willingness to pay to avoid the trauma created by unemployment are omitted from the Project BCA, it has also been recognised that the broader community may hold non-market values (Portney, 1994) for social outcomes such as employment (Johnson and Desvouges, 1997).

In a study of the Metropolitan Colliery in the NSW Southern Coalfields, Gillespie Economics (2008) estimated the value the community would hold for the 320 jobs provided over 23 years at $756M (present value). In a similar study of the Bulli Seam Operations, Gillespie Economics (2009a) estimated the value the community would hold for the 1,170 jobs provided over 30 years at $870M (present value). In a study of for the Warkworth Mine extension, Gillespie Economics (2009b) estimated the value the community would hold for 951 jobs from 2022 to 2031 at $286M (present value).

The Project will directly employ on average approximately 434 people for 30 years. Using benefit transfer from the more conservative Bulli Seam Operation study and applying the employment value to the estimated incremental direct employment of the Project[13] gives an estimated $324M for the non-market employment benefits of the Project. This value has been included in the BCA. In the context of a fully employed economy and a different project context to the source study[14] there may be some contention about the inclusion of this value. Consequently, sensitivity testing that excludes this value has also been undertaken.

2.5 CONSOLIDATION OF VALUE ESTIMATES

2.5.1 Aggregate Costs and Benefits

The present value of costs and benefits, using a 7% discount rate, is provided in Table 2.2. The main decision criterion for assessing the economic desirability of a project to society is its net present value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the Project, because the community as a whole would obtain net benefits from the Project.

The Project is estimated to have total net production benefits of $3,047M. Assuming 100% foreign ownership, $1,321M of these net production benefits would accrue to Australia[15]. The estimated net production benefits that accrue to Australia can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the

[12] Streeting, M. and Hamilton, C. (1991) *Economic analysis of the forests of south-eastern Australia*. Prepared for the Resource Assessment Commission.
[13] This is consistent with the non-market valuation studies which focused on direct employment.
[14] The source study was concerned with a continuation of an existing underground mine rather than a new open cut mine.
[15] This is the net production benefits of the Project minus net profit accruing to Shenhua.

Project. The threshold value indicates the price that the community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the no development option.

For the Project to be questionable from an economic efficiency perspective, all incremental residual environmental impacts from the Project, that impact Australia[16], would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $1,321M. This is equivalent to each household in the region valuing residual environmental impacts at $43,000. The equivalent figure for NSW and Australian households is $500 and $160, respectively.

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to quantify the residual environmental impacts of the Project. From Table 2.2 these impacts to Australia are estimated at $6M, considerably less than the estimated net production benefits of the Project to Australia.

Overall, the Project is estimated to have net social benefits to Australia of between $1,315M and $1,639M, and hence is desirable and justified from an economic efficiency perspective.

While the major environmental, cultural and social impacts have been quantified and included in the Project BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $1,315M and $1,639M for the Project to be questionable from an Australian economic perspective.

[16] Consistent with the approach to considering net production benefits, environmental impacts that occur outside Australia would be excluded from the analysis. This is mainly relevant to the consideration of greenhouse gas impacts.

Table 2.2
Benefit Cost Analysis Results of the Project (Present Values @7% discount rate)

	Costs		Benefits	
	Description	**Value ($M)**	**Description**	**Value ($M)**
Production	Opportunity cost of land	$157	Value of coal	$8,147
	Opportunity cost of capital	$0	Residual value of land and capital	$0
	Develpoment costs including land acquisitions and water allocations and Kamilaroi Highway Realignment	$1,323		
	Operating costs	$3,620		
	Decommissioning and rehabilitation costs	$0		
	Sub-total	***$5,100***	***Sub-total***	***$8,147***
	Net Production Benefits			**$3,047 ($1,321)**
Non-market Impacts	Greenhouse gas impacts	$88 ($1)	Non-market values of employment	$324
	Agricultural impacts	Included in opportunity cost of land and development costs (land acquisitions)		
	Noise impacts	Cost of acquisition and noise mitigation measures are included in development costs.		
	Blasting	Minimal.		
	Air quality impacts	Cost of acquisition is included in development costs		
	Surface water	$2		
	Groundwater	$2		
	Ecology	Some loss of values but offset. Cost of biodiversity offset included in development costs and operating costs		
	Road transport impacts	$0.3 Cost of Kamilaroi Hwy road over rail overpass and realignment and an alternative route to the The Dip Road included in development costs.		
	Aboriginal heritage	Some loss of values but offset. Cost of offset and mitigation strategies included in development costs and operating costs		
	Non-Aboriginal heritage impacts	Minimal		
	Visual impacts	Minimal. Costs of mitigation included in development costs		
	Non-market impacts sub-total	$93 ($6)		**$324**
NET SOCIAL BENEFITS – including employment benefits				**$3,278 ($1,639)**
NET SOCIAL BENEFITS – excluding employment benefits				**$2,954 ($1,315)**

Note: totals may have minor discrepancies due to rounding. When impacts accrue globally, the numbers in brackets relates to the level of impact estimated to accrue to Australia

2.5.2 Distribution of Costs and Benefits

While BCA is primarily concerned with the aggregate benefits and costs of the Project to Australia, the distribution of costs and benefits may also be of interest to decision-makers.

The net production benefit shown in Table 2.3 is potentially distributed amongst a range of stakeholders including:

- Shenhua Watermark shareholders in the form of after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of any Company tax payable ($745M present value) or Minerals Resource Rent Tax from the Project, which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the local and regional area;
- the NSW Government via royalties ($565M present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the local and regional area; and
- the local and regional community in the form of voluntary contributions to community infrastructure and services ($11M present value).

The environmental, cultural and social impacts of the Project may potentially accrue to a number of different stakeholder groups at the local, State, National and global level, however, are largely internalised into the production costs of Shenhua Watermark.

Noise costs, air quality costs and agricultural production costs will occur at a local level. These have been incorporated into the estimation of net production benefits via acquisition costs for affected properties and mitigation costs. As such, the bearers of these costs are compensated. Road transport impacts would also occur at the local level with the costs of road works included in the estimate of net production benefits. Residual road transport impacts have been estimated and found to be insignificant. Similarly, surface water and groundwater effects will occur at the local level, but have been incorporated into the analysis via inclusion of the costs of acquisition of Water Access Licences and the opportunity cost of reduced flows in rivers. Greenhouse gas costs will occur at the national and global level and will be internalised through payment of the Commonwealth Government's carbon tax. The economic costs associated with the clearing of native vegetation will occur at the State level and would be counterbalanced by the Project biodiversity offsets. Similarly Aboriginal heritage impacts will potentially occur to Aboriginal people and NSW households[17], however, these economic costs would be counterbalanced by the Project Aboriginal Heritage Offsets Areas and mitigation strategies. The cost of providing biodiversity and Aboriginal heritage offsets is included in the estimation of net production benefits. Visual impacts will occur at the local level and will be internalised by Shenhua Watermark through the funding of visual mitigation measures. All of these measures mean that those who experience costs have them either mitigated or compensated. Other potential environmental impacts would largely occur at the local level and were found to be insignificant. Any non-market benefits associated with employment provided by the Project would largely accrue at the local or State level[18].

[17] Non-market valuation studies that have surveyed NSW households have found that they value the conservation of highly significant Aboriginal heritage (Gillespie Economics 2008, 2009a, 2009b).

[18] It should be noted that the study from which the employment values were transferred, surveyed NSW households only.

Table 2.3 - Distribution of Benefits and Costs (Present Values at 7% Discount Rate)

Value ($M)		Distribution			
		Local	State	National	Global
Net Production Benefits					
Net production benefits to Shenhua Watermark	$1,726	-	-	-	✓
Net production benefits to Commonwealth Government – Company tax	$745	✓	✓	✓	-
Net production benefits to NSW Government – Royalties	$565	✓	✓	-	-
Net production benefits to local and regional community in the form of voluntary contributions	$11	✓	-	-	-
Total	***$3,047***				
Non-market Costs and Benefits					
Benefits					
Non-market benefit of employment	$324	✓	✓	-	-
Total	***$324***				
Costs					
Greenhouse gas emissions rest of the world[1]	$87	-	-	-	✓
Greenhouse gas emissions Australia[2]	$1	✓	✓	✓	
Agricultural impacts	Included in opportunity cost of land and development costs (land acquisitions)	✓	-	-	-
Noise impacts	Cost of acquisition and noise mitigation measures are included in development costs.	✓	-	-	-
Blasting	Minimal.	✓	-	-	-
Air quality impacts	Cost of acquisition is included in development costs	✓	-	-	-
Surface water	$2	✓	-	-	-
Groundwater	$2	✓	-	-	-
Ecology	Some loss of values but offset. Cost of biodiversity offset included in development costs and operating costs	✓	✓	-	-
Road transport impacts	$0.3 Cost of Kamiloroi Rd Realignment and an alternative route to the The Dip Rd included in development costs.	✓	-	-	-
Aboriginal heritage	Some loss of values but offset. Cost of offset and mitigation strategies included in development costs and operating costs	✓	✓	-	-
Non-Aboriginal heritage impacts	Minimal	✓	-	-	-
Visual impacts	Minimal. Costs of mitigation included in development costs	✓	-	-	-
Total	***$93***				
Net Social Benefits	**$3,278**				

Note: Totals may have minor discrepancies due to rounding.

[1]Assuming the global social damage cost of carbon is distributed in accordance with relative share of global gross domestic product.

The non-market costs that accrue to NSW are estimated at less than $6M. These are considerably less than the net production benefits that directly accrue to NSW through royalties ($565M) and voluntary contributions to the local and regional community ($11M) (and potential non-market employment benefits ($342M)) [19]. Consequently, the Project would result in net benefits to NSW.

2.6 SENSITIVITY ANALYSIS

The NPV presented in Table 2.2 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV.

In this analysis, the BCA result was tested for 20% (+ and -) changes to the following variables at a 4%, 7% and 10% discount rate:

- Opportunity costs of land;
- Development costs;
- Operating costs;
- Value of coal;
- Greenhouse costs;
- Surface and groundwater impacts;
- Road transport impacts; and
- Non-market employment impacts.

What this analysis indicates (refer to Attachment 2) is that the results of the BCA are not sensitive to the changes made in assumptions regarding any of these variables. In particular, significant increases in the values used for external impacts such as road transport impacts, greenhouse gas costs, surface water and groundwater impacts did not change the positive sign of the net present value of the Project. Hence the Project's desirability from an economic efficiency perspective is not changed.

The results were most sensitive to any potential decreases in the sale value of coal. A sustained reduction in coal price (over 55%) would be required to make the Project welfare reducing.

[19] Noting that NSW will also share some of the benefits that accrue to the Commonwealth through company taxes and the MRRT.

3 ECONOMIC IMPACT ASSESSMENT

3.1 INTRODUCTION

The BCA in Section 2 is concerned with whether the incremental benefits of the Project exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' the Project compared to 'without' it. In contrast, the focus of the regional economic impact assessment is the effect (impact) of the Project on the economy in terms of a number of specific indicators of economic activity, such as gross regional output, value-added, income and employment.

These indicators can be defined as follows:

- ***Gross regional output*** – the gross value of business turnover;
- ***Value-added*** – the difference between the gross regional output and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output;
- ***Income*** – the wages paid to employees including imputed wages for self employed and business owners; and
- ***Employment*** – the number of people employed (including full-time and part-time).

An impacting agent may be an existing activity within an economy or may be a change to a local economy (Powell *et al.,* 1985; Jensen and West, 1986). This assessment is concerned with the economic impact of average annual production of the Project (i.e. 10 Mtpa ROM coal production).

The economy on which the impact is measured can range from a township to the entire nation (Powell *et al.,* 1985). In selecting the appropriate economy, regard needs to be had to capturing the local expenditure and employment associated with the production scenarios, but not making the economy so large that the impact of the proposal becomes trivial (Powell and Chalmers, 1995). For this study, the economic impacts have been estimated for three regions:

- The local economy comprising the Local Government Areas (LGAs) of Gunnedah, Tamworth and Liverpool Plains;
- The regional economy comprising the LGAs of Gunnedah, Tamworth, Liverpool Plains, Narrabri and Upper Hunter; and
- The NSW economy.

A range of methods can be used to examine the economic impacts of an activity on an economy including economic base theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models (Powell *et al.,* 1985). This study uses input-output analysis.

Input-output analysis essentially involves two steps:

- Construction of an appropriate input-output table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy; and
- Identification of the initial impact or stimulus of the Project (construction and/or operation) in a form that is compatible with the input-output equations so that the input-output multipliers and flow-on effects can then be estimated (West, 1993).

The input-output method is based on a number of assumptions that are outlined in Attachment 3. These result in estimated impacts being an upper bound impact estimate.

3.2 INPUT-OUTPUT TABLE AND ECONOMIC STRUCTURE OF THE REGION

A 2006 input-output table[20] of the local and regional economy was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 4) using a 2005-06 input-output table of the NSW economy (developed by Monash University) as the parent table. The 109 sector input-output tables of the local and regional economy were aggregated to 30 sectors and 6 sectors for the purpose of describing the economies.

Highly aggregated 2006 input-output tables for the local and regional economy are provided in Tables 3.1 and 3.2. The rows of these tables indicate how the gross regional output of an industry is allocated as sales to other industries, to households, to exports and other final demands (OFD - which includes stock changes, capital expenditure and government expenditure). The corresponding column shows the sources of inputs to produce that gross regional output. These include purchases of intermediate inputs from other industries, the use of labour (household income), the returns to capital or other value-added (OVA - which includes gross operating surplus and depreciation and net indirect taxes and subsidies) and goods and services imported from outside the region. The number of people employed in each industry is also indicated in the final row.

Table 3.1 - Aggregated Transactions Table: Local Economy 2006 ($'000)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Services	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	23,108	8	118,020	2	118	3,597	**144,853**	3,521	127,343	267,025	**542,741**
Mining	13	1,361	2,901	8,794	539	315	**13,924**	117	-739	47,543	**60,845**
Manuf.	24,609	1,414	98,633	1,420	33,940	105,200	**265,215**	68,305	96,006	814,084	**1,243,610**
Utilities	3,268	303	14,848	113,246	1,605	23,711	**156,980**	15,922	2,304	78,088	**253,295**
Building	1,971	398	1,867	2,714	61,441	21,950	**90,342**	0	237,444	45,384	**373,171**
Services	45,023	3,522	143,935	7,346	31,801	464,697	**696,323**	821,179	719,639	983,083	**3,220,224**
TOTAL	**97,992**	**7,005**	**380,205**	**133,521**	**129,444**	**619,470**	**1,367,637**	**909,043**	**1,181,997**	**2,235,207**	**5,693,885**
Household Income	124,250	9,086	177,980	15,935	83,243	1,039,985	**1,450,479**	0	0	0	**1,450,479**
OVA	151,532	34,087	138,615	52,048	45,383	666,533	**1,088,199**	83,348	41,793	4,017	**1,217,357**
Imports	168,967	10,666	546,810	51,790	115,101	894,235	**1,787,570**	518,189	224,547	158,462	**2,688,768**
TOTAL	**542,741**	**60,845**	**1,243,610**	**253,295**	**373,171**	**3,220,224**	**5,693,885**	**1,510,580**	**1,448,338**	**2,397,687**	**11,050,490**
Employment	**3,470**	**152**	**2,927**	**266**	**1,404**	**20,226**	**28,445**				

Table 3.2- Aggregated Transactions Table: Region Economy 2006 ($'000)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Services	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	75,824	13	182,552	5	232	6,801	**265,426**	10,390	199,318	516,982	**992,117**
Mining	91	2,897	5,244	11,495	769	1,124	**21,619**	387	-357	80,251	**101,900**
Manuf.	43,956	2,200	136,974	1,877	46,471	141,221	**372,698**	103,039	115,563	1,029,788	**1,621,089**
Utilities	6,055	448	19,993	140,798	2,075	31,488	**200,857**	22,510	2,553	92,101	**318,021**
Building	3,434	610	2,394	3,494	82,934	27,607	**120,473**	0	308,871	64,667	**494,012**
Services	84,936	5,951	188,210	9,506	43,027	611,153	**942,783**	1,121,681	878,873	1,163,794	**4,107,131**
TOTAL	**214,297**	**12,119**	**535,367**	**167,174**	**175,506**	**819,395**	**1,923,857**	**1,258,008**	**1,504,821**	**2,947,583**	**7,634,269**
Household Income	228,283	15,146	232,381	20,774	113,977	1,365,096	**1,975,657**	0	0	0	**1,975,657**
OVA	264,335	59,221	177,365	65,742	56,342	800,091	**1,423,096**	116,110	53,208	5,298	**1,597,712**
Imports	285,202	15,414	675,976	64,330	148,187	1,122,549	**2,311,658**	730,237	285,875	208,965	**3,536,735**
TOTAL	**992,117**	**101,900**	**1,621,089**	**318,021**	**494,012**	**4,107,131**	**7,634,269**	**2,104,355**	**1,843,904**	**3,161,846**	**14,744,374**
Employment	**6,187**	**242**	**3,668**	**342**	**1,893**	**26,150**	**38,482**				

[20] A key driver in the development of regional input-output tables is detailed employment by industry data from the Census. At the time of the preparation of this report this data from the 2011 Census was not available.

Value-added for the local economy is estimated at $2,668M, comprising $1,450M to households as wages and salaries (including payments to self employed persons and employers) and $1,216M in OVA.

Value-added for the regional economy is estimated at $3,573M, comprising $1,976M to households as wages and salaries (including payments to self employed persons and employers) and $1,598M in OVA.

The employment total working in the local and regional economy was 28,445 and 38,482, respectively.

The economic structure of the local and regional economy can be compared with that for NSW through a comparison of results from the respective input-output models (Figures 3.1, 3.2 and 3.3). This reveals that the agriculture sectors in the local and regional economy are of greater relative importance than they are to the NSW economy, while the building sectors and service sectors are of less relative importance than they are to the NSW economy. The mining sectors, manufacturing sectors and utilities are of similar relative importance in the local, regional and NSW economy.

Figure 3.1 - Summary of Aggregated Sectors: Local Economy (2006)

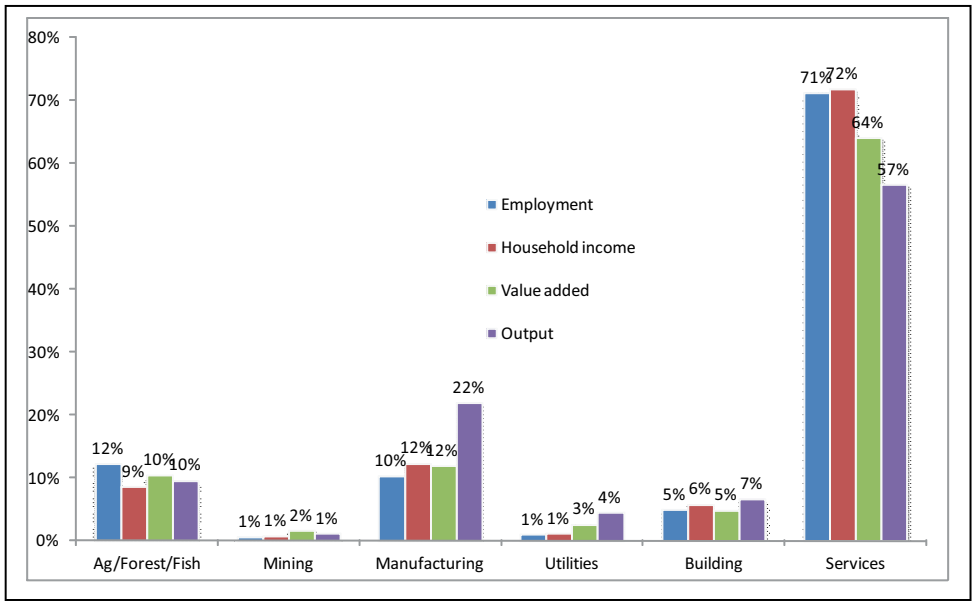


Figure 3.2 - Summary of Aggregated Sectors: Regional Economy (2006)

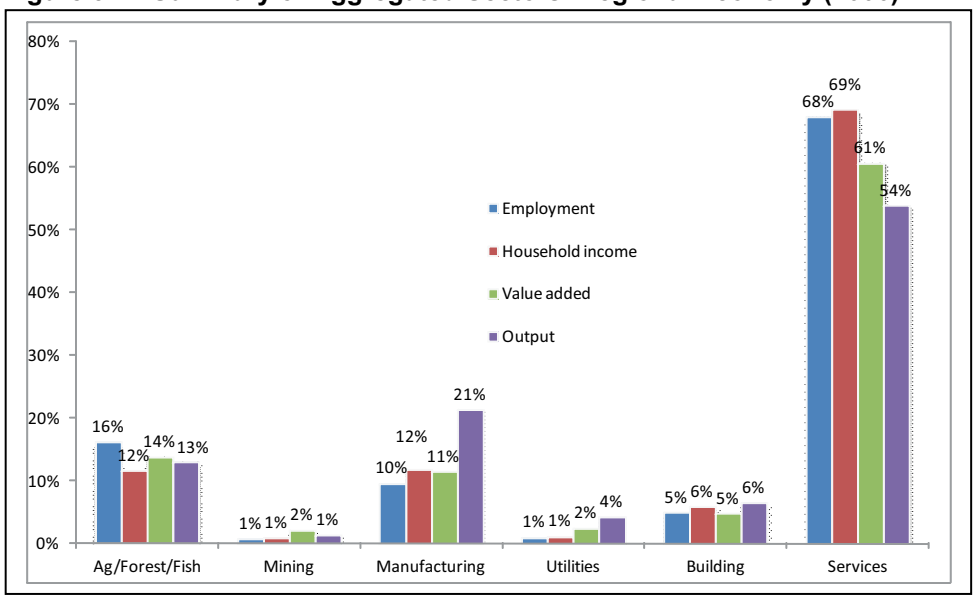
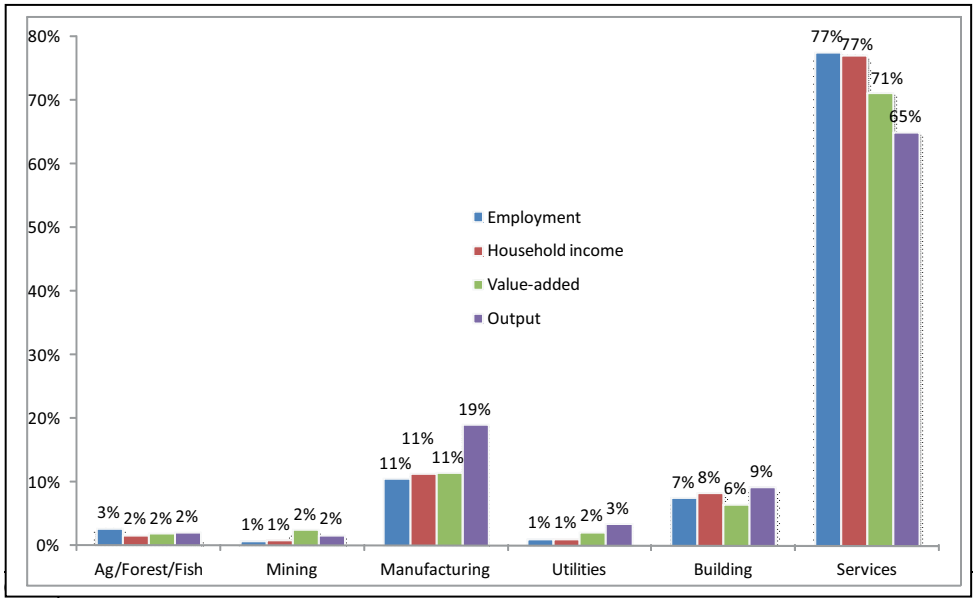


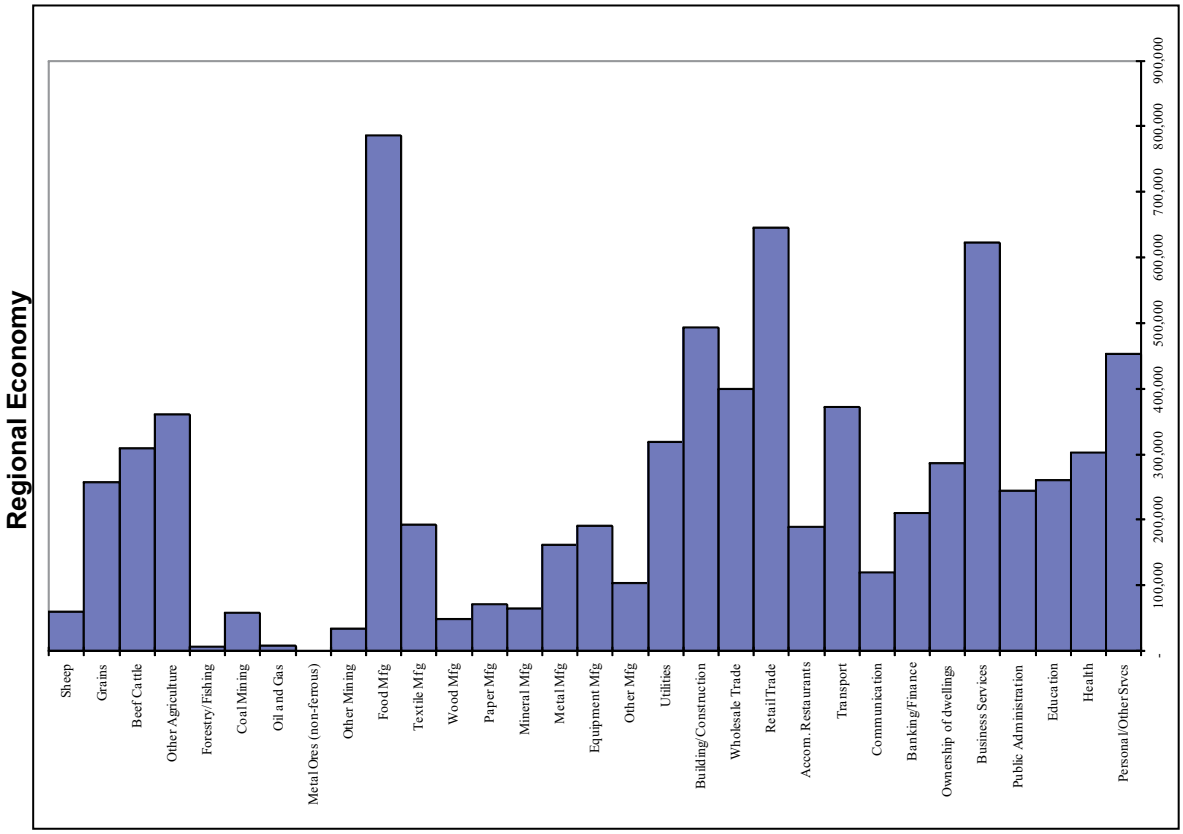
Figure 3.3 - Summary of Aggregated Sectors: NSW Economy (2006)



Figures 3.4 to 3.7 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the local and regional economy.

In terms of output, food manufacturing, retail trade and business services sectors are the most significant to both the local and regional economy. For value-added, the retail trade sector and the business services sectors are the most significant. These sectors together with the health sectors are the most significant sectors in terms of household income. The retail trade sector is the most significant employer in the local and regional economy.

Figure 3.4 Sectoral Distribution of Gross Regional Output ($'000)



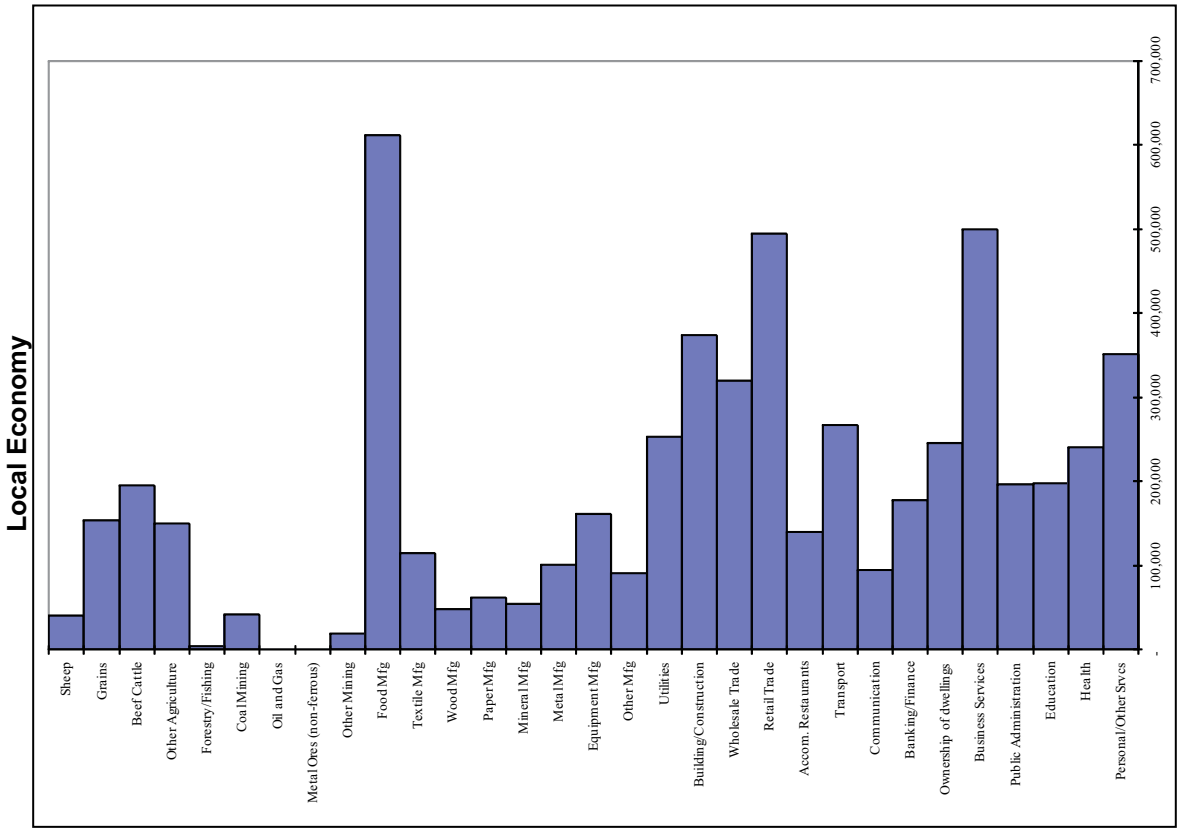
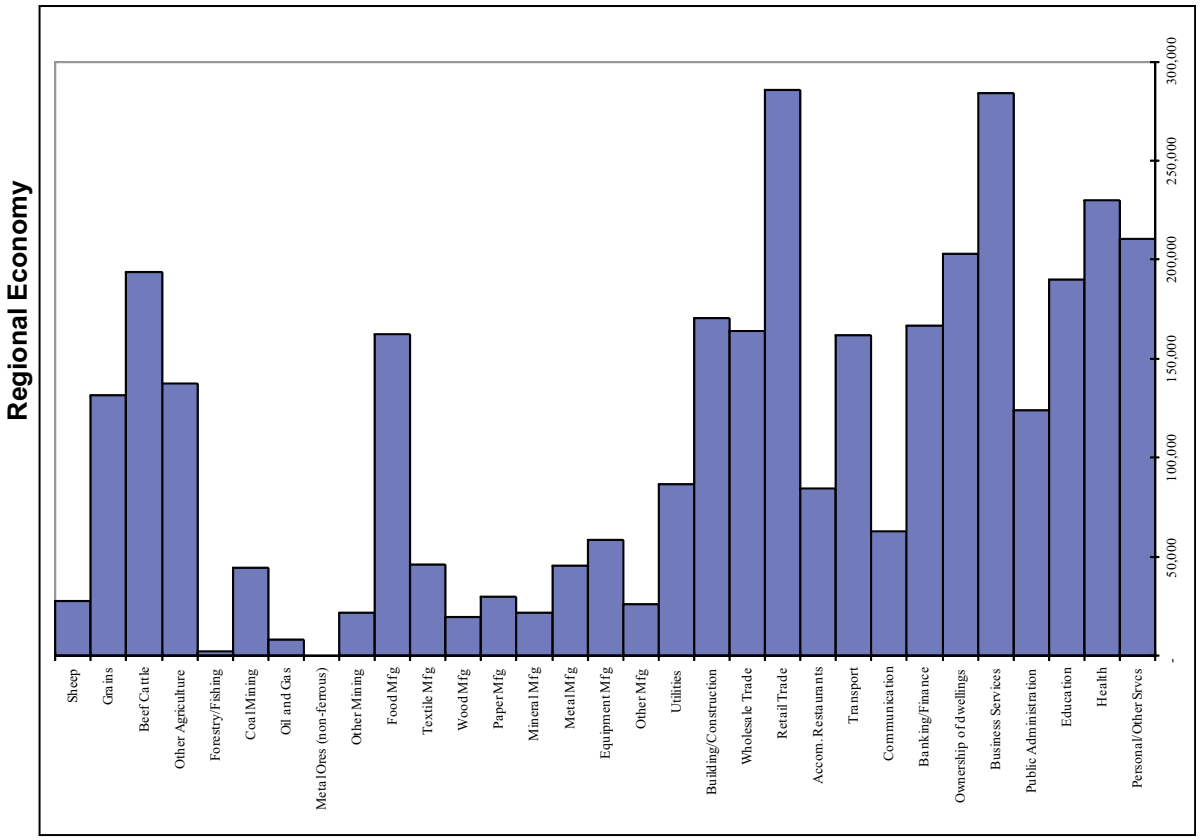


Figure 3.5 Sectoral Distribution of Value Added ($'000)



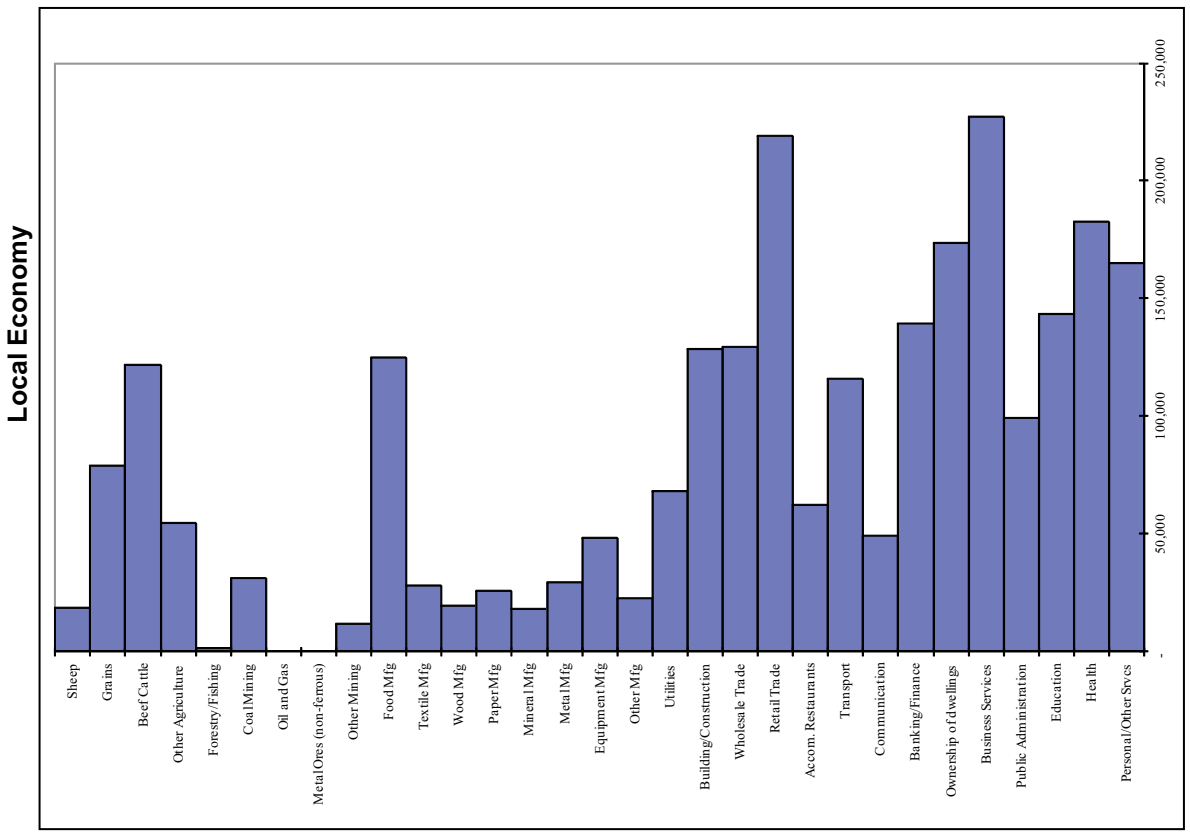
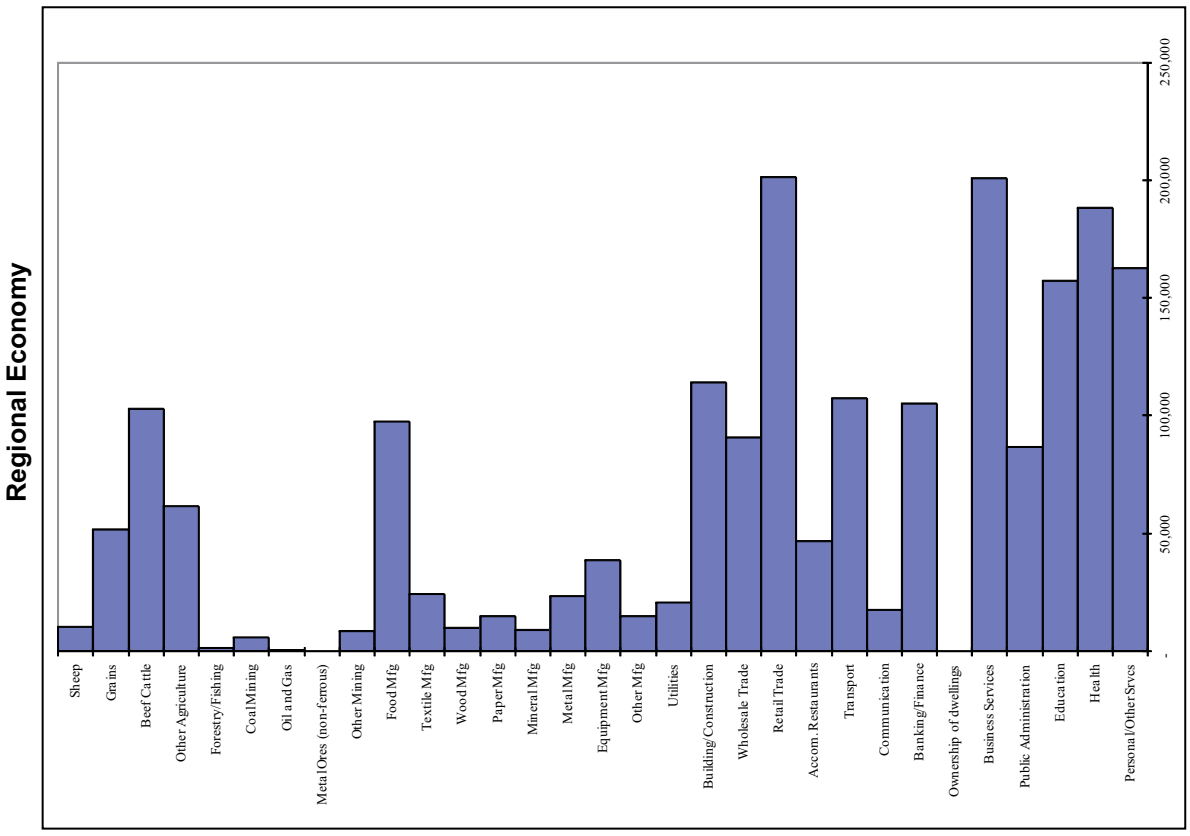


Figure 3.6 Sectoral Distribution of Household Income ($'000)



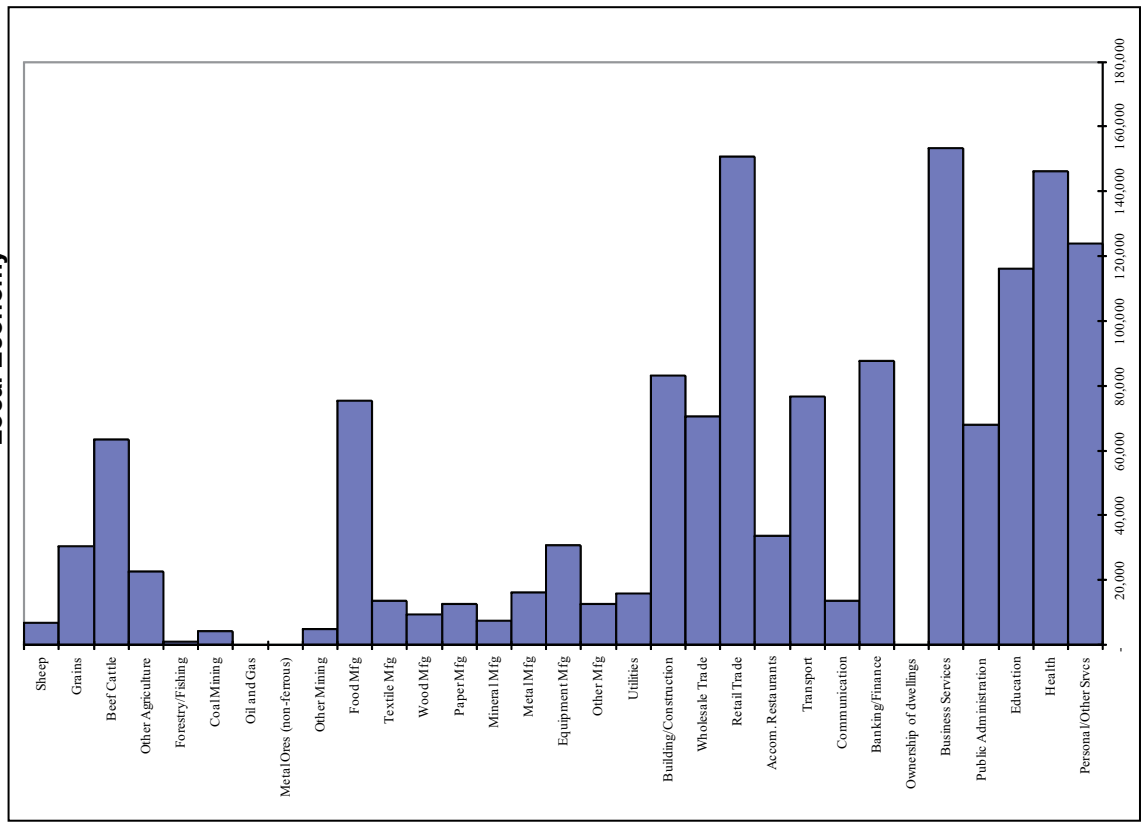
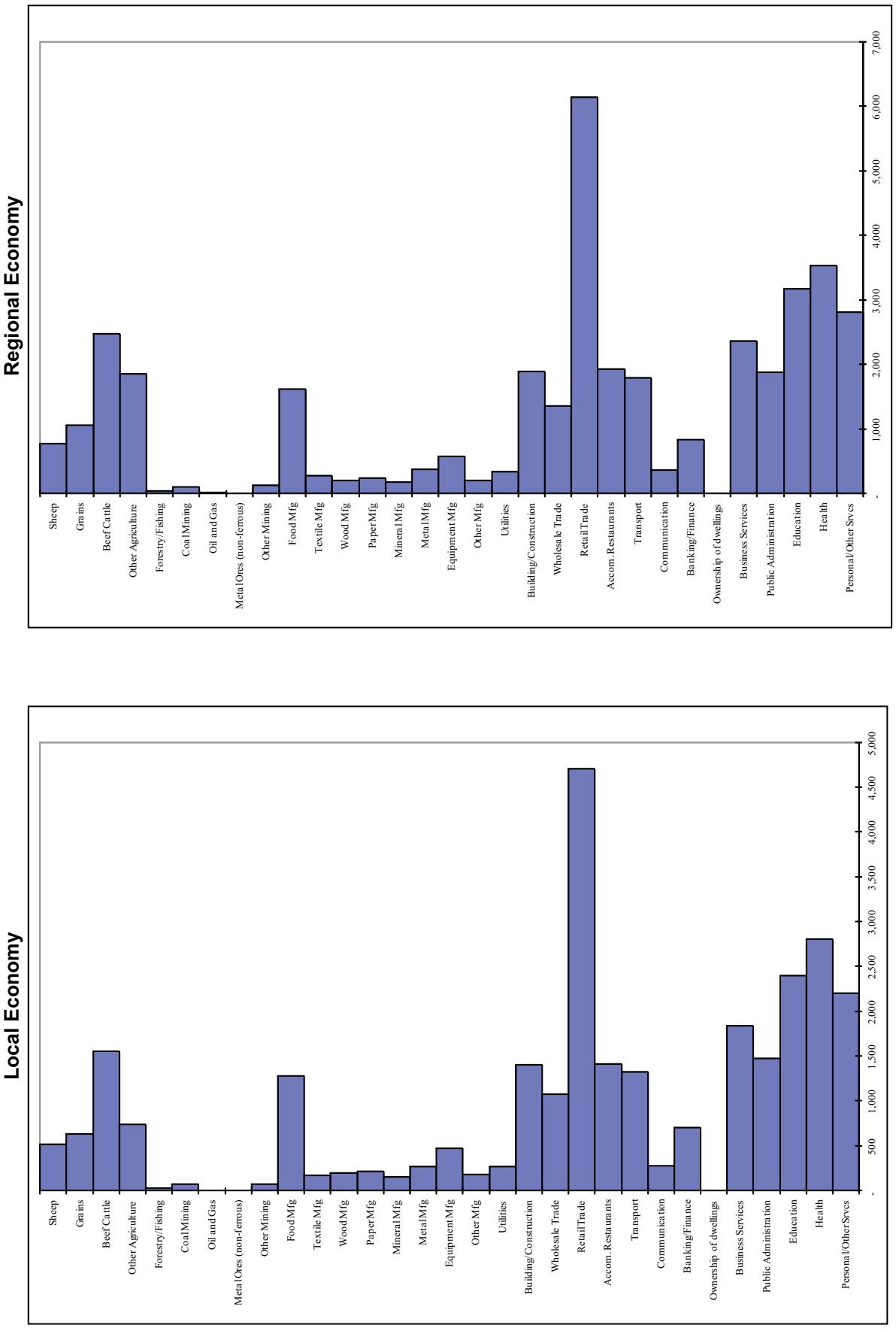


Figure 3.7 Sectoral Distribution of Employment (No.)



3.3 ECONOMIC IMPACT OF THE PROJECT

The revenue, expenditure and employment associated with the construction and operation of the Project would stimulate economic activity for the local and regional economy, as well as for the broader NSW economy. The regional impacts of both these stimuli are estimated for the indicators of output, value-added, income and employment.

3.3.1 *Construction Phase*

Introduction

Economic activity associated with the Project construction phase is estimated to potentially mainly occur within five sectors of the economy:

- the *other construction sector* which includes businesses involved in the construction of non-residential buildings and sites, including port terminals;
- the *construction trade services sector* which includes businesses involved in plumbing, electrical, and other trades;
- the *other property services sector* which includes businesses involved in the leasing of industrial machinery, plant or equipment;
- the *agriculture, mining and construction machinery, lifting and material handling equipment manufacturing sector*; and
- *other machinery and equipment manufacturing sector*.

Impact on the Local and Regional Economy

Given the largely specialist nature of capital equipment and the relatively small size of the local and regional economies, for the purpose of this analysis an assumption is made that all such purchases and the leasing of machinery are made outside the regional economy. Thus regional economic activity from the Project construction phase primarily relates to the *other construction sector* and *construction trade services sector*.

The average annual construction workforce required for the Project during the peak year of construction is 425. Based on the input-output coefficients of the *other construction sector* and *trade services sector* in the local economy transactions table (indexed to 2012), approximately $116M of the development costs in the peak year of construction would need to be spent on the other construction sector and construction trade services sector within the region to result in a workforce of 425 people. The direct and indirect regional economic impact of this level of expenditure in the local and regional economy is reported in Tables 3.3 and 3.4.

Impacts

Table 3.3 - Regional Economic Impacts of Construction of the Project on the Local Economy

	Direct	Production induced	Consumption induced	Total Flow on	Total
OUTPUT ($'000)	116,170	49,921	39,774	89,695	205,865
Type 11A Ratio	1.00	0.43	0.34	0.77	1.77
VALUE ADDED ($'000)	46,706	20,970	21,531	42,501	89,207
Type 11A Ratio	1.00	0.45	0.46	0.91	1.91
INCOME ($'000)	30,360	14,530	8,908	23,437	53,798
Type 11A Ratio	1.00	0.48	0.29	0.77	1.77
EMPL. (No.)	425	222	160	382	807
Type 11A Ratio	1.00	0.52	0.38	0.90	1.90

*Direct employment of 425 represents average annual construction employment. It is assumed that these people reside in the region. Where they do not, a proportion of the consumption-induced flow-on impacts will leak from the region.

Table 3.4 - Regional Economic Impacts of Construction of the Project on the Regional Economy

	Direct	Production induced	Consumption induced	Total Flow on	Total
OUTPUT ($'000)	116,170	51,647	41,680	93,327	209,497
Type 11A Ratio	1.00	0.45	0.36	0.80	1.80
VALUE ADDED ($'000)	46,706	21,690	22,240	43,930	90,636
Type 11A Ratio	1.00	0.46	0.48	0.94	1.94
INCOME ($'000)	31,048	15,333	9,684	25,017	56,066
Type 11A Ratio	1.00	0.49	0.31	0.81	1.81
EMPL. (No.)	425	229	170	398	823
Type 11A Ratio	1.00	0.54	0.40	0.94	1.94

*Direct employment of 425 represents average annual construction employment. It is assumed that these people reside in the region. Where they do not, a proportion of the consumption-induced flow-on impacts will leak from the region.

In estimating the total regional impacts, it is important to separate the flow-on effects that are associated with firms buying goods and services from each other (production-induced effects) and the flow-on effects that are associated with employing people who subsequently buy goods and services as households (consumption-induced effects). This is because these two effects operate in different ways and have different spatial impacts.

Production-induced effects occur in a near-proportional way within a region, whereas the consumption-induced flow-on effects only occur in a proportional way if workers and their families are located in the region or migrate into the region. Where workers commute from outside the region some of the consumption-induced flow-on effects leak from the region. Where workers are already located in the region (i.e. unemployed or employed), some of the consumption-induced flow-ons in the region may already be occurring through expenditure of their current wage or unemployment benefits.

In total, the peak construction year of the Project is estimated to make up to the following total annual contribution to the local economy:

- $206M in annual direct and indirect regional output or business turnover;
- $89M in annual direct and indirect regional value added;
- $54M in annual direct and indirect household income; and
- 807 direct and indirect jobs.

The peak construction year of the Project is estimated to make up to the following total annual contribution to the regional economy:

- $209M in annual direct and indirect regional output or business turnover;
- $91M in annual direct and indirect regional value added;
- $56M in annual direct and indirect household income; and
- 823 direct and indirect jobs.

Multipliers

Multipliers are summary measures used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry (ABS, 1995). There are many types of multipliers that can be generated from input-output analysis (refer to Attachment 3). Type 11A ratio multipliers summarise the total impact on all industries in an economy in relation to the initial own sector effect (e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc).

The Type 11A ratio multipliers for the construction phase of the Project in the local economy range from 1.77 for output up to 1.91 for value-added. For the regional economy the Type 11A ratio multipliers range from 1.80 for output up to 1.94 for value-added.

Main Sectors Affected

Flow-on impacts from the construction phase of the Project are likely to affect a number of different sectors of the local and regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be *construction trade-services, wholesale and retail trade, ownership of dwellings, legal, accounting, marketing and business management services, other business services, health services, accommodation, cafes and restaurants, education, retail mechanical repairs and personal services*.

Impact on the NSW Economy

When the impact of $116M of expenditure in the *other construction sector* and *construction trade services sector* is assessed for the NSW economy, the impacts are greater because of the larger inter-sectoral linkages and hence multipliers for the larger economy.

Impacts

Table 3.5 - Regional Economic Impacts of Construction of the Project on the NSW Economy

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	116,170	105,345	133,100	238,446	354,616
Type 11A Ratio	1.00	0.91	1.15	2.05	3.05
VALUE ADDED ($'000)	46,706	45,370	67,795	113,165	159,872
Type 11A Ratio	1.000	0.97	1.45	2.42	3.42
INCOME ($'000)	38,281	37,683	38,797	76,480	114,761
Type 11A Ratio	1.00	0.98	1.01	2.00	3.00
EMPL. (No.)	427	438	518	956	1,383
Type 11A Ratio	1.00	1.03	1.21	2.24	3.24

Based on the above approach, the construction phase of the Project may result in impacts on the NSW economy of up to:

- $355M in annual direct and indirect output;
- $160M in annual direct and indirect regional value added;
- $115M in annual direct and indirect household income; and
- 1,383 direct and indirect jobs.

The above estimated impacts on the NSW economy are likely to be understated because expenditures in NSW may not be limited to expenditures in the *other construction* sector and *construction trade services* sector. This is because the larger NSW economy is likely to be able to also supply some machinery and equipment manufacturing and machinery leasing that could not be supplied by the smaller local and regional economies.

3.3.2 *Operation Phase*

Introduction

For the analysis of the operational phase of the Project, a new Project sector was inserted into the local and regional input-output table reflecting average annual production levels of 10 Mtpa ROM. The revenue and expenditure data for the new sectors were obtained from financial information provided by Shenhua Watermark for the Project. For these new sectors:

- the estimated gross annual revenue was allocated to the *Output* row;
- the estimated wage bill of those residing in the region was allocated to the *household wages* row with any remainder allocated to *imports*;
- non-wage expenditure was initially allocated across the relevant *intermediate sectors* in the economy, *imports* and *other value-added*;
- allocation was then made between *intermediate sectors* in the local economy and *imports* based on advice from Shenhua Watermark and regional location quotients;
- purchase prices for expenditure in the each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the National Input-Output Tables;
- the difference between total revenue and total costs was allocated to the *other value-added* row*;* and
- direct employment by Project that resides in the region was allocated to the *employment* row.

The main difference between the sector for the local economy and the sector for the regional economy was that a greater number of employees reside in the regional economy and the regional economy was also able to capture a greater level of direct expenditure.

Impacts on the Local and Regional Economy

Economic Activity

The total and disaggregated annual impacts of the Project on the local and regional economy (in 2012 dollars) are shown in Tables 3.6 and 3.7.

Table 3.6 - Economic Impacts of the Project on the Local Economy ($2012)

	Direct Effect	Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	744,384	98,631	59,279	157,910	902,294
Type 11A Ratio	*1.00*	*0.13*	*0.08*	*0.21*	*1.21*
VALUE ADDED ($'000)	423,710	36,839	32,090	68,929	492,639
Type 11A Ratio	*1.00*	*0.09*	*0.08*	*0.16*	*1.16*
INCOME ($'000)	45,135	21,769	13,276	35,044	80,180
Type 11A Ratio	*1.00*	*0.48*	*0.29*	*0.78*	*1.78*
EMPL. (No.)	369	302	238	539	908
Type 11A Ratio	*1.00*	*0.82*	*0.64*	*1.46*	*2.46*

*Direct employment of 369 represents average annual employees residing in the local economy. Contractors are located in production-induced flow-ons.

Table 3.7 - Economic Impacts of the Project on the Regional Economy ($2012)

	Direct Effect	Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	744,384	101,117	67,787	168,904	913,288
Type 11A Ratio	*1.00*	*0.14*	*0.09*	*0.23*	*1.23*
VALUE ADDED ($'000)	432,631	38,115	36,170	74,285	506,916
Type 11A Ratio	*1.00*	*0.09*	*0.08*	*0.17*	*1.17*
INCOME ($'000)	52,569	22,865	15,751	38,615	91,184
Type 11A Ratio	*1.00*	*0.44*	*0.30*	*0.74*	*1.74*
EMPL. (No.)	430	309	276	585	1,015
Type 11A Ratio	*1.00*	*0.72*	*0.64*	*1.36*	*2.36*

*Direct employment of 430 represents average annual employees residing in the regional economy. Contractors are located in production-induced flow-ons.

The Project is estimated to make up to the following total annual contribution to the local economy for 30 years:

- $902M in annual direct and indirect regional output or business turnover;
- $493M in annual direct and indirect regional value added;
- $80M in annual direct and indirect household income; and
- 908 direct and indirect jobs.

The Project is estimated to make up to the following total annual contribution to the regional economy for 30 years:

- $913M in annual direct and indirect regional output or business turnover;
- $507M in annual direct and indirect regional value added;
- $91M in annual direct and indirect household income; and
- 1,015 direct and indirect jobs.

Multipliers

The Type 11A ratio multipliers for the Project impact on the local economy range from 1.16 for value-added up to 2.46 for employment. For the regional economy, the Project impact Type 11A ratio multiplier range from 1.17 for value-added up to 2.36 for employment.

Capital intensive industries such as coal mining tend to have a high level of linkage with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to a relatively high ratio multiplier for employment. A lower ratio multiplier for income (compared to employment) also generally

occur as a result of comparatively higher wage levels in the mining sectors compared to incomes in the sectors that would experience flow-on effects from the Project. Capital intensive mining projects also typically have a relatively low ratio multiplier for output and value-added reflecting the relatively high direct output and value-added compared to that in flow-on sectors.

Main Sectors Affected

Flow-on impacts from the Project are likely to affect a number of different sectors of the local and regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be the:

- Ownership of dwellings sector;
- Agricultural and mining machinery manufacturing sector;
- Retail trade sector;
- Wholesale trade sector;
- Construction trade services sector;
- Health services sector; and
- Education sector.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities would be generated by the Project (Table 3.8).

Table 3.8 - Sectoral Distribution of Employment Impacts on the Local and Regional Economy

	Local Economy				Regional Economy			
Sector	**Average Direct Effects**	**Product.-induced**	**Consump.-induced**	**Total**	**Average Direct Effects**	**Product.-induced**	**Consump.-induced**	**Total**
Primary	0	1	3	4	0	1	6	7
Mining	369	13	0	382	430	15	0	445
Manufacturing	0	48	13	61	0	49	15	65
Utilities	0	5	2	7	0	5	3	7
Wholesale/Retail	0	69	55	124	0	70	63	132
Accommodation, cafes, restaurants	0	10	34	44	0	10	39	49
Building/Construction	0	42	3	44	0	42	3	45
Transport	0	23	8	31	0	24	9	33
Services	0	91	120	211	0	93	138	231
Total	**369**	**302**	**238**	**908**	**430**	**309**	**276**	**1,015**

Note: Totals may have minor discrepancies due to rounding.

Table 3.8 indicates that direct, production-induced and consumption-induced employment impacts of the Project on the regional economy are likely to have different distributions across sectors. Production-induced flow-on employment would occur mainly in services sectors, wholesale/retail trade sectors, manufacturing sectors, building construction sectors, transport sectors and mining sectors while consumption induced flow-on employment would be mainly in services sectors, wholesale/retail trade sectors and accommodation/cafes/restaurants sectors.

Businesses that can provide the inputs to the production process required by the Project and/or the products and services required by employees would directly benefit from the Project by way of an increased economic activity. However, because of the inter-linkages between sectors, many indirect businesses also benefit.

Impact on the NSW Economy

Introduction

The NSW economic impacts of the Project were assessed by inserting a new Project sector into a 2012 NSW input-output table in the same manner described in Section 3.2.1. The primary difference from the sector identified for the regional economy was that all direct employment was assumed to reside in NSW and a greater level of expenditure was captured by NSW economy compared to the regional economy.

Economic Activity

The total and disaggregated annual impacts of the Project on the NSW economy (in 2012 dollars) are shown in Table 3.9.

Table 3.9 - NSW Economic Impacts of the Project

	Direct Effect	Production Induced	Consump. Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	744,384	489,576	319,748	809,325	1,553,709
Type 11A Ratio	*1.00*	*0.66*	*0.43*	*1.09*	*2.09*
VALUE ADDED ($'000)	433,267	206,317	162,865	369,182	802,449
Type 11A Ratio	*1.00*	*0.48*	*0.38*	*0.85*	*1.85*
INCOME ($'000)	53,100	129,389	93,203	222,592	275,692
Type 11A Ratio	*1.00*	*2.44*	*1.76*	*4.19*	*5.19*
EMPL. (No.)	434	1,582	1,244	2,826	3,260
Type 11A Ratio	*1.00*	*3.64*	*2.87*	*6.51*	*7.51*

The Project is estimated to make up to the following total contribution to the NSW economy for 25 years:

- $1,554M in annual direct and indirect regional output or business turnover;
- $802M in annual direct and indirect regional value added;
- $276M in annual direct and indirect household income; and
- 3,260 direct and indirect jobs.

The impacts on the NSW economy are substantially greater than for the regional economy, as the NSW economy is able to capture more mine and household expenditure, and there is a greater level of intersectoral linkages in the larger NSW economy. At the NSW level, there is greater scope for labour and resources required for the Project to be diverted from other sectors of the economy, particularly in times of near full employment of the economy, and hence for there to be some offsetting reduction in economic activity.

3.4 MINE CESSATION

As outlined in Sections 3.2 and 3.3, the Project will stimulate demand in the local, regional and NSW economy, for up to 30 years, leading to increased business turnover in a range of sectors and increased employment opportunities. Conversely, the cessation of the mining operations in the future would result in a contraction in local, regional and NSW economic activity.

The magnitude of the local and regional economic impacts of cessation of the Project would depend on a number of interrelated factors at the time, including:

- The movements of workers and their families;
- Alternative development opportunities; and
- Economic structure and trends in the regional economy at the time.

Ignoring all other influences, the impact of Project cessation on the local and regional area would depend on whether the workers and their families affected would leave the local and regional area. If it is assumed that some or all of the workers remain in the local and regional area, then the impacts of Project cessation would not be as severe compared to a greater level leaving the local and regional area. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption, the local and regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table 3.6 Table 3.7, respectively. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 3.6 and Table 3.7.

The decision by workers, on cessation of the Project, to move or stay would be affected by a number of factors including the prospects of gaining employment in the local and regional economy compared to other regions, the likely loss or gain from homeowners selling, and the extent of "attachment" to the local and regional areas (Economic and Planning Impact Consultants, 1989).

To the extent that alternative development opportunities arise in the local and regional economy, the regional economic impacts associated with mining closure that arise through reduced production and employment expenditure can be substantially ameliorated and absorbed by the growth of the region. One key factor in the growth potential of a region is its capacity to expand its factors of production by attracting investment and labour from outside the region (BIE, 1994). This in turn can depend on a region's natural endowments. In this respect, the local and regional area is highly prospective with considerable coal resources (NSW DPI, 2010).

It is therefore likely that, over time, new mining developments would occur, offering potential to strengthen and broaden the economic base of the local and regional area and hence buffer against impacts of the cessation of individual activities.

Ultimately, the significance of the economic impacts of cessation of the Project would depend on the economic structure and trends in the local and regional economy at the time. For example, if Project cessation takes place in a declining economy, the impacts might be significant. Alternatively, if Project cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Project may not be a cause for concern.

Nevertheless, given the uncertainty about the future complementary mining activity in the local and regional economy it is not possible to foresee the likely circumstances within which Project cessation would occur.

4 CONCLUSION

A BCA of the Project indicated that it would have net production benefits to Australia of $1,321M. Provided the residual environmental, social and cultural impacts of the Project that accrue to Australia are considered to be valued at less than $1,321M, the Project can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

Instead of leaving the environmental, cultural and social impacts unquantified, an attempt was made to quantify them. The main quantifiable environmental impacts of the Project that have not already been incorporated into the estimate of net production benefits, relate to greenhouse gas emissions, road transport impacts and surface water and groundwater impacts. These impacts are estimated at $93M globally or $6M to Australia, considerably less than the estimated net production benefits of the Project. There may also be some non-market benefits of employment provided by the Project which are estimated to be in the order of $324M. Overall, the Project is estimated to have net social benefits to Australia of between $1,315M and $1,639M and hence is desirable and justified from an economic efficiency perspective.

While the BCA is primarily concerned with the aggregate costs and benefits of the Project to Australia, the costs and benefits may be distributed among a number of different stakeholder groups at the local, state, National and global level. The total net production benefit will be distributed amongst a range of stakeholders including:

- Shenhua Watermark shareholders in the form of after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of any Company tax payable ($745M present value) or Minerals Resource Rent Tax from the Project, which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the local and regional area;
- the NSW Government via royalties ($565M present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the local and regional area; and
- the local and regional community in the form of voluntary contributions to community infrastructure and services ($11M present value).

The environmental, cultural and social impacts of the Project may potentially accrue to a number of different stakeholder groups at the local, State, National and global level, however, are largely internalised into the productions costs of Shenhua Watermark.

The non-market costs that accrue to NSW are estimated at less than $6M. These are considerably less than the net production benefits (and potential non-market employment benefits) that directly accrue to NSW. Consequently, as well as resulting in net benefits to Australia the Project would result in net benefits to NSW.

An economic impact analysis, using input-output analysis found that the operation of the Project is estimated to make up to the following contribution to the local economy:

- $902M in annual direct and indirect regional output or business turnover;
- $493M in annual direct and indirect regional value added;
- $80M in annual direct and indirect household income; and
- 908 direct and indirect jobs.

The impact of the Project operation on the regional economy is estimated at up to:

- $913M in annual direct and indirect regional output or business turnover;
- $507M in annual direct and indirect regional value added;
- $91M in annual direct and indirect household income; and
- 1,015 direct and indirect jobs.

For the NSW economy, the operation of the Project is estimated to make up to the following contribution:

- $1,554M in annual direct and indirect regional output or business turnover;
- $802M in annual direct and indirect regional value added;
- $276M in annual direct and indirect household income; and
- 3,260 direct and indirect jobs.

Cessation of the Project operation may lead to a reduction in economic activity. The significance of these Project cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Project cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

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ATTACHMENT 1 – VALUING GREENHOUSE GAS EMISSIONS

To place an economic value on carbon dioxide equivalent (CO_2-e) emissions a shadow price of carbon is required that reflects its social costs. The social cost of carbon is the present value of additional economic damages now and in the future caused by an additional tonne of carbon emissions.

A prerequisite to valuing this environmental damage is scientific dose-response functions identifying how incremental emissions of CO_2-e would impact climate change and subsequently impact human activities, health and the environment on a spatial basis. Only once these physical linkages are identified is it possible to begin to place economic values on the physical changes using a range of market and non market valuation methods. Neither the identification of the physical impacts of additional greenhouse gas nor valuation of these impacts is an easy task, although various attempts have been made using different climate and economic modelling tools. The result is a great range in the estimated damage costs of greenhouse gas.

The *Stern Review: Economics of Climate Change* (Stern, 2006) acknowledged that the academic literature provides a wide range of estimates of the social cost of carbon. It adopted an estimate of United States (US) $85 per tonne (/t) of carbon dioxide (CO_2) for the "business as usual" case (i.e. an environment in which there is an annually increasing concentration of greenhouse gas in the atmosphere).

Tol (2006) highlights some significant concerns with Stern's damage cost estimates including:

- that in estimating the damage of climate change Stern has consistently selected the most pessimistic study in the literature in relation to impacts;
- Stern's estimate of the social cost of carbon is based on a single integrated assessment model, PAGE2002, which assumes all climate change impacts are necessarily negative and that vulnerability to climate change is independent of development; and
- Stern uses a near zero discount rate which contravenes economic theory and the approach recommended by Treasury's around the world.

All these have the effect of magnifying the social cost of the carbon estimate, providing what Tol (2006) considers to be an outlier in the marginal damage cost literature.

Tol (2005) in a review of 103 estimates of the social cost of carbon from 28 published studies found that the range of estimates was right-skewed: the mode was US$0.55/t CO_2 (in 1995 US$), the median was US$3.82/t CO_2, the mean US$25.34/t CO_2 and the 95th percentile US$95.37/t CO_2. He also found that studies that used a lower discount rate and those that used equity weighting across regions with different average incomes per head, generated higher estimates and larger uncertainties. The studies did not use a standard reference scenario, but in general considered 'business as usual' trajectories.

Tol (2005) concluded that "it is unlikely that the marginal damage costs of CO_2 emissions exceed US$14/t CO_2 and are likely to be substantially smaller than that". Nordhaus's (2008) modelling using the DICE-2007 Model suggests a social cost of carbon with no emissions limitations of US$30 per tonne of carbon (US$8/t CO_2).

Tol (2011) surveyed the literature on the economic impact of climate change. Tol (2011) identifies the mean estimated from published studies is a marginal cost of carbon of $177/t C ($48/ tCO2-e) and a modal estimate of $49/t C ($13 tCo2-e) reflecting the fact that the mean estimate is driven by some very large estimates. For peer reviewed studies only, the mean estimate of the social cost of carbon is $80/tC ($22/tCo2-e).

An alternative method to trying to estimate the damage costs of CO_2 is to examine the price of carbon credits. This is relevant because emitters can essentially emit CO_2 resulting in climate change damage costs or may purchase credits that offset their CO_2 impacts, internalising the cost of the externality at

the price of the carbon credit. The price of carbon credits therefore provides an alternative estimate of the economic cost of greenhouse gas. However, the price is ultimately a function of the characteristics of the scheme and the scarcity of permits, etc. and hence may or may not reflect the actual social cost of carbon.

In the first half of 2008 the carbon price under the European Union Emissions Trading Scheme was over €20/t CO_2 The average price was €22/t CO_2 in the second half of 2008, and €13/t CO_2 in the first half of 2009. In March 2012, the permit price reduced to under €10 /t CO_2.

In 2008, spot prices in the Chicago Climate Exchange were in the order of US$3.95/t CO_2. However, the Chicago Climate Exchange cap and trade system ended on December 31, 2010.

In 2011, the greenhouse penalty for benchmark participants in the New South Wales Government Greenhouse Gas Reduction Scheme that fail to reduce emissions rose to $15.50 t CO_2.

Under the Australian Commonwealth Government's Climate Change Plan (Department of Climate Change and Energy Efficiency 2011) around 500 of the biggest polluters in Australia will need to buy and surrender to the Government a permit for every tonne of carbon pollution they produce. For the first three years, the carbon price will be fixed like a tax, before moving to an emissions trading scheme in 2015. In the fixed price stage, starting on 1 July 2012, the carbon price will start at $23 a tonne, rising at 2.5 per cent a year in real terms. From 1 July 2015, the carbon price will be set by the market.

Given the above information and the great uncertainty around damage cost estimates, the BCA uses the carbon price proposed by Australian Government's Climate Change Plan i.e. $23 a tonne, rising at 2.5 per cent a year in real terms for three years, as reflective of the global social damage cost of carbon. From 2015 it is assumed that the carbon price remains constant. A range for the social cost of greenhouse gas emissions from AUD$8/t CO_2-e to AUD$40/t CO_2-e was used in the sensitivity analysis described in Section 2.6 of this report.

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ATTACHMENT 2 – BCA SENSITIVITY TESTING

Table 2-1
Benefit Cost Analysis Sensitivity Testing, Project Australian Net Present Value ($Millions)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$2,401	$1,639	$1,176
INCREASE 20%			
Opportunity cost of land	$2,392	$1,630	$1,167
Development costs	$2,309	$1,560	$1,105
Operating costs	$2,076	$1,422	$1,023
Coal value	$3,242	$2,207	$1,579
Surface water	$2,401	$1,639	$1,175
Groundwater	$2,401	$1,639	$1,175
Road transport	$2,402	$1,639	$1,176
Employment benefits	$2,468	$1,704	$1,239
GREENHOUSE COSTS @ $40/TONNE (T)	$2,401	$1,639	$1,175

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE 20%			
Opportunity cost of land	$2,411	$1,648	$1,185
Development costs	$2,494	$1,718	$1,246
Operating costs	$2,728	$1,856	$1,329
Coal value	$1,561	$1,071	$772
Surface water	$2,402	$1,640	$1,176
Groundwater	$2,402	$1,640	$1,176
Road transport	$2,402	$1,639	$1,176
Employment benefits	$2,335	$1,574	$1,113
GREENHOUSE COSTS @ $8/T	$2,403	$1,640	$1,176

ATTACHMENT 3 – UNDERLYING ASSUMPTIONS AND INTERPRETATIONS OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS

1. "The *basic assumptions* in input-output analysis include the following:

   - there is a fixed input structure in each industry, described by fixed technological coefficients (evidence from comparisons between input-output tables for the same country over time have indicated that material input requirements tend to be stable and change but slowly; however, requirements for primary factors of production, that is labour and capital, are probably less constant);
   - all products of an industry are identical or are made in fixed proportions to each other;
   - each industry exhibits constant returns to scale in production;
   - unlimited labour and capital are available at fixed prices; that is, any change in the demand for productive factors will not induce any change in their cost (in reality, constraints such as limited skilled labour or investment funds lead to competition for resources among industries, which in turn raises the prices of these scarce factors of production and of industry output generally in the face of strong demand); and
   - there are no other constraints, such as the balance of payments or the actions of government, on the response of each industry to a stimulus.

2. The multipliers therefore describe *average effects, not marginal effects*, and thus do not take account of economies of scale, unused capacity or technological change. Generally, average effects are expected to be higher than the marginal effects.

3. The input-output tables underlying multiplier analysis only take account of one form of *interdependence,* namely the sales and purchase links between industries. Other interdependence such as collective competition for factors of production, changes in commodity prices which induce producers and consumers to alter the mix of their purchases and other constraints which operate on the economy as a whole are not generally taken into account.

4. The combination of the assumptions used and the excluded interdependence means that input-output multipliers are higher than would realistically be the case. In other words, they tend to *overstate* the potential impact of final demand stimulus. The overstatement is potentially more serious when large changes in demand and production are considered.

5. The multipliers also do not account for some important pre-existing conditions. This is especially true of Type II multipliers, in which employment generated and income earned induce further increases in demand. The implicit assumption is that those taken into employment were previously unemployed and were previously consuming nothing. In reality, however, not all 'new' employment would be drawn from the ranks of the unemployed; and to the extent that it was, those previously unemployed would presumably have consumed out of income support measures and personal savings. Employment, output and income responses are therefore overstated by the multipliers for these additional reasons.

6. The most *appropriate interpretation* of multipliers is that they provide a relative measure (to be compared with other industries) of the interdependence between one industry and the rest of the economy which arises solely from purchases and sales of industry output based on estimates of transactions occurring over a (recent) historical period. Progressive departure from these conditions would progressively reduce the precision of multipliers as predictive device" (ABS 1995, p.24).

Multipliers therefore do not take account of economies of scale, unused capacity or technological change since they describe average effects rather than marginal effects (ABS, 1995).

Multipliers indicate the total impact of changes in demand for the output of any one industry on all industries in an economy (ABS, 1995). Conventional output, employment, value-added and income

multipliers show the output, employment, value-added and income responses to an initial output stimulus (Jensen and West, 1986).

Components of the conventional output multiplier are as follows:

Initial effect - which is the initial output stimulus, usually a $1 change in output from a particular industry (Powell and Chalmers, 1995; ABS, 1995).

First round effects - the amount of output from all intermediate sectors of the economy required to produce the initial $1 change in output from the particular industry (Powell and Chalmers, 1995; ABS, 1995).

Industrial support effects - the subsequent or induced extra output from intermediate sectors arising from the first round effects (Powell and Chalmers, 1995; ABS, 1995).

Production induced effects - the sum of the first round effects and industrial support effects (i.e. the total amount of output from all industries in the economy required to produce the initial $1 change in output) (Powell and Chalmers, 1995; ABS, 1995).

Consumption induced effects - the spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries (Powell and Chalmers, 1995; ABS, 1995).

The *simple multiplier* is the initial effect plus the production induced effects.

The *total multiplier* is the sum of the initial effect plus the production-induced effect and consumption-induced effect.

Conventional employment, value-added and income multipliers have similar components to the output multiplier, however, through conversion using the respective coefficients show the employment, value-added and income responses to an initial output stimulus (Jensen and West, 1986).

For employment, value-added and income, it is also possible to derive relationships between the initial or own sector effect and flow-on effects. For example, the flow-on income effects from an initial income effect or the flow-on employment effects from an initial employment effect, etc. These own sector relationships are referred to as ratio multipliers, although they are not technically multipliers because there is no direct line of causation between the elements of the multiplier. For instance, it is not the initial change in income that leads to income flow-on effects, both are the result of an output stimulus (Jensen and West, 1986).

A description of the different ratio multipliers is given below.

$$\text{Type 1A Ratio Multiplier} = \frac{\text{Initial + First Round Effects}}{\text{Initial Effects}}$$

$$\text{Type 1B Ratio Multiplier} = \frac{\text{Initial + Production Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11A Ratio Multiplier} = \frac{\text{Initial + Production Induced + Consumption Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11B Ratio Multiplier} = \frac{\text{Flow-on Effects}}{\text{Initial Effects}}$$

Source: Centre for Farm Planning and Land Management (1989).

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ATTACHMENT 4 – THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

The Generation of Regional Input-Output Tables (GRIT) system was designed to:

- combine the benefits of survey based tables (accuracy and understanding of the economic structure) with those of non-survey tables (speed and low cost);
- enable the tables to be compiled from other recently compiled tables;
- allow tables to be constructed for any region for which certain minimum amounts of data were available;
- develop regional tables from national tables using available region-specific data;
- produce tables consistent with the national tables in terms of sector classification and accounting conventions;
- proceed in a number of clearly defined stages; and
- provide for the possibility of ready updates of the tables.

The resultant GRIT procedure has a number of well-defined steps. Of particular significance are those that involve the analyst incorporating region-specific data and information specific to the objectives of the study. The analyst has to be satisfied about the accuracy of the information used for the important sectors; in this case the coal mining sector. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study.

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). This means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A4-1 (Powell and Chalmers, 1995).

Table A4-1
The GRIT Method

Phase	Step	Action
PHASE I		ADJUSTMENTS TO NATIONAL TABLE
	1	Selection of national input-output table (106-sector table with direct allocation of all imports, in basic values).
	2	Adjustment of national table for updating.
	3	Adjustment for international trade.
PHASE II		ADJUSTMENTS FOR REGIONAL IMPORTS
		(*Steps 4-14 apply to each region for which input-output tables are required*)
	4	Calculation of 'non-existent' sectors.
	5	Calculation of remaining imports.
PHASE III		DEFINITION OF REGIONAL SECTORS
	6	Insertion of disaggregated superior data.
	7	Aggregation of sectors.
	8	Insertion of aggregated superior data.
PHASE IV		DERIVATION OF PROTOTYPE TRANSACTIONS TABLES
	9	Derivation of transactions values.
	10	Adjustments to complete the prototype tables.
	11	Derivation of inverses and multipliers for prototype tables.
PHASE V		DERIVATION OF FINAL TRANSACTIONS TABLES
	12	Final superior data insertions and other adjustments.
	13	Derivation of final transactions tables.
	14	Derivation of inverses and multipliers for final tables.

Source: Bayne and West (1988).

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ATTACHMENT 5 – PEER REVIEW OF THE ECONOMIC IMPACT ASSESSMENT

ENVIRONMENTAL & RESOURCE ECONOMICS

12 October 2012

James Bailey
Hansen Bailey Consulting
PO Box 473
Singleton, NSW 2330

Dear James,

I have reviewed the draft version of the "Watermark Coal Project Economic Impact Assessment" (hereafter referred to as the Assessment) prepared for Shenhua Watermark Coal Pty Ltd by Gillespie Economics. My comments on the draft Assessment were provided to Gillespie Economics and I have held discussions with Mr Gillespie on those comments. In response, Gillespie Economics has prepared a final version of the Assessment.

The Assessment comprises two components: A benefit cost analysis and an input-output analysis of the proposed Watermark Mine. The benefit cost analysis aims to provide decision makers with guidance as to the mine's expected impact on the overall well-being of the Australian society. This is an analysis of the economic efficiency of the mine. In addition, some information about the distribution of benefits and costs across the community are provided. The input-output analysis provides estimates of the changes in the extent and structure of the local, regional and NSW economies should the mine proceed. This analysis provides decision makers with a better understanding of the changing sectoral composition of the economy and likely impacts on employment.

Overall, the Gillespie Economics Assessment in soundly based conceptually and has been carried out proficiently. As with most economic studies, the Assessment is based on information derived from numerous sources. Most significantly, it relies on inputs from the mine proponent regarding expected coal prices as well as the costs of mine establishment and operation. It also uses information provided by a number of consultants to the mine proponent who have forecast the environmental and social impacts of the mine.

A key feature of the benefit cost analysis is the use of costs of offsetting arrangements to reflect the costs of the environmental damage expected from the mine. This approach assumes that the offsets established are perfect substitutes for the assets that are damaged. This in turn relies on the public authorities responsible for negotiating the offsets that the 'no net damage' principle is applied.

The benefit cost analysis also uses impact estimates from previously undertaken non-market valuation studies. This is the process known as 'benefit transfer'. Gillespie Economics correctly notes the caveats associated with this approach.

Both the offset cost and benefit transfer approaches are used instead of primary data collection

"MANANDAWARA" PO BOX 8714 GUNDAROO NSW 2620 AUSTRALIA e: jeff.bennett@bigpond.com p: +61 2 6236 8161 f: +61 2 6236 8161 e: +61 419 232 250

exercises to estimate the non-marketed environmental and social costs. Collection of primary data would have afforded more accurate estimates but would have involved additional costs. It is worth contemplating if an investment of that kind would have been worthwhile. Given that the present value of mine benefits is significantly larger than the present value of the associated costs, it is unlikely that refinement of the non-market value estimates through primary data collection would have altered the overall recommendation of the benefit cost analysis. This is demonstrated by the sensitivity analysis conducted as part of the Assessment. It is clear that the assessment's conclusion that the mine would provide a net benefit to the Australian society is robust to a range of variations in a range of key analytical parameters. The parameters included in the sensitivity analysis include other key factors determining mine costs and benefits such as the price of coal and the opportunity costs of land. Sensitivity to the discount rate employed is also assessed.

Some debate has arisen as to the appropriateness of including in the assessment the non-use, society benefits arising from mine employment. Gillespie Economics takes the approach of including that benefit element in the first instance and then determining if its removal from the benefit cost calculus impacts the final recommendation. The finding is that the positive sign of net present value of the mine is not affected by the exclusion of the employment benefit. Again, this represents sound practice by Gillespie Economics as it demonstrates that policy makers should not be concerned about the employment 'debate' in this instance because it is immaterial to the overall finding of the benefit cost analysis.

The approach taken by Gillespie Economics to the incorporation of the costs associated with carbon emissions from the mine also deserves comment. The per unit cost of carbon emissions used is the rate of the current carbon tax being levied by the Australian Government. This makes the assumption that the government has correctly matched the cost of carbon to the tax rate. While this is debatable, especially as more recent policy changes have linked the Australian carbon price to that being levied in the European Union, the Gillespie Economics approach is considered reasonable given policy and costing uncertainties. The extent of emissions used for the assessment relates to the mining of coal at Watermark and transportation of coal to port. The emissions relating to the burning of the coal are not included. This is an appropriate approach given that the scope of the project under consideration by the NSW Government includes the production of the coal but not its consumption.

The Assessment also provides a very useful analysis of the distribution of the benefits and costs of the mine. This is especially important in this case because of the foreign ownership of Shenhua Watermark Coal Pty Ltd. Profits expatriated overseas are correctly not included in the Assessment's estimate of mine benefits. What remains to be included are the tax and royalty payments made by Shenhua to the Australian and NSW state governments.

The input-output (I-O) analysis comprising the second part of the assessment has been performed consistent with established principles. The GRIT system used is appropriate to the purpose for which the analysis is put. It is important that decision makers recognise that the input-output approach is essentially a static analysis. This means that the analysis uses information on the structure of the economy (the I-O tables) that is pertinent to a specific period of time and doesn't take into account variations over time beyond those associated with the specific 'shocks' relating to the mine expenditure. This feature of the second part of the report has been made in the Assessment. Similarly, the Assessment correctly points out the differences between the goals of the I-O analysis and those of the benefit cost analysis.

In conclusion, I am satisfied that the Gillespie Economics Assessment of the Watermark Mine provides a sound basis for decision making.

Yours sincerely,

Prof Jeff Bennett
Principal