Vickery Coal Project

Environmental Impact Statement

APPENDIX K

SOCIO-ECONOMIC ASSESSMENT

Resource Strategies

WHITEHAVEN COAL

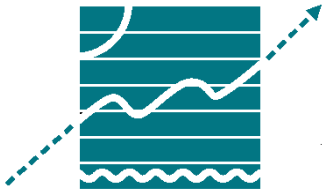
Vickery Coal Project

Socio-Economic Assessment

Prepared for

Whitehaven Coal Limited

By



Gillespie Economics
Email: gillecon@bigpond.net.au

October 2012

TABLE OF CONTENTS

TABLES

FIGURES

ATTACHMENTS

EXECUTIVE SUMMARY

Whitehaven Coal Limited (Whitehaven) is seeking Development Consent under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act*, *1979* (EP&A Act) to develop the Vickery Coal Project (the Project), including the construction and operation of an open cut coal mine and associated infrastructure located in the NSW Gunnedah Coalfield, approximately 25 kilometres north of Gunnedah.

An Environmental Impact Statement (EIS) of the Project is required in accordance with provisions of the EP&A Act. A socio-economic assessment is required as part of this EIS.

From a socio-economic perspective there are three important aspects of the Project that can be considered:

- the economic efficiency of the Project (i.e. consideration of economic costs and benefits);
- the economic impacts of the Project (i.e. the economic activity that the Project would provide to the local, regional and State economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

A Benefit Cost Analysis of the Project indicated that it would have net production benefits to Australia of $915 million (M). Provided the residual environmental, social and cultural impacts of the Project that accrue to Australia are considered to be valued at less than $915M, 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, surface water and groundwater impacts. These impacts are estimated at $50M globally or $3M 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 $144M. Overall, the Project is estimated to have net benefits to Australia of between $912M and $1,056M and hence is desirable and justified from an economic efficiency perspective.

While the Benefit Cost Analysis 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, including:

- Whitehaven shareholders in the form of any after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of Company tax payable ($932M in total or $220M present value at 7% discount rate) 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 ($1,144M in total or $386M present value at 7% discount rate) 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.

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 Whitehaven.

Noise costs, air quality costs and agricultural production costs will occur at a local level, but have already been incorporated into the estimation of net production benefits via acquisition costs for affected properties and mitigation costs. 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. The cost of providing these offsets is included in the estimation of net production benefits. Visual impacts will occur at the local level and will be internalised by Whitehaven through the funding of visual mitigation measures. 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[1].

The non-market costs that accrue to NSW are estimated at less than $3M. These are considerably less than the net production benefits (and potential non-market employment benefits) that directly accrue to NSW through royalties[2]. 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:

- $588M in annual direct and indirect regional output or business turnover;
- $271M in annual direct and indirect regional value added;
- $38M in annual direct and indirect household income; and
- 423 direct and indirect jobs.

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

- $1,111M in annual direct and indirect regional output or business turnover;
- $520M in annual direct and indirect regional value added;
- $196M in annual direct and indirect household income; and
- 2,292 direct and indirect jobs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities.

[1] It should be noted that the study from which the employment values were transferred surveyed NSW households only.
[2] Noting that NSW will also share some of the benefits that accrue to the Commonwealth through company taxes and Minerals Resource Rent Tax, shareholder payments as well as any direct contributions through the Voluntary Planning Agreement.

The peak construction period of the Project would last for approximately 12 months and require a workforce of around 50 people. The maximum direct and indirect population associated with this was estimated at 148. Operations at the Project would last for 30 years and require a direct incremental workforce of 193 (145 residing in the region). The maximum direct and indirect population associated with this was estimated at 1,057.

There may be a number of community infrastructure impacts associated with these maximum potential population influxes of the Project, which would be exacerbated by the cumulative impacts of a number of coal mining projects in the region. Potential Project and cumulative impacts include:

- pressure on short-term accommodation for construction workforce – potentially squeezing out some tourism;
- increased demand for housing potentially leading to short to medium term increases in house prices and rental prices, leading to some displacement of those on low incomes;
- increased demand for health services;
- increased demand for schools places;
- increased demand for child care facilities;
- increased demand for recreation facilities and other community infrastructure;
- social division;
- changing sense of place;
- labour – skills shortages and difficulty retaining workers in non-mine sectors; and
- increased crime during construction phases associated with influx of single males.

Whitehaven would work in partnership with the Narrabri and Gunnedah Shire Councils and the local community so that the benefits of the projected economic growth in the region are maximised and impacts minimised, as far as possible. In this respect, a range of general and specific social impact mitigation and management measures are proposed and would include:

- Early provision of information to the Narrabri and Gunnedah Shire Councils and relevant State Government agencies regarding employment and population level changes to facilitate early community infrastructure provision responses.
- Continuation of Whitehaven's current donations policy which supports education, health and community causes.
- Employment of local residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation.
- Purchase of local non-labour inputs to production preferentially where local producers can be cost and quality competitive.
- A code of conduct for construction workers with regard to behaviour in Contractor Induction Program.
- A Voluntary Planning Agreement with Narrabri and Gunnedah Councils.

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

Whitehaven Coal Limited (Whitehaven) is seeking Development Consent under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act*, 1979 (EP&A Act) to develop an open cut coal mine and associated infrastructure (herein referred to as the Vickery Coal Project [the Project]). The Project is located within the Gunnedah Basin, in the NSW Gunnedah Coalfield, with the planned open cut being situated approximately 25 kilometres (km) north of Gunnedah.

An Environmental Impact Statement (EIS) of the Project is required in accordance with provisions of the EP&A Act. A socio-economic assessment is required as part of this EIS.

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

- *potential direct and indirect economic benefits of the project for local and regional communities and the State;*

…

- *potential impacts on local and regional communities, including:*
  - *increased demand for local and regional infrastructure and services (such as housing, childcare, health, education and emergency services); and*
  - *impacts on social amenity;*
- *a detailed 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; 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 NSW Department of Planning and Infrastructure's (DP&I) (James and Gillespie, 2002) *Draft Guideline for Economic Effects and Evaluation in EIA* (draft guideline) and the Office of Social Policy's (1995) *Techniques for Effective Social Impact Assessment: A Practical Guide*.

From a socio-economic perspective there are three important aspects of the Project that can be considered:

- the economic efficiency of the Project (i.e. consideration of economic costs and benefits);
- the economic impacts of the Project (i.e. the economic activity that the Project would provide to the local/regional and State economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

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 DP&I's 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 DP&I's draft guideline (James and Gillespie, 2002) indicates that economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic activity to the local/regional economy can be estimated using input-output modelling (economic impact assessment).

The DP&I's draft guideline (James and Gillespie, 2002) also identifies the need to consider the distribution of benefits and costs in terms of:

- intra-generational equity effects – the incidence of benefits and costs within the present generation; and
- inter-generational equity effects – the distribution of benefits and cost between present and future generations.

These social impacts are often considered in terms of the impacts on employment, population and community infrastructure and services.

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

- a BCA of the Project (Section 2);
- an Economic Impact Assessment of the Project (Section 3); and
- an Employment, Population and Community Infrastructure Assessment (EPCIA) (Section 4).

A consultation program for the EIS was undertaken by Whitehaven and is described in Section 3 in the Main Report of the EIS.

2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

Introduction to BCA

BCA has its theoretical underpinnings in neoclassical welfare economics and 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 (NPV) 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 Project BCA 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 2 in the Main Report of the EIS. It includes the construction and operation of an open cut mining operation extracting up to 4.5 million tonnes per annum (Mtpa) of Run-Of-Mine (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[3], 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 Whitehaven 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.

[3] 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.

Under the base case, the land required for the Project would continue to be used for rural and other purposes. In contrast, the Project comprises:

- Development and operation of an open cut mine within Coal Lease 316, Authorisation 406, Mining Lease 1471 and Mining Lease Application (MLA) 1, MLA 2 and MLA 3.
- Use of conventional mining equipment, haul trucks and excavators to remove up to 4.5 Mtpa of ROM coal and approximately 48 million bank cubic metres of waste rock per annum from the planned open cut.
- Placement of waste rock (i.e. overburden and interburden/partings) within external emplacements to the west and east of the planned open cut and within mined-out voids.
- Construction and use of a Mine Infrastructure Area (MIA), including on-site coal crushing, screening and handling facilities to produce sized ROM coal, workshops, offices and services.
- Transport of ROM coal by haulage trucks to the Whitehaven Coal Handling and Preparation Plant (CHPP) on the outskirts of Gunnedah (approximately 20 km to the south of the Project open cut) for processing.
- Use of an on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes of domestic specification coal per annum for direct collection by customers at the Project site.
- Use an on-site mobile crusher to produce up to approximately 90,000 cubic metres (m^3) of gravel materials per annum for direct collection by customers at the Project site.
- Construction and use of a water supply bore, and a surface water extraction point on the bank of the Namoi River and associated pump and pipeline systems.
- Construction and use of new dams, sediment basins, channels, dewatering bores and other water management infrastructure required to operate the mine.
- Construction and use of new soil stockpile areas, laydown areas and gravel/borrow areas.
- Construction of a 66 kilovolt (kV)/11 kV electricity substation and 11 kV electricity transmission line.
- Transport of coarse rejects generated within the Whitehaven CHPP via truck to the Project for emplacement within an in-pit emplacement area.
- Transport of tailings (i.e. fine rejects) generated within the Whitehaven CHPP via truck to the Project for emplacement within co-disposal storage areas in the open cut and/or disposal in existing off-site licensed facilities (e.g. the Brickworks Pit).
- Realignment of sections of Blue Vale Road, Shannon Harbour Road and Hoad Lane to the east and south of the open cut.
- Realignment of the southern extent of Braymont Road to the south of the open cut.
- Construction of an approximately 1 km long section of private haul road (including an overpass over the Kamilaroi Highway) between Blue Vale Road and the Whitehaven CHPP.
- Ongoing exploration, monitoring and rehabilitation activities.
- Construction and use of other associated infrastructure, equipment and mine service facilities.

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.

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 Whitehaven in the development of the Project description. Section 6 in the Main Report of the EIS provides more detail on the consideration of Project alternatives.

The Project assessed in the EIS and evaluated in the BCA is considered by Whitehaven 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 Whitehaven 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 • Opportunity cost of land[1] • Development costs including acquisition costs for impacted properties and offsets[1] • Operating costs of mine including mitigation measures • Rehabilitation and decommissioning costs at end of the Project life	• Value of coal production • Value of gravel materials • Residual value of capital 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

[1] Foregone agricultural production is reflected in land prices.

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, then no environmental, social or cultural economic costs arise.

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 32 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[4]. An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[5].

2.4.1 Production Costs and Benefits[6]

Production Costs

Opportunity Cost of Land and Capital

There is an opportunity cost associated with using land and capital equipment that is already in Whitehaven ownership for the Project instead of its next best use. An indication of the opportunity cost of this land and capital equipment can be gained from its market value.

Land already in Whitehaven ownership that will be used in the Project is estimated to have a market value of $9M. No capital equipment owned by Whitehaven will be brought forward into the Project.

Development Cost of the Project

Development costs of the Project are associated with the land acquisitions, development of external waste rock emplacements, development of a MIA including coal crushing and screening facilities, construction of soil stockpile areas, purchase of water allocations, construction of dams, channels, dewatering bores, realignment of sections of roads and construction of a private haul road and Kamilaroi Highway overpass.

These incremental development costs over the life of the mine are estimated at $1.1 billion (B). These development costs include an allowance for acquisition of land for properties adversely affected by noise/dust and ecological offsets. Development costs are included in the economic analysis in the years that 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). Average annual operating costs (excluding depreciation and royalties) are estimated at approximately $285M per annum for the 30 year mine life.

While royalties are a cost to Whitehaven, 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 $1,144M ($386M present value).

[4] 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.

[5] Benefit transfer refers to borrowing economic values that have been determined for other study sites.

[6] All values reported in this section are undiscounted Australian dollars unless otherwise specified.

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 development costs of the Project in the years in which they occur.

Rehabilitation and Decommissioning Costs

Rehabilitation costs and site decommissioning costs are estimated at $144M over the life of the Project.

Production Benefits

Value of Coal

Total ROM coal production is estimated at 135 million tonnes (Mt) with peak production at 4.5 Mtpa ROM. Product coal is a combination of coking coal and thermal coal, for export.

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

Projected prices for the Project product thermal coal were provided by Whitehaven and averaged AUD$143/tonne for coking coal and AUD$113 for thermal coal. There is obviously considerable 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).

Sale Value of Gravel

The Project would produce up to approximately 90,000 m^3 of gravel materials per annum for direct collection by customers at the mine site. The assumed price for gravel materials used in the analysis is AUD$4/$m^3$.

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.

The land owned by Whitehaven at the end of the mine life would include land directly associated with the disturbance area, biodiversity offset land and buffer lands around the Project area that would be acquired to manage noise and air quality impacts.

Following mine closure, it is assumed that the buffer lands would be sold by Whitehaven. It is assumed that the biodiversity offset area would have no residual value.

Rehabilitation of the Project disturbance area would involve recreation of approximately 780 hectares (ha) of agricultural land. The remaining 1,462 ha would be rehabilitated to native woodland which is assumed to have no residual value.

The total residual value of land (i.e. the buffer land and re-established agricultural land) is estimated at $16M, or $2M present value (at 7% discount rate).

No residual value for capital equipment is included.

2.4.2 Environmental, Social and Cultural Costs and Benefits

Greenhouse Gases

The Project is predicted to generate a total of some 4.1 Mt of direct (scope 1) greenhouse gas emissions associated with mining activities (PAE Holmes, 2012) and 0.2 Mt of scope 2 greenhouse gas emissions associated with the CHPP operation (Appendix D of the EIS). In addition, a total of some 1.3 Mt of indirect (scope 3) greenhouse gas emissions associated with the processing of Project ROM coal (at the Whitehaven CHPP), the transportation of product coal to the Port of Newcastle and on-site diesel usage would be generated (Appendix D of the EIS). The economic analysis has included these emissions as a potential external cost of the Project.

To place an economic value on carbon dioxide equivalent (CO_2-e) emissions, a shadow price of CO_2-e is required that reflects its social costs. The 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 uncertainty around the 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 damage costs of CO_2-e is to examine the price of CO_2-e credits. Again, however, there is a wide range of permit 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 Gross Domestic Product (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.

It is noted that Gillespie Economics (2012) conducted a detailed assessment to estimate the annual economic impact to existing agricultural resources which would be disturbed by the Project (presented in the Agricultural Impact Statement for the Project [Appendix G of the EIS]). This analysis used gross margins developed by the NSW Department of Primary Industries to estimate the foregone gross margin present value of agricultural production from land directly impacted by the Project as $3.5M.

The allowance included in the BCA for foregone agricultural production (as reflected by land prices) is considered conservative as it is greater than the detailed estimate of the present value of the forgone agricultural production prepared by Gillespie Economics (2012) (Appendix G of the EIS).

Operational Noise

As described in the Noise and Blasting Impact Assessment (Wilkinson Murray, 2012) (Appendix C of the EIS), five rural residences and one property have been identified as being in the Project noise management zone, where exceedances of 1 to 5 A-weighted decibels (dBA) above applicable noise criteria are predicted. Contemporary Project Approval conditions for residences in the moderate noise management zone typically require proponents to provide at receiver noise mitigation on request. An allowance in the development costs of the Project has been made for potential at receiver mitigation at five residences.

Two rural residences, one approved residence location and one property have been identified in Appendix C of the EIS as being in the Project noise affectation zone (i.e. greater than 5 dBA above applicable noise criteria). 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 noise is estimated. It is expected that the owners of the properties located within the Project noise affectation zone would be granted the opportunity to be acquired by Whitehaven via conditions of the Development Consent. Instead of incorporating the partial property value impact on these properties, conservatively, the full cost of acquiring them has been incorporated into the development cost associated with the Project[7].

Road Transport Noise

The potential noise impact of Project road traffic was also assessed. It was concluded that noise levels associated with Project related road movements would not exceed relevant criteria in the vicinity of the Project (Appendix C of the EIS), and therefore no significant economic effects would arise with respect to Project road noise that would warrant inclusion in the BCA.

Rail Transport Noise

The Project would generate a maximum additional two laden train movements per day on the Werris Creek Mungindi Railway from the Whitehaven CHPP to Werris Creek and along the Main Northern Railway to the Port of Newcastle (Appendix C of the EIS).

Appendix C of the EIS concluded that these increased rail movements would marginally increase rail noise levels (i.e. the compliance distance from the track to meet the relevant rail noise criteria would at maximum increase by a negligible 2 metres). Consideration of the above indicates that no significant economic effects would arise with respect to Project rail noise that would warrant inclusion in the BCA.

Blasting Overpressure and Vibration

Blasting at the Project has the potential to cause structural damage or human discomfort at properties surrounding the Project. The potential impacts of blast overpressure and vibration were assessed in Appendix C of the EIS. The assessment concluded that with the implementation of appropriate blasting controls all nearby private receivers would be below relevant building damage and human comfort criteria. Hence, no economic effects have been identified in the BCA with respect to blasting impacts.

Air Quality

Potential air quality impacts may occur at nearby residences as a result of dust generation at the Project from activities such as coal and waste rock handling, emissions from stockpiles and haul roads, and blasting.

The Air Quality and Greenhouse Gas Assessment for the Project (Appendix D of the EIS) indicated that one nearby private vacant lot with an existing Development Application for a dwelling would be impacted by air quality emissions above relevant criteria.

The impacts on this property 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, this property is also adversely affected by noise and is therefore included in the noise acquisition zone.

[7] 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 development cost assumptions is also undertaken to determine the impact of changes in assumptions.

Instead of incorporating the partial property value impact on this property (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.

Surface Water

The Project would result in changes to flows in local creeks due to the progressive development of the open cut and associated subsequent capture and re-use of runoff from operational disturbance areas and controlled releases from licensed discharge points.

The maximum predicted reduction in contributing catchment over the life of the Project (alone) when compared to the total catchment of the Namoi River is 0.012% (Evans & Peck, 2012) (Appendix B of the EIS). The opportunity cost of this water has been included in the analysis.

Whitehaven currently holds existing water access licences for the Project, including an allocation of 1,155.2 million litres per annum (ML/annum) for surface water extraction from the Namoi River (as both general security and supplementary access licences). This allocation would be retained for the life of the Project and is anticipated to be returned to the market following mine closure. The opportunity cost of this water has been included in the BCA.

Potential impacts of the Project on surface water quality include the reduction in surface water quality due to controlled licensed discharges to receiving waters or uncontrolled runoff from disturbed areas and/or release of contaminants, acid rock drainage from mine waste rock emplacements, saline runoff from Project irrigation areas and/or alteration of groundwater quality affecting base flow in surface water resources. Potential water quality issues at the Project would be effectively managed on-site such that there would be a low risk of adverse water quality impacts occurring off-site (Appendix B of the EIS) and hence no economic effects have been identified in the BCA with respect to water quality impacts.

Groundwater

Porous rock and the alluvial groundwater systems are present in the vicinity of the Project (Heritage Computing, 2012) (Appendix A of the EIS). The porous rock groundwater system includes the coal measures of the Maules Creek Formation and the alluvial groundwater system is associated with the Upper Namoi Alluvium to the north, west and south of the Project mining area.

As mining progresses, the open cut would act as a groundwater sink (Appendix A of the EIS). This would cause a temporary change in groundwater flow direction, in places localised reversal of direction, until mining is completed and the porous rock groundwater system recovers (Appendix A of the EIS).

Groundwater associated with the Upper Namoi Alluvium would be sourced via indirect depressurisation via enhanced leakage to the underlying porous rock groundwater system (Appendix A of the EIS).

Whitehaven currently holds existing water access licences for the Project, including an allocation of 180 ML/annum for groundwater extraction from the Upper Namoi Zone 4 Groundwater Source (Appendix A of the EIS). This allocation would be retained for the life of the Project and it is anticipated that an allocation of approximately 80 ML/annum would be returned to the market following mine closure (approximately 100 ML/annum would be retained for the Project in perpetuity to account for on-going groundwater inflows into the final voids).

In addition to the above, Whitehaven would be required to purchase approximately 700 ML/annum of water access licences from the NSW Murray Darling Porous Rock Groundwater Source from the market and hold these licences for the life of the Project (Appendix A of the EIS). It is anticipated that an allocation of approximately 370 ML/annum from the groundwater source would be returned to the market following mine closure (approximately 430 ML/annum would be retained for the Project in perpetuity to account for on-going groundwater inflows into the final voids).

The cost of purchasing and holding relevant groundwater extraction licences has been incorporated into the development cost of the Project.

The predicted drawdown effects on groundwater users in the vicinity of the Project are not likely to be significant and would not materially affect the existing or potential future beneficial use of groundwater (Appendix A of the EIS). Hence, no economic effects have been identified in the BCA with respect to drawdown effects on groundwater users.

Flora and Fauna

The additional surface disturbance associated with the Project would involve the clearance of approximately 1,748 ha of predominately native vegetation, including forest, woodland, derived native grasslands and areas previously disturbed and regenerating (Niche Environment and Heritage, 2012) (Appendix E of the EIS).

Endangered ecological communities and some threatened fauna species were identified in the Project area and surrounds as described in Appendix E of the EIS. An assessment of the impacts of the Project indicated that neither the endangered ecological communities nor the threatened fauna species would be significantly impacted by the Project due to a range of impact avoidance, mitigation and offset measures.

The Project incorporates progressive rehabilitation of disturbance areas and a biodiversity offset comprising some 1,671 ha. The conservation of the proposed biodiversity offset areas would be secured in perpetuity through one of a selection of mechanisms being considered.

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 potential impacts of the Project on local traffic conditions and road safety have been considered by GTA Consultants (2012) (Appendix F of the EIS). It was concluded that no significant impacts on the performance and safety of the public road network would be expected to arise as a result of the Project and no specific traffic management or mitigation measures were considered to be warranted. Hence, no economic effects have been identified in the BCA with respect to the predicted road transport movements associated with the Project (with the exception of the private haul road and Kamilaroi Highway overpass which has been included in the capital cost of the Project).

Aboriginal Heritage

The Project has the potential to impact Aboriginal heritage sites in Project land disturbance areas. Of the 40 known Aboriginal heritage sites located within the study area, 24 would be subject to direct disturbance and one may be subject to indirect disturbance (Landskape, 2012) (Appendix I of the EIS). However, these are of low to moderate archaeological significance. The potential economic non-use values of these sites have not been estimated in this analysis, but are assumed to be minor.

Non-Aboriginal Heritage

The Broadwater Homestead Complex was considered to be potentially of local significance (Heritage Management Consultants, 2012) (Appendix J of the EIS). The Broadwater Homestead Complex is located approximately 2 km west of the Western Emplacement and 3 km west of the open cut. As such, the Broadwater Homestead Complex, would not be directly impacted by the Project and potential impacts from blasting induced vibration are expected to be negligible (Appendix J of the EIS). Therefore no significant economic effects would arise with respect to non-Aboriginal heritage that would warrant inclusion in the BCA.

Visual Impacts

Potential views of the Project landforms would be available from the following locations (Urbis, 2012) (Appendix H of the EIS):

- rural dwellings to the south-east, south-west, west and north of the Project (regional and sub-regional settings);
- local and State roads (local, sub-regional and regional settings); and
- other areas such as private roads and paddocks.

Visual impacts of the Project would include new views of the waste rock emplacements and mine infrastructure from local viewpoints. Night-lighting impacts would also be associated with the Project. Visual impacts associated with mine landforms would decrease over time due to progressive rehabilitation. The use of night-lighting would be restricted to minimise potential impacts to private receivers.

Visual intrusion can potentially impact the consumer surplus of affected households (can be estimated using the property valuation method) and visitors to surrounding areas (which can be measured via the contingent valuation method). Visual impacts would be most appreciable at the nearest privately owned dwellings with views of the Project landforms. The potential impacts at the nearest private dwellings have been assessed as being low to high and following rehabilitation, residual impacts would be low to very low (Appendix H of the EIS). 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.

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, 1991). These values have not been included in the Project BCA.

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 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 193 people for 30 years. Applying the more conservative Bulli Seam Operation employment value to the estimated incremental direct employment[8] gives an estimated $144M 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[9] 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 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 $1,121M, with $915M of these net production benefits accruing to Australia. 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 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[10], would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $915M. This is equivalent to each household in the region valuing residual environmental impacts at $91,000. The equivalent figure for NSW and Australian households is $340 and $110, 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 $3M, 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 $912M and $1,056M, and hence is desirable and justified from an economic efficiency perspective.

---

[8] This is consistent with the non-market valuation studies which focused on direct employment.

[9] The source study was concerned with a continuation of an existing underground mine rather than a new open cut mine.

[10] 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.

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 $912M and $1,056M for the Project to be questionable from an Australian economic perspective.

Table 2.2
Benefit Cost Analysis Results of the Project (Present Values at 7% Discount Rate)

	COSTS		BENEFITS	
	Description	**Value ($M)**	**Description**	**Value ($M)**
Production	Opportunity cost of land	$8	Value of coal	$4,707
	Opportunity cost of capital	$0	Value of gravel	$4
	Development costs	$573	Residual value of land	$2
	Operating costs	$2,969	Residual value of capital	$0
	Decommissioning and rehabilitation costs	$42	-	-
	Sub-total	**$3,592**	-	**$4,713**
	Net Production Benefits	**-**	**-**	**$1,121 ($915)**
Non-market Impacts	Greenhouse gas impacts	$48 ($1)	Non-market values of employment	$144
	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 capital costs	-	-
	Blasting	Minimal	-	-
	Air quality impacts	Cost of acquisition is included in development costs	**-**	**-**
	Surface water	$2	-	-
	Groundwater	$1	-	-
	Ecology	Some loss of values but offset. Cost of biodiversity offset included in development costs and operating costs	-	-
	Road transport impacts	Minimal	**-**	**-**
	Aboriginal heritage	Minimal	-	-
	Non-Aboriginal heritage impacts	Minimal	-	-
	Visual impacts	Minimal Costs of mitigation included in development costs	-	-
	Non-market impacts sub-total	**$50 ($3)**	**-**	**$144**
NET SOCIAL BENEFITS (including employment benefits)				**$1,214 ($1,056)**
NET SOCIAL BENEFITS (excluding employment benefits)				**$1,071 ($912)**

Note: Totals may have minor discrepancies due to rounding.

Note: 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:

- Whitehaven shareholders in the form of any after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of Company tax payable ($932M in total or $220M present value at 7% discount rate) 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 ($1,144M in total or $386M present value at 7% discount rate) 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.

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 Whitehaven.

Noise costs, air quality costs and agricultural production costs will occur at a local level, but have already been incorporated into the estimation of net production benefits via acquisition costs for affected properties and mitigation costs. 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. The cost of providing these offsets is included in the estimation of net production benefits. Visual impacts will occur at the local level and will be internalised by Whitehaven through the funding of visual mitigation measures. 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[11].

[11] 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		Distribution			
		Local	**State**	**National**	**Global**
NET PRODUCTION BENEFITS					
Net production benefits to Whitehaven	$514M	✓	✓	✓	✓
Net production benefits to Commonwealth Government – Company tax	$220M	✓	✓	✓	-
Net production benefits to NSW Government – Royalties	$386M	✓	✓	-	-
Voluntary contributions to local and regional community	Unspecified	✓	-	-	-
Total	***$1,121M***				
NON-MARKET COSTS AND BENEFITS					
Benefits					
Non-market benefit of employment	$144M	✓	✓	-	-
Total	***$144M***	-	-	-	-
Costs					
Greenhouse gas emissions rest of the world[1]	$47M	-	-	-	✓
Greenhouse gas emissions Australia[1]	$1M	✓	✓	✓	
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	$2M	✓	-	-	-
Groundwater	$1M	✓	-	-	-
Ecology	Some loss of values but offset. Cost of biodiversity offset included in development costs and operating costs	✓	✓	-	-
Road transport impacts	Minimal	✓	-	-	-
Aboriginal heritage	Minimal	✓	✓	-	-
Non-Aboriginal heritage impacts	Minimal	✓	-	-	-
Visual impacts	Minimal Costs of mitigation included in development costs	✓	-	-	-
Total	***$50M***				
Net Benefits	**$1,214M**				

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 $3M. These are considerably less than the net production benefits (and potential non-market employment benefits) that directly accrue to NSW through royalties[12]. Consequently, as well as resulting in net benefits to Australia the Project would result in net benefits to NSW.

2.6 SENSITIVITY ANALYSIS

This 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% changes to the following variables at a 4%, 7% and 10% discount rate:

- opportunity costs of land;
- development costs;
- operating costs;
- value of coal;
- level of foreign ownership;
- greenhouse costs;
- surface and groundwater impacts; and
- non-market employment impacts.

What this analysis indicates (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 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 30%) would be required to make the Project undesirable from an economic efficiency perspective.

[12] Noting that NSW will also share some of the benefits that accrue to the Commonwealth through company taxes and Minerals Resource Rent Tax, Whitehaven shareholders as well as any direct contributions through the Voluntary Planning Agreement.

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. 4.5 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 two regions:

- the local/regional economy comprising the Local Government Areas (LGAs) of Gunnedah and Narrabri; 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, and 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 of the regional economy was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 4) using a 2006 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.

A highly aggregated 2006 input-output table for the regional economy is provided in Table 3.1. The rows of the table 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: Regional Economy 2006 ($'000)

	Ag, Forestry, Fishing	Mining	Manuf.	Utilities	Building	Services	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	35,880	6	22,442	1	48	1,440	**59,818**	2,239	75,566	273,793	411,416
Mining	0	1,366	408	4,542	80	75	**6,472**	9	414	39,497	46,391
Manuf.	18,864	521	33,443	358	7,526	19,964	**80,677**	13,561	14,582	252,514	361,334
Utilities	2,466	233	4,773	35,397	447	7,841	**51,156**	5,122	474	24,237	80,988
Building	1,176	219	599	919	18,524	6,158	**27,596**	0	63,881	17,943	109,419
Services	35,693	2,975	45,703	2,314	9,353	138,231	**234,269**	144,288	216,795	340,979	936,331
TOTAL	**94,079**	**5,321**	**107,369**	**43,531**	**35,979**	**173,709**	**459,987**	**165,218**	**371,711**	**948,963**	**1,945,879**
Household wages	87,711	6,599	48,813	5,236	25,714	294,091	**468,164**	0	0	0	468,164
OVA	110,176	27,920	47,614	17,119	12,784	193,010	**408,623**	25,985	13,143	1,706	449,457
Imports	119,450	6,551	157,538	15,103	34,943	275,521	**609,105**	279,748	70,615	67,275	1,026,744
TOTAL	**411,416**	**46,391**	**361,334**	**80,988**	**109,419**	**936,331**	**1,945,879**	**470,952**	**455,469**	**1,017,944**	**3,890,243**
Employment	2,288	105	728	88	440	5,868	**9,517**				

Note: Totals may have minor discrepancies due to rounding.

Gross regional product (GRP) (value-added) for the regional economy is estimated at $917M, comprising $468M to households as wages and salaries (including payments to self employed persons and employers) and $449M in OVA.

A total of 9,517 people were working in the region during 2006.

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

Figure 3.1
Summary of Aggregated Sectors: Regional Economy (2006)

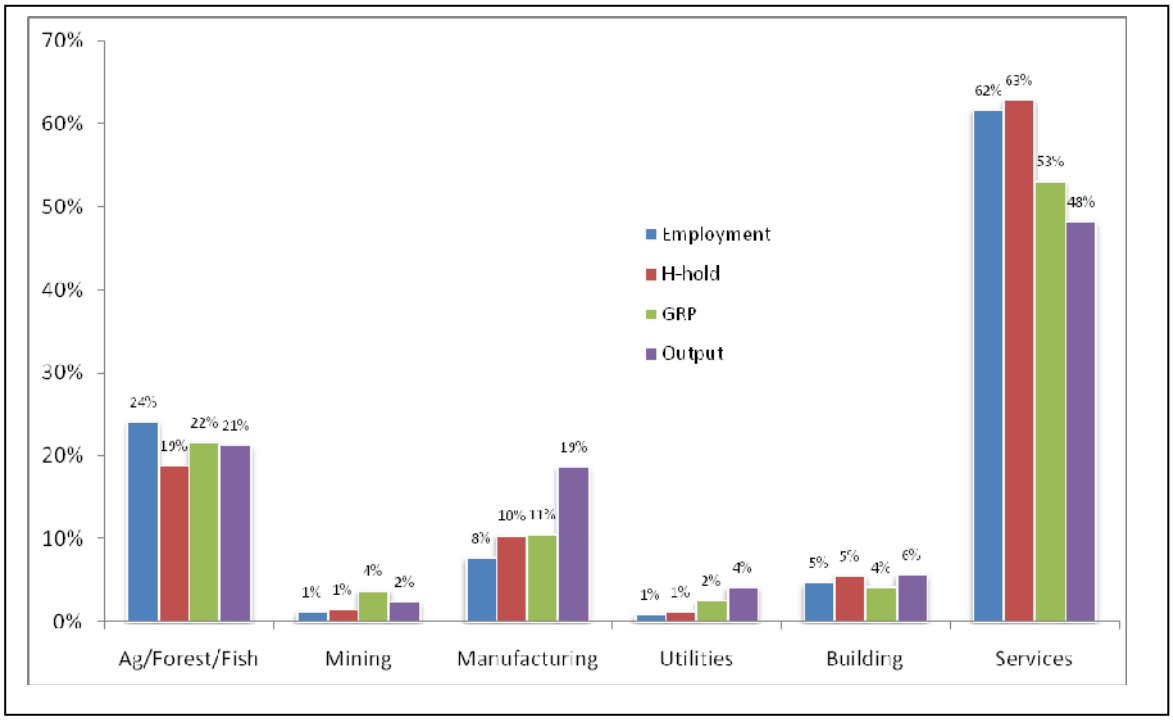
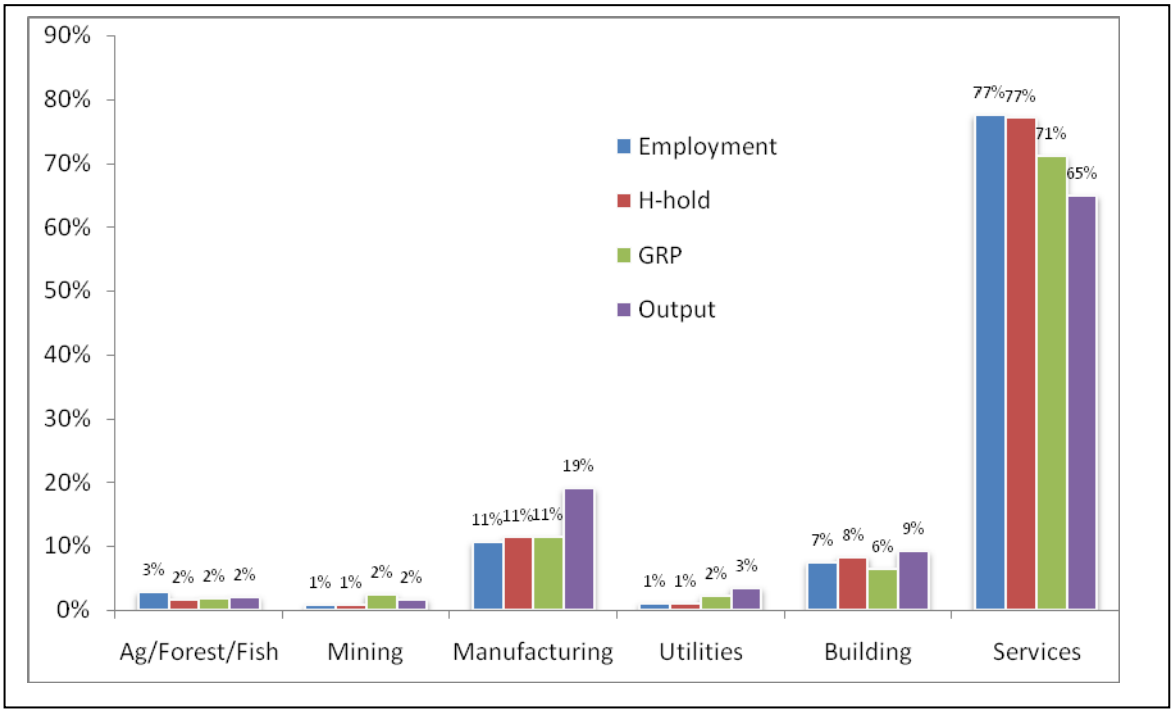


Figure 3.2
Summary of Aggregated Sectors: NSW Economy (2006)



Figures 3.3 to 3.5 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 structure of the economy.

From these figures it is evident that in terms of gross regional output and value-added grains and other agriculture sector, business services and retail trade are the most significant sectors. The retail trade sector is the most significant sector in terms of regional employment while the retail trade sector and business services sector are the most significant sectors in terms of income. Imports and exports are spread across many sectors with major contributors being the *grains and other agriculture sectors, food and textile manufacturing, retail trade* and *business services*.

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 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

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 Regional Economy

Given the largely specialist nature of capital equipment and the relatively small size of the regional economy, for the purpose of this analysis a conservative 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 is estimated at 50 people for a period of one year. Based on the input-output coefficients of the *other construction sector* and *trade services sector* in the local economy transactions table (indexed to 2012) in the order of $13M of the development costs would need to be spent on the *other construction sector* and *construction trade services sector* within the region to result in a workforce of 50 people. The direct and indirect regional economic impact of this level of expenditure in the regional economy is reported in Table 3.2.

Figure 3.3 Sectoral Distribution of Gross Regional Output and Value-Added ($'000)

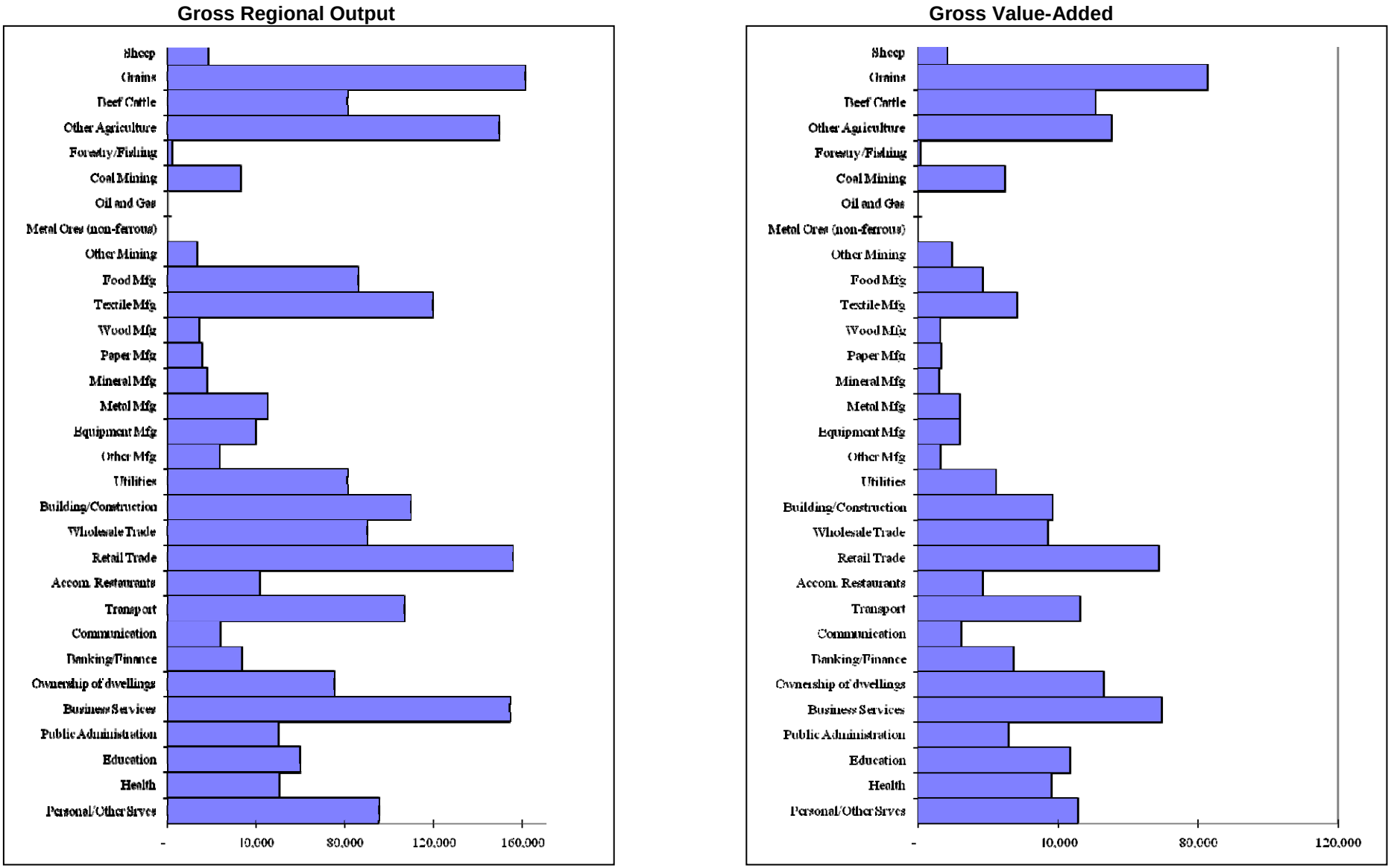


Figure 3.4 Sectoral Distribution of Gross Regional Income ($'000) and Employment (No.)

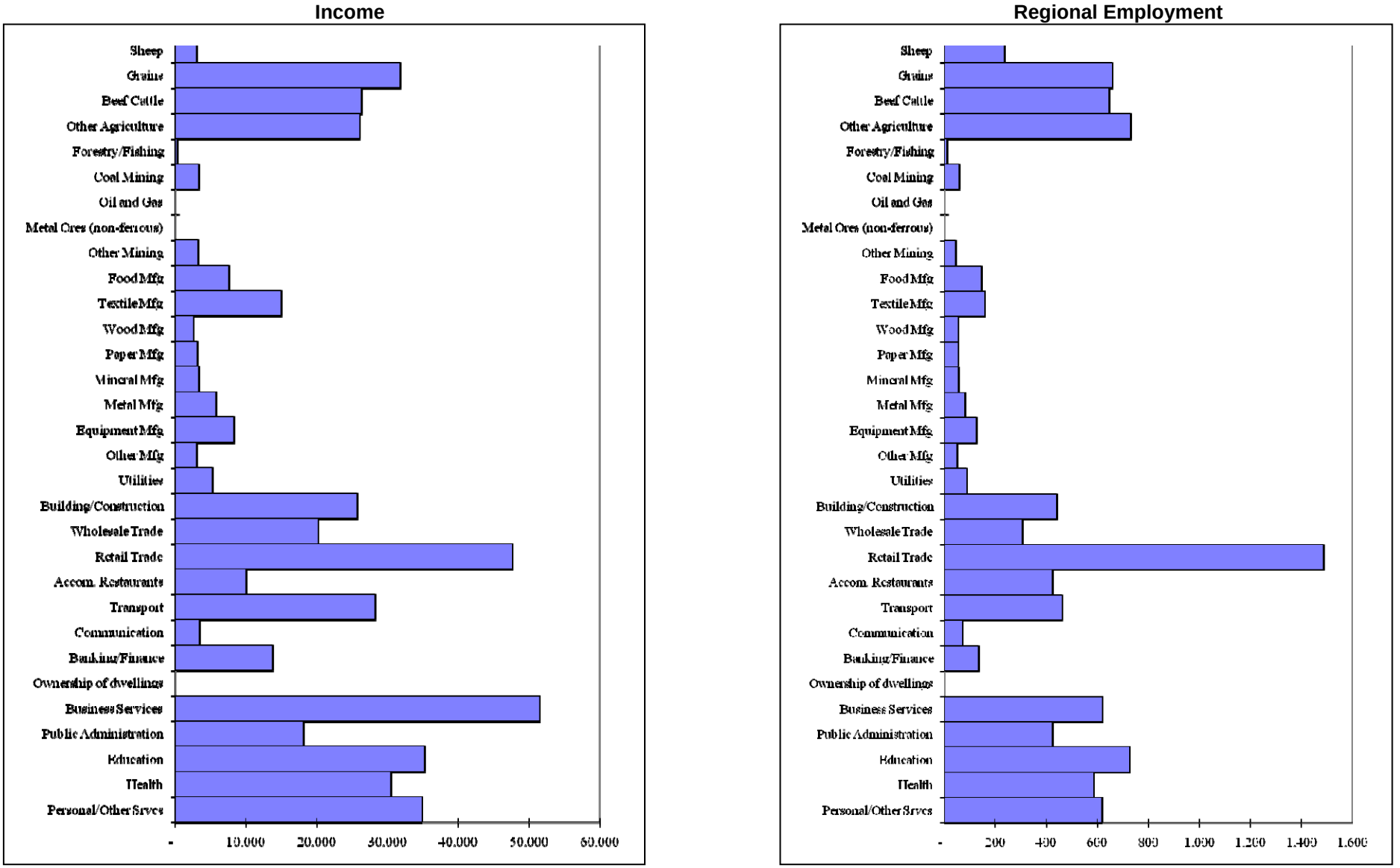


Figure 3.5 Sectoral Distribution of Imports and Exports ($'000)

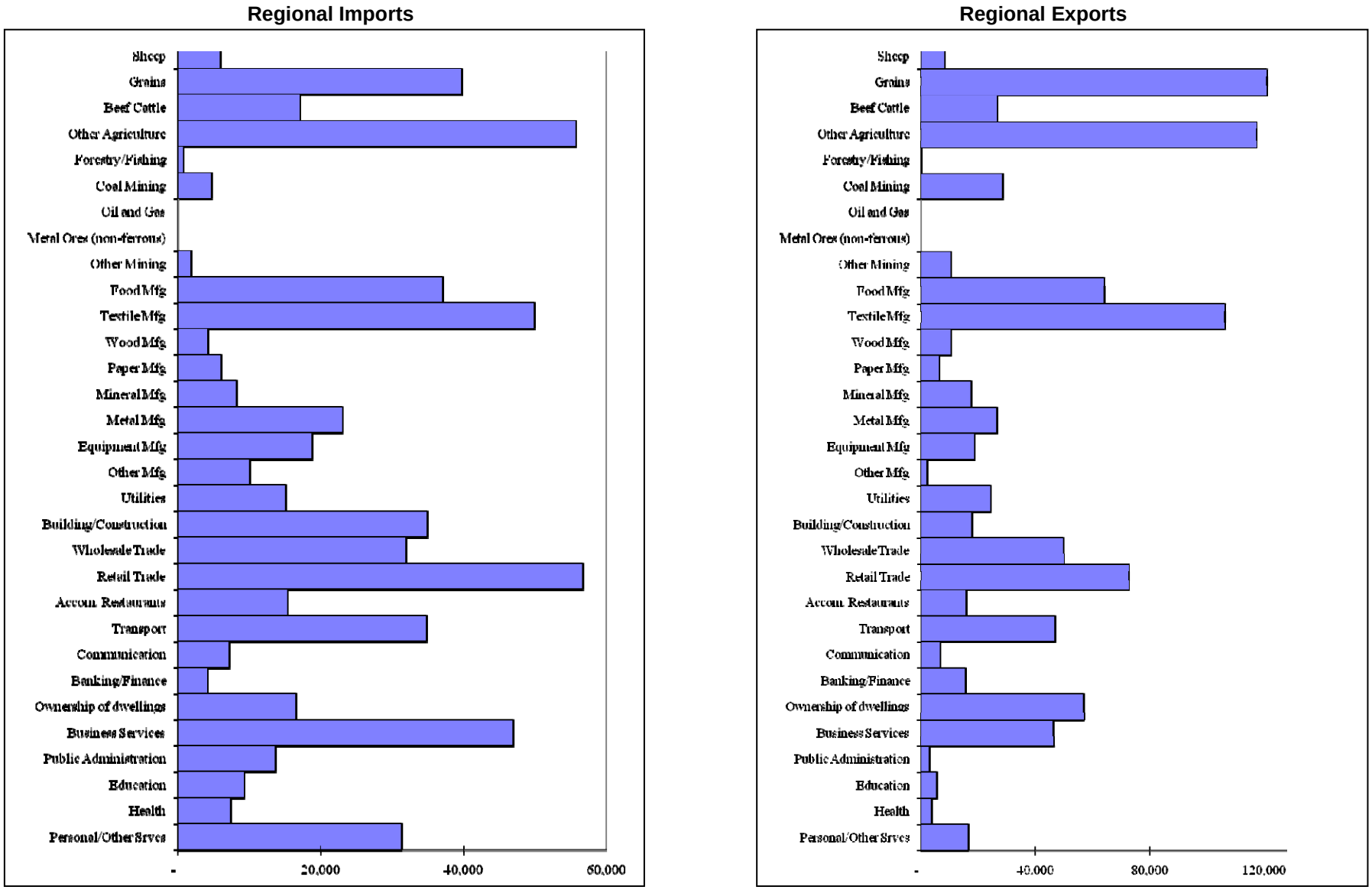


Table 3.2
Economic Impacts of Construction of the Project on the Regional Economy

	Direct	Production-Induced	Consumption-Induced	Total Flow On	Total Effect
OUTPUT ($'000)	12,694	5,302	2,632	7,934	20,629
Type 11A Ratio	1.00	0.42	0.21	0.63	1.63
VALUE ADDED ($'000)	5,163	2,238	1,265	3,503	8,666
Type 11A Ratio	1.00	0.43	0.25	0.68	1.68
INCOME ($'000)	3,492	1,591	834	2,425	5,917
Type 11A Ratio	1.00	0.46	0.24	0.69	1.69
EMPLOYMENT (No.)	50*	24	15	39	89
Type 11A Ratio	1.00	0.48	0.31	0.79	1.79

Note: Totals may have minor discrepancies due to rounding.

* Direct employment of 50 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.

Impacts

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 construction of the Project is estimated to make up to the following contribution to the regional economy for a period of one year:

- $21M in annual direct and indirect regional output or business turnover;
- $9M in annual direct and indirect regional value added;
- $6M in annual direct and indirect household income; and
- 89 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 (Australian Bureau of Statistics [ABS], 1995). There are many types of multipliers that can be generated from input-output analysis (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 region economy range from 1.63 for output up to 1.79 for employment.

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, income and employment flow-ons are likely to be *other construction and construction trade services, wholesale and retail trade, scientific research, technical and computer services, other property services*.

Impact on the NSW Economy

When the impact of $13M of expenditure in the *other construction sector* and *construction trade services sector* is assessed for the NSW economy (Table 3.3), the impacts are greater because of the larger inter-sectoral linkages and hence multipliers for the larger economy.

Table 3.3
Economic Impacts of Construction of the Project on the NSW Economy

	Direct Effect	Production-Induced	Consumption-Induced	Total Flow-on	Total Effect
OUTPUT ($'000)	12,694	11,466	14,914	26,379	39,074
Type 11A Ratio	1.00	0.90	1.18	2.08	3.08
VALUE ADDED ($'000)	5,163	4,935	7,596	12,531	17,694
Type 11A Ratio	1.00	0.96	1.47	2.43	3.43
INCOME ($'000)	4,401	4,110	4,347	8,457	12,859
Type 11A Ratio	1.00	0.93	0.99	1.92	2.92
EMPLOYMENT (No.)	50	48	58	106	156
Type 11A Ratio	1.00	0.95	1.15	2.11	3.11

Note: Totals may have minor discrepancies due to rounding.

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

- $39M in annual direct and indirect output;
- $18M in annual direct and indirect regional value added;
- $13M in annual direct and indirect household income; and
- 156 direct and indirect jobs.

The above estimated impacts on the NSW economy are likely to be conservative 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 Operations

Introduction

For the analysis of the Project, a new Project sector was inserted into the regional input-output table reflecting average annual production levels of 4.5 Mtpa ROM. The revenue and expenditure data for these new sectors was obtained from financial information provided by Whitehaven 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 Whitehaven and regional location quotients;
- purchase prices for expenditure in 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.

Impacts on the Regional Economy

Economic Activity

The total and disaggregated annual impacts of the Project on the regional economy (in 2012 dollars) are shown in Table 3.4.

Table 3.4
Economic Impacts of the Project on the Regional Economy ($2012)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	Total Effect
OUTPUT ($'000)	492,139	79,022	17,008	96,030	588,169
Type 11A Ratio	*1.00*	*0.16*	*0.04*	*0.20*	*1.20*
VALUE ADDED ($'000)	229,496	33,132	8,174	41,306	270,801
Type 11A Ratio	*1.00*	*0.14*	*0.04*	*0.18*	*1.18*
INCOME ($'000)	16,767	16,080	5,391	21,471	38,238
Type 11A Ratio	*1.00*	*0.96*	*0.32*	*1.28*	*2.28*
EMPLOYMENT (No.)	145	179	99	278	423
Type 11A Ratio	*1.00*	*1.24*	*0.68*	*1.92*	*2.92*

Note: Totals may have minor discrepancies due to rounding.

* Direct employment of 145 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 (with lesser impacts during the ramp up years):

- $588M in annual direct and indirect regional output or business turnover;
- $271M in annual direct and indirect regional value added;
- $38M in annual direct and indirect household income; and
- 423 direct and indirect jobs.

Multipliers

The Type 11A ratio multipliers for the Project impact on the regional economy range from 1.18 for value-added up to 2.92 for employment.

Capital intensive industries 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 regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be the:

- *other property services sector*;
- *wholesale mechanical repairs sector*;
- *agricultural, mining and construction machinery, lifting and material handling equipment manufacturing sector*;
- *scientific research, technical and computer services sector*;
- *wholesale trade sector*; and
- *retail trade 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 operation (Table 3.5).

Table 3.5
Sectoral Distribution of Total Regional Employment Impacts of the Project

Sector	Average Direct Effects	Production-Induced	Consumption-Induced	Total
Primary	0	0	2	2
Mining	145	9	0	155
Manufacturing	0	17	3	21
Utilities	0	2	1	3
Wholesale/Retail	0	34	25	58
Accommodation, cafes, restaurants	0	1	14	16
Building/Construction	0	6	1	6
Transport	0	6	4	10
Services	0	104	49	153
Total	**145**	**179**	**99**	**423**

Note: Totals may have minor discrepancies due to rounding.

[1] While the Project would provide on average 193 direct jobs, only 145 are assumed to reside inside the region (i.e. Narrabri and Gunnedah LGAs).

Table 3.5 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 *mining, manufacturing, wholesale/retail* and *services* sectors while consumption induced flow-on employment would be mainly in *wholesale/retail, accommodation/cafes/restaurants* and *services* sectors (Table 3.5).

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 increase in economic activity. However, because of the inter-linkages between sectors, many indirect businesses would 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. 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 the 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 3.6.

Table 3.6
NSW Economic Impacts of the Project

	Direct Effect	Production-Induced	Consumption-Induced	Total Flow-on	Total Effect
OUTPUT ($'000)	492,139	392,156	226,812	618,968	1,111,107
Type 11A Ratio	*1.00*	*0.80*	*0.46*	*1.26*	*2.26*
VALUE ADDED ($'000)	228,894	175,121	115,528	290,648	519,542
Type 11A Ratio	*1.00*	*0.77*	*0.51*	*1.27*	*2.27*
INCOME ($'000)	22,356	107,092	66,113	173,205	195,561
Type 11A Ratio	*1.00*	*4.79*	*2.96*	*7.75*	*8.75*
EMPLOYMENT (No.)	193	1,216	883	2,099	2,292
Type 11A Ratio	*1.00*	*6.30*	*4.57*	*10.87*	*11.87*

Note: Totals may have minor discrepancies due to rounding.

The Project is estimated to make up to the following total contribution to the NSW economy for 30 years (with lesser impacts during the ramp up years):

- $1,111M in annual direct and indirect regional output or business turnover;
- $520M in annual direct and indirect regional value added;
- $196M in annual direct and indirect household income; and
- 2,292 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

The establishment and operation of the Project would stimulate demand in the regional and NSW economies leading to increased business turnover in a range of sectors and increased employment opportunities. Conversely, cessation of the mining operations would result in a contraction in regional economic activity.

The magnitude of the 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 would depend on whether the workers and their families affected would leave the region. If it is assumed that some or all of the workers remain in the region, then the impacts of Project cessation would not be as severe compared to a greater proportion of employees leaving the region. 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 regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table 3.4. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 3.4.

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 region compared to other regions, the likely loss or gain from homeowners selling, and the extent of "attachment" to the local region (Economic and Planning Impact Consultants, 1989).

To the extent that alternative development opportunities arise in the regional economy, the regional economic impacts associated with Project 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 a region’s capacity to expand its factors of productions by attracting investment and labour from outside the region (Bureau of Industry Economics, 1994). This in turn can depend on a region’s natural endowments. The Gunnedah Basin is a prospective location with a range of coal and coal-bed methane resources and a range of development proposals pending. New mining resource developments in the region would help broaden the region’s economic base and buffer against impacts of the cessation of individual projects.

Ultimately, the significance of the economic impacts of cessation of the Project would depend on 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 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 region it is not possible to foresee the likely circumstances within which Project cessation would occur. It is therefore important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Project would maintain in the region.

4. EMPLOYMENT, POPULATION AND COMMUNITY INFRASTRUCTURE ASSESSMENT

4.1 INTRODUCTION

This section addresses social impacts that may potentially arise from social change processes, specifically changes in employment levels and populations. Changes in the workforce and populations of a region may well have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. This may include the number and type of services that are available to be used and the accessibility of these services.

The objective of this EPCIA is to examine the potential impacts of the Project on the existing community infrastructure as a result of employment and population change associated with the Project while having regard to other projects that are also occurring within the region.

The basic methodology for carrying out the EPCIA was to:

- analyse the existing socio-economic environment of the region potentially impacted by the Project;
- analyse the likely incremental magnitude of the additional Project workforce and associated population growth including estimated flow-on employment effects;
- consider the potential impacts of estimated employment and population change on community infrastructure based on ABS data and available reports about current social issues in the region; and
- recommend impact mitigation or management measures for any substantive impacts that are identified.

The geographic scope of the EPCIA was determined by the location of Project and the region that would potentially service the Project and its employees. The Project is located in the Gunnedah Basin, in the NSW Gunnedah Coalfield, approximately 25 km north of Gunnedah in NSW. It is envisaged that similar to Whitehaven' nearby Tarrawonga Coal Mine most employees will reside in the Gunnedah and Narrabri LGAs. While these LGAs were combined for the purpose of the regional economic impact assessment (Section 3) for the EPCIA, they are described separately below.

The assessment draws on a range of publications and reports as well as data provided by Whitehaven, the ABS Census (ABS, 2001; 2006; ABS, 2011[13]), and information from Section 3 on the potential regional economic impacts of the Project. While the Project would also be expected to have population and workforce effects at a NSW state level and in other nearby centres such as Tamworth and Moree, these effects would not be of sufficient magnitude to warrant consideration of potential adverse effects.

[13] At the time of preparation of this report only some 2011 Census population data was available. No labour force data was available. Where 2011 Census information was not available, earlier Census data was relied on.

4.2 REGIONAL PROFILE

Population

In 2011, Narrabri LGA had a population of 12,925 and Gunnedah LGA had a population of 12,066, representing approximately 0.19% and 0.17% of the NSW population, respectively (Table 4.1).

Table 4.1
Narrabri, Gunnedah and NSW Population and Growth Rates - 2001 to 2011

Region	Total Population			Population Change 2001 - 2011	
	2001	2006	2011	People	%
Narrabri LGA	13,930	13,117	12,925	-1,005	-7.21%
Gunnedah LGA	12,089	11,524	12,066	-23	-0.19%
NSW	6,326,579	6,549,178	6,917,658	591,079	9.34%

Source: ABS (2011, 2006, 2001) (Basic Community Profile [BCP] usual place of residence).

The population of Narrabri LGA declined between 2001 and 2011 (Table 4.1). While the population of Gunnedah LGA declined between 2001 and 2006 it has grown between 2006 and 2011. Overall there was a small reduction in population.

Consistent with the trend for NSW, the proportion of the Narrabri and Gunnedah LGA populations under the age of 44 has been declining over time, while the proportion of the population over the age of 44 has been increasing (Table 4.2). However, both Narrabri and Gunnedah LGAs have a higher proportion of the population in the 14 years and younger age bracket and the greater than 45 years age brackets but a substantially lower proportion of population in the 15 to 44 year age bracket compared to NSW (Table 4.2).

The median age for the population of Narrabri and Gunnedah LGAs is 39 and 40, respectively compared to 38 for NSW (ABS, 2011).

Table 4.2
Distribution of the Narrabri, Gunnedah and NSW Population by Age Group

Proportion of Total Population	Narrabri			Gunnedah			NSW		
	2001	2006	2011	2001	2006	2011	2001	2006	2011
Aged 14 years and younger	23%	23%	22%	24%	23%	21%	21%	20%	19%
Aged 15 years to 44 years	41%	37%	35%	37%	34%	35%	43%	42%	41%
Aged 45 years to 64 years	24%	26%	27%	24%	27%	26%	23%	25%	25%
Aged 65 years and over	12%	14%	16%	15%	17%	18%	13%	14%	15%

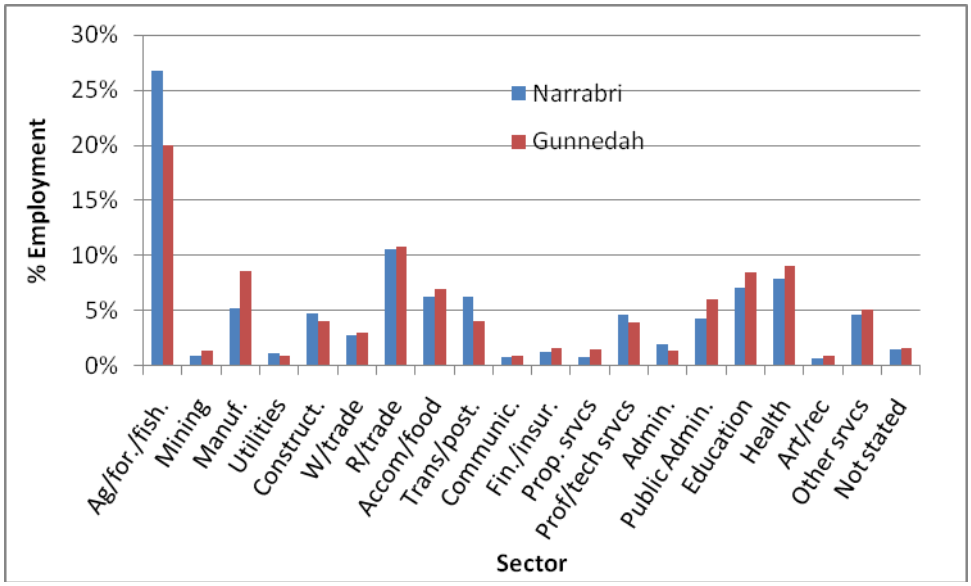
Source: ABS (2001, 2006, 2011) BCP (usual place of residence).
Note: Total percentages may not add to 100% due to rounding.

Employment

Employment by industry data is presented on Figure 4.1. In both Narrabri LGA and Gunnedah LGA the main employment sectors are *agriculture/forestry/fishing*, *retail trade*, *health*, *education*, *accommodation/food* and *manufacturing*.

Figure 4.1 shows the greater relative importance of *agriculture/forestry/fishing*, *construction*, *transport*, *professional/technical services* and *administration* in the Narrabri LGA and the greater relative importance of *mining*, *manufacturing*, *accommodation/food*, *financial/insurance*, *public administration*, *education*, *health*, *retail trade*, *arts/recreation* and *other services* in the Gunnedah LGA.

Figure 4.1
Employment by Industry in the Narrabri and Gunnedah LGAs



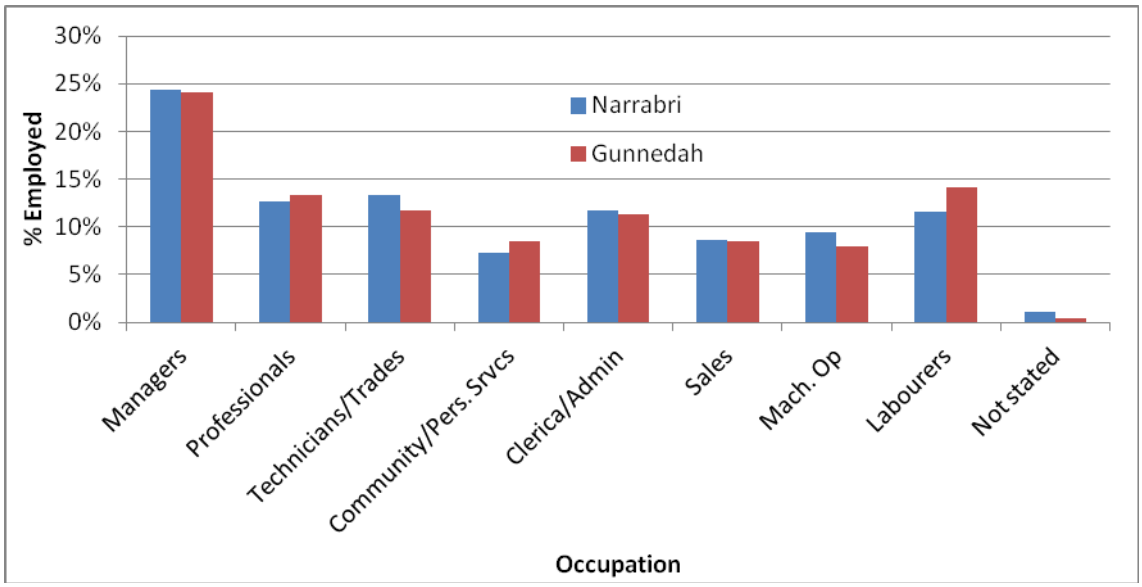
Source: ABS (2006) Place of Employment Profile.

Relative to the NSW economy, the sector in Narrabri and Gunnedah LGAs that employs a significantly greater proportion of workers is the *agriculture/forestry/fishing* sector. Sectors that employ a lesser proportion of workers include the *construction, wholesale trade, professional/technical services, administration* and *health sectors*.

Reflecting the employment by industry data, Narrabri LGA has a higher relative proportion of managers (mainly farm managers), technicians and trade workers, clerical and administrative workers and machinery operators (Figure 4.2). Gunnedah LGA has a higher relative proportion of professionals, communications and personal services workers and labourers (Figure 4.2).

Relative to the NSW economy, the Narrabri and Gunnedah LGAs have a higher relative proportion of managers, machine operators and labourers and a significantly lower proportion of professionals and clerical and administrative workers.

Figure 4.2
Occupations in the Narrabri and Gunnedah LGAs



Source: ABS (2006) Place of Employment Profile.

The median individual income and median family income of Narrabri LGA residents is 7% and 16% lower than that for NSW, respectively. The median individual income and median family income of Gunnedah LGA residents is 14% and 19% lower than that for NSW, respectively (ABS, 2011). Average individual taxable income in 2009 in the Narrabri and Gunnedah LGAs was $36,698 and $37,898, respectively, compared to $46,662 for NSW (ABS, 2011).

The total labour force residing in Narrabri and Gunnedah LGAs has declined since 1996 and the level of employed people residing in Narrabri and Gunnedah LGAs in 2006 was below the level in 1996. The unemployment rate in the Narrabri LGA and Gunnedah LGA declined between censuses (Table 4.3). However, the unemployment rate for both LGAs has been consistently higher than that for NSW (Table 4.3) with particularly high unemployment rates for youths (The Public Practice, undated; Schofield and Ferguson, 2005). The level of unemployment in the June 2012 quarter is reported as 392 people (5.2%) for Narrabri LGA and 419 (6.7%) for Gunnedah LGA (Commonwealth Department of Education, Employment and Workplace Relations, 2012).

Table 4.3
Labour Force in the Narrabri and Gunnedah LGAs

Labour Force	Narrabri			Gunnedah		
	1996	**2001**	**2006**	**1996**	**2001**	**2006**
Employed	5,942	6,017	5,757	5,018	4,567	4,681
Unemployed	593	522	440	524	475	427
Total labour force	6,535	6,539	6,197	5,542	5,042	5,108
Not in the labour force	3,824	3,427	3,378	3,865	3,545	3,397
Labour force status not stated	278	352	542	219	330	425
Unemployment rate	9.1%	8.0%	7.1%	9.5%	9.4%	8.4%
Total labour force as % of over 15 years of age population	56%	58%	57%	52%	51%	52%
NSW Unemployment Rate	**8.80%**	**7.20%**	**5.90%**	**8.8%**	**7.20%**	**5.90%**

Source: ABS (2006) Time Series Profile Place of Usual Residence.
Note: Totals may have minor discrepancies due to rounding.

Housing

In 2011 there were 4,783 private occupied dwellings in the Narrabri LGA and 4,488 in the Gunnedah LGA, about 0.19% and 0.18% of the State total, respectively (Table 4.4). The Narrabri and Gunnedah LGAs had a higher proportion of separate houses than the State (approximately 89% compared with 70% for NSW) and a lower proportion of townhouses/units/flats/apartments (approximately 9% and 10% respectively, compared with 30% in NSW) (Table 4.4).

Table 4.4
Housing Stock in Narrabri, Gunnedah and NSW 2011
(Occupied Dwellings Only)

Housing Stock	Narrabri LGA	Gunnedah LGA	NSW
Total Private Dwellings	4,783	4,488	2,471,296
% Separate Houses	89%	89%	70%
% Townhouse, Flat, Unit, Apartment	9%	10%	30%
% Other	1%	1%	1%
% Not Stated	0%	0%	0%

Source: ABS (2011) BCP Place of Usual Residence.
Note: Percentages may not add to 100% due to rounding.

At the 2011 Census, there were 789 unoccupied dwellings in the Narrabri LGA and 488 unoccupied dwellings in the Gunnedah LGA (Table 4.5).

Table 4.5
Housing Stock in the Narrabri and Gunnedah LGAs 2011 (All Dwellings)

	Narrabri LGA		Gunnedah LGA		NSW	
	No.	%	No.	%	No.	%
Occupied Dwellings	4,783	85.8	4,487	90.2	2,471,299	90.3
Unoccupied Dwellings	789	14.2	488	9.8	265,338	9.7
Total	5,572	100	4,975	100	2,736,637	100

Source: ABS (2011) Census Quick Stats.

Supply and demand analysis for residential and rural residential land in the Narrabri LGA (Edge Planning, 2009) found that there was sufficient supply of residential land for at least the next 10 years in all settlements, with large stocks of land in Wee Waa, Narrabri, Baan Baa and Boggabri. The total number of potential additional residential lots identified was 3,782. In addition, Edge Planning (2009) identified a considerable number of vacant lots of rural residential land (i.e. 1,713) with subdivision potential. These were mostly located in Narrabri.

No equivalent analysis has been undertaken for Gunnedah LGA. However, RW Corkery & Co (2009) suggests that at least 550 lots were available for residential development under the provisions of the *Gunnedah Local Environmental Plan 1998*.

Short Stay Accommodation

There are 43 short-term accommodation establishments in Narrabri (Narrabri Shire Council, 2011a) and 32 in Gunnedah (Gunnedah Shire Council, 2011a), including hotels, motels, serviced apartments, caravan parks and farm stays/bed and breakfasts.

Data on establishments with 15 or more rooms shows that there are eight establishments providing 200 rooms and 635 beds in Narrabri (Table 4.6). In Gunnedah, there are six establishments providing 138 rooms and 382 beds (Table 4.6). Room occupancy rates in the March quarter 2011 were relatively high at between 61% and 69%, although bed occupancy rates were much lower (Table 4.6).

Table 4.6
Narrabri and Gunnedah - Hotels, Motels and Serviced Apartments (15 or more rooms)

Short Stay Tourism Accommodation	Narrabri[1]	Gunnedah[2]
Establishments	8	6
Rooms	200	138
Beds	635	382
Guest Nights	20,371	10,395
Room Occupancy Rates	79.0%	61.0%
Bed Occupancy Rate	35.6%	31.7%
Accommodation Gross Takings ($)	$1,281,663	$724,414

Source: ABS 8635.1.55.001 - Tourist Accommodation, Small Area Data, NSW, March 2011 and March 2012

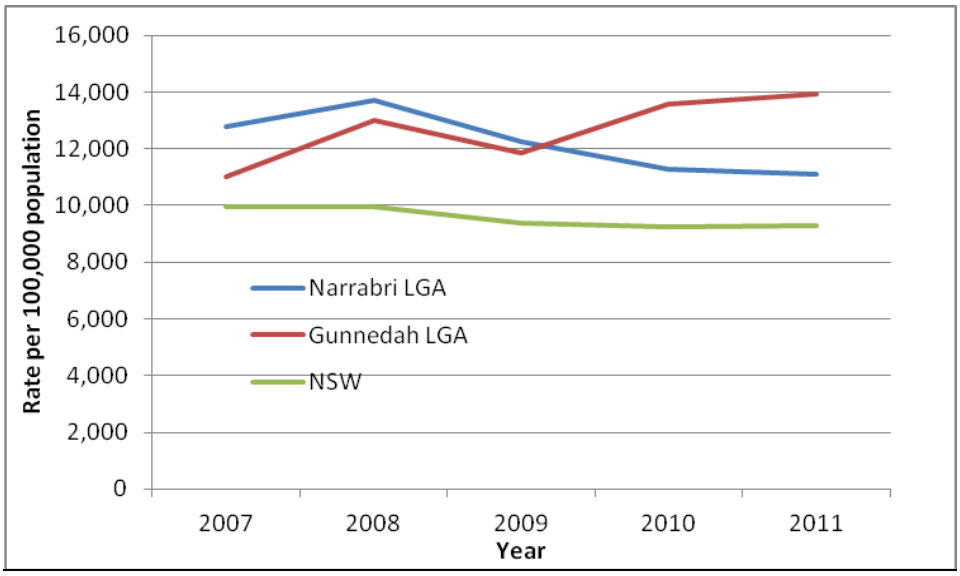
[1] Narrabri data is for March 2011 quarter (March 2012 data was not available).

[2] Gunnedah data is for March 2012 quarter.

Crime and Safety

NSW Bureau of Crime Statistics and Research (2012) indicates that the incidence of crime in the Narrabri and Gunnedah LGAs per 100,000 head of population is generally higher than that for NSW (Figure 4.3).

Figure 4.3
Narrabri LGA, Gunnedah LGA and NSW Incidence of Crime per 100,000 Head of Population (2007 to 2011)



Source: NSW Bureau of Crime Statistics and Research (2012).

While the overall incidence of crime per capita was higher in the Narrabri and Gunnedah LGAs than for NSW, the per capita incidence of different crimes varied between LGAs (Table 4.7).

Table 4.7
Narrabri LGA, Gunnedah LGA and NSW Incidence of Crime per 100,000 Head of Population for 2010

Offences	Narrabri LGA	Gunnedah LGA	NSW
17 Major Offences[1]	5,960	8,308	5,203
Other Homicide	0	0	1
Other Assault	95	24	34
Abduction and Kidnapping	0	16	5
Blackmail and Extortion	0	0	1
Harassment, Threatening Behaviour and Private Nuisance	539	823	407
Other Offences against the Person	22	33	19
Other Theft	633	807	582
Arson	58	147	84
Drug Offences	342	416	534
Prohibited and Regulated Weapons Offences	189	163	106
Disorderly Conduct	1,121	1,044	343
Betting and Gaming Offences	0	0	2
Liquor Offences	750	440	223
Pornography Offences	7	0	4
Prostitution Offences	0	0	2
Against Justice Procedures	750	1,133	733
Transport Regulatory Offences	22	24	793
Other Offences	597	554	196
Total	**11,084**	**13,934**	**9,274**

Source: NSW Bureau of Crime Statistics and Research (2012).
[1] Includes murder, assault, armed robbery, break and enter, theft, fraud and malicious damage to property.
Note: Totals may have minor discrepancies due to rounding.

It is difficult to specify reasons for the higher overall incidence of crime in Narrabri and Gunnedah LGAs compared with the State of NSW. Causal factors that lead to criminal activity are complex and include many and varied social and economic circumstances and conditions. However, socio-economic characteristics of the Narrabri and Gunnedah LGAs that may be relevant include relatively lower income levels and higher unemployment rates, particularly amongst youths.

Community Infrastructure

Education

The town of Gunnedah has four primary schools – two State, one Catholic and one Christian Community – and two high schools, one State and one Catholic. There is also a school for children with intellectual and physical disabilities. Together these schools cater for an average of approximately 1,500 primary school children and over 1,000 high school children (Gunnedah Shire Council, 2011b). There are also six other primary schools located in villages throughout the Gunnedah LGA (Gunnedah Shire Council, 2011b).

There are also a number of boarding schools in Armidale and Tamworth (approximately 145 km and 65 km from Gunnedah, respectively) providing education from kindergarten through until year twelve for both boys and girls (Gunnedah Shire Council, 2011b).

At the tertiary level residents have access to the New England Institute of Technical and Further Education (TAFE) – Gunnedah Campus and the University of New England is located approximately two hours from Gunnedah in Armidale (Gunnedah Council, 2011b).

Narrabri LGA is serviced by 12 primary schools – three Catholic, one Christian and eight State – and two State high schools. At the tertiary level residents have access to the New England Institute of TAFE – Narrabri Campus (Narrabri Shire Council, 2011b).

The NSW Department of Education and Training is the main provider of primary and secondary education to residents of the Narrabri and Gunnedah LGAs, accounting for 67% and 61% of primary school enrolments and 89% and 57% of secondary school enrolments in 2011, respectively (Table 4.8).

Table 4.8
Education in the Narrabri and Gunnedah LGAs

	Narrabri				Gunnedah			
	1996	**2001**	**2006**	**2011**	**1996**	**2001**	**2006**	**2011**
Preschool	265	242	266	255	252	250	233	259
Infants/Primary	1,636	1,512	1,289	1,151	1,466	1,351	1,160	1,054
Public	*72%*	*67%*	*64%*	*67%*	*75%*	*70%*	*63%*	61%
Private	*28%*	*33%*	*36%*	*33%*	*25%*	*30%*	*37%*	39%
Secondary	968	901	863	802	1,007	874	771	806
Public	*94%*	*92%*	*92%*	*89%*	*68%*	*58%*	*60%*	57%
Private	*6%*	*8%*	*8%*	*11%*	*32%*	*42%*	*40%*	43%
TAFE	389	460	311	289	379	472	295	236
University	166	180	136	168	115	128	115	148
Other	34	61	58	42	24	53	46	46
Not Stated	665	487	985	1,011	581	416	821	962
Total	4,123	3,843	3,908	3,718	3,824	3,544	3,441	3,511

Source: ABS (2006) Time Series Profile, usual place of residence and ABS (2011) BCP.
Note: Totals may have minor discrepancies due to rounding.

In both LGAs there has been declining demand for total enrolments at infant/primary schools with an increasing proportion of enrolments being in private schools (Table 4.8). There is therefore likely to be some spare capacity, particularly in public infant/primary school infrastructure.

Similarly, in both LGAs there has been a declining demand for total secondary school enrolments, with the exception of an increase in the Gunnedah LGA between 2006 and 2011. In both LGAs there has generally been an increasing proportion of demand for enrolments in private schools (Table 4.8). There is therefore likely to be some spare capacity in the secondary public school infrastructure in Narrabri and Gunnedah LGAs.

Health, Arts and Recreation

Hospitals in the Narrabri LGA are located in the towns of Narrabri, Wee Waa and Boggabri. The Narrabri hospital is a 38 bed facility with district level services in obstetrics and surgery featuring a newly refurbished emergency unit. The hospital has recently undergone a $42M redevelopment to a 47 bed hospital and combined health service to meet the health needs of the ageing community in Narrabri and the surrounding district (NSW Treasury, 2011). The John Prior Health Service in Boggabri offers a multi-purpose facility including residential aged care, respite service, community health services and an ambulance station. Wee Waa Community Hospital provides a wide range of medical care for the district and outlying areas including minor medical surgical and community health services. It also has a 24 hour emergency department. Wee Waa also has a Community Health Centre and new doctor's surgery (Narrabri Shire Council, 2011c).

The Gunnedah LGA has a modern hospital of 50 beds. The hospital provides general medical and surgical services including a new rehabilitation unit and a day surgery care facility together with a public health dental clinic and a physiotherapy unit. Gunnedah Hospital also has a helipad and can access Childflight services to Newcastle. Further specialist care is available in Tamworth. Other health facilities in Gunnedah include the NSW Ambulance Service, the Baby Health Centre, Community Health Centre, X-ray facilities and a pathology service.

According to the 2006 population census there were 424 people employed in the health care and social assistance industries in the Narrabri LGA and 377 employed in these industries in the Gunnedah LGA (Table 4.9). The proportion of employment in the health care and social assistance sectors in the Narrabri and Gunnedah LGAs was lower than for NSW, particularly in hospitals and medical and other health care services (Table 4.9).

Table 4.9
Employment in Health, Arts and Recreation Services 2006

	Narrabri LGA		Gunnedah LGA		NSW	
Health Care and Social Assistance						
Health Care and Social Assistance	19	0.36%	16	0.38%	9,400	0.30%
Hospitals	125	2.34%	59	1.41%	94,187	3.40%
Medical and Other Health Care Services	88	1.64%	88	2.10%	85,108	3.10%
Residential Care Services	85	1.59%	109	2.60%	44,648	1.60%
Social Assistance Services	107	2.00%	105	2.51%	59,618	2.20%
Total	***424***	**7.92%**	***377***	**9.01%**	***292,961***	***10.70%***
Arts and recreation services						
Arts and Recreation Services	0	0.00%	0	0.00%	1,740	0.10%
Heritage Activities	9	0.17%	3	0.07%	4,424	0.20%
Creative and Performing Arts Activities	6	0.11%	3	0.07%	8,122	0.30%
Sports and Recreation Activities	19	0.36%	28	0.67%	18,873	0.70%
Gambling Activities	0	0.00%	6	0.14%	4,799	0.20%
Total	***34***	***0.64%***	***40***	***0.96%***	***37,958***	***1.40%***
TOTAL	**458**	**8.56%**	**417**	**9.96%**	**330,919**	**12.00%**
TOTAL EMPLOYMENT	**5,351**		**4,186**		**2,748,394**	

Source: ABS (2009).

Note: Totals may have minor discrepancies due to rounding.

The proportion of employment in Narrabri and Gunnedah LGAs in arts and recreation services was lower than for NSW, across all subsectors (Table 4.9).

4.3 PROJECT WORKFORCE AND POPULATION CHANGE

4.3.1 Introduction

The main drivers for potential impacts on community infrastructure are changes in employment and population and the spatial location of these changes in employment and population. Employment that is directly generated by the Project may be sourced from:

- the local region either from:
  - the unemployment pool; and/or
  - workers from other industries;
- in-migration; or
- commuters.

Sourcing labour from the local region has minimal direct impact on local community infrastructure and services, since it results in no changes to the regional population and hence demand for services. It may, however, have an indirect impact on some local community infrastructure and service demand where changes in employment status or income result in changes in demand for some particular services (e.g. health services).

Whether local labour is sourced from the unemployment pool or from other industries, it can reduce unemployment levels - directly in the case of employing unemployed people and indirectly via the filter effect[14], where labour is sourced from other industries.

The impact of commuter workers would depend on the extent to which they integrate into regional communities, however, for the purpose of this analysis it is assumed that the impact of commuter workers is likely to be modest.

In-migration resulting in population change is likely to have the greatest potential impact on demand for community services and infrastructure, with this impact dependent on the new residential location of the migrating workforce and their families.

As well as direct employment and population changes, mining projects may also generate indirect labour demand through expenditure by employees in the local region and mine operational expenditure in the local region on other inputs to production. This induced demand for labour may also have consequences for population change and demand for community infrastructure and services.

To facilitate consideration of potential community infrastructure impacts, this section explores the likely direct and indirect employment and population effects of the Project.

[14] The filter effect refers to the situation where labour is sourced from other industries in the region making jobs available in those industries which are subsequently filled by people either from the unemployment pool or other industries with the latter making jobs available in that industry, etc.

4.3.2 Construction

Direct Workforce and Population Change

The average annual construction workforce required for Project is estimated at 50 people for a period of one year. Construction generally requires a labour force with highly specialised skills including specialised welders, fitters, electrical contractors, machinery mechanics and construction engineers (Centre for International Economics, 2001). These types of professions are located in the construction sector, wholesale trade sector (mechanics) and the professional/technical service sector. Examination of the employment by industry data in Section 4.2 indicates that both the Narrabri and Gunnedah LGAs have a lower proportion of workers in these sectors than NSW. Consequently, it is likely that many of the construction workers would temporarily migrate into the region for the period that they are required. It is anticipated that the majority of non-local workers would be single or not bring their families into the region. This reflects the fact that the construction workforce in the mining industry and large infrastructure projects is generally very mobile and tends not to have accompanying spouses and children. Consequently, construction of the Project is likely to at most result in a direct influx of 50 people to the region. Assuming that they are spread between Narrabri, Boggabri and Gunnedah in the same proportions as the existing operational workforce at Whitehaven's Tarrawonga Coal Mine then the maximum direct employment and population change to the region from the construction phase of the Project would be as per Table 4.10.

Table 4.10
Maximum Direct and Indirect Construction Workforce and Population by Location

Location of Existing Workforce at Tarrawonga Mine		Direct Construction Effects		Indirect Construction Effects		Total Construction Effects
		Construction Workforce	Direct Population	Construction Workforce	Indirect Population	Total Population
Narrabri LGA	**39%**	**19**	**19**	**15**	**38**	**57**
Narrabri	15%	**7**	7	6	15	22
Boggabri	24%	**12**	12	9	23	35
Gunnedah LGA	**61%**	**31**	**31**	**24**	**60**	**91**
Region Sub-total	**100%**	**50**	**50**	**39**	**98**	**148**

Note: Totals may have minor discrepancies due to rounding.

Indirect Workforce and Population Change

From Section 3.3.1, it is evident that up to 24 jobs (associated with production-induced flow-ons) and up to 15 jobs (associated with consumption-induced flow-ons) would arise in the Narrabri and Gunnedah LGAs (Table 3.2) due to flow-on employment associated with Project construction.

Any flow-on employment that is generated by Project construction is more likely to exhibit normal family structures. If all flow-on employment was filled by non-locals then the maximum increase in population of the region associated with flow-ons would be 98. However, given the temporary nature of the flow-on effects during construction, it is considered unlikely that places would be filled by migration but rather by the local population.

4.3.3 Operation

Direct Workforce and Population Change

The Project would last for approximately 30 years and require an average operational workforce of some 193 employees (with a peak of 250 operational employees). The regional economic impact assessment assumed that 75% of direct employees would reside in the region. For the EPCIA it is also important to consider the proportion of these employees, assumed to reside in the region, who migrate into the region.

The operational labour force for the Project would include a mix of professionals, managers, administration, trades, plant/equipment operators, labourers and road transport operators. However, it is likely most of the labour force would relate to trades, plant/equipment operators (earthmoving contractors), labourers, road transport and repairs and maintenance. Based on historical and recent employment data (Section 4.2), there is good potential to obtain some of these people from within the Narrabri and Gunnedah LGAs.

However, there are a number of major mining projects that are proposed in the Narrabri and Gunnedah LGAs that are more advanced than the Project and which will have first claim on any available workforce in the region. Consequently, it is likely that the Project will be associated with a greater proportion of in-migrating workforce than other projects.

If all of the operational labour force (assumed to reside in the region) migrated into the Narrabri and Gunnedah LGAs, and are distributed between Narrabri, Boggabri and Gunnedah and other areas in the same proportions as the existing operational workforce at Tarrawonga Coal Mine, then the Project operational employment and population change to the region would be as per Table 4.11.

Table 4.11
Maximum Direct and Indirect Operation Workforce and Population by Location

Location of Existing Workforce		Direct Operation Effects		Indirect Operation Effects		Total Operation Effects
		Operation Workforce	Direct Population	Indirect Workforce	Indirect Population	Total Population
Narrabri LGA	**39%**	**56**	**140**	**107**	**268**	**409**
Narrabri	15%	21	54	41	103	156
Boggabri	24%	35	87	66	166	252
Gunnedah LGA	**61%**	**89**	222	**171**	**426**	**649**
Region Sub-total	**100%**	**145**	**363**	**278**	**695**	**1,057**

Note: Totals may have minor discrepancies due to rounding.

Unlike temporary construction workers, a normal family size has been assumed for the migrating workers (i.e. 2.5 is the average for Narrabri and Gunnedah LGAs). On this basis the population of the Narrabri and Gunnedah LGAs associated with the Project direct workforce would increase by up to 363 people.

Indirect Workforce and Population Change

For every direct job generated where the person resides in the region there would be 1.92 flow-on jobs to the region (1.24 associated with production induced flow-ons and 0.68 associated with consumption induced effects) (Section 3.3.2). The Project would result in 145 direct operational jobs where the person resides in the region and therefore it is estimated that 278 indirect jobs would be generated in the region (Table 4.11). Conservatively assuming that all flow-on employment is filled by non-locals, then the maximum population increase in the region associated with flow-ons is 695 (Table 4.11).

4.3.4 Cumulative Workforce and Population Change

Major coal mining projects that are proposed in the Narrabri and Gunnedah LGAs include the Tarrawonga Coal Project, the Continuation of the Boggabri Coal Mine and the Maules Creek Coal Project. Gillespie Economics (2011) summarised the potential total (i.e. direct and indirect) cumulative population change associated with these projects during the Tarrawonga Coal Project peak construction year (i.e. Year 1 or 2013) and an operational stage representative of the greatest cumulative impact (i.e. Year 9 or 2021) (Table 4.12).

Table 4.12
Cumulative Total Population Change for the Tarrawonga Coal Project, Continuation of the Boggabri Coal Mine and Maules Creek Project

Location	2013			2021		
	Direct Population	Indirect Population	Total Population	Direct Population	Indirect Population	Total Population
Narrabri LGA	**718**	**1,193**	**1,911**	**934**	**1,133**	**2,068**
Narrabri	367	986	1,353	777	935	1,712
Boggabri	79	207	286	157	199	356
Boggabri Construction Village	272	-	272	-	-	-
Gunnedah LGA	**231**	**607**	**838**	**464**	**583**	**1,046**
Other – not specified	**33**	**88**	**120**	**70**	**83**	**153**
Region Total	**981**	**1,888**	**2,869**	**1,467**	**1,799**	**3,267**

Source: Gillespie Economics (2011).
Note: Totals may have minor discrepancies due to rounding.

While these estimated cumulative direct and indirect population impacts (Table 4.12) should be considered an upper level estimate as they are underpinned by the inherent assumptions of multipliers (Attachment 3), they do indicate the considerable population changes that will be associated with the Tarrawonga Coal Project, Continuation of the Boggabri Coal Mine and the Maules Creek Project.

The total population change associated with cumulative projects is estimated at up to 4,324 during Project operation.

4.4 COMMUNITY INFRASTRUCTURE IMPACT ASSESSMENT

4.4.1 Context of Population Change

To understand the likely impact of the Project on community infrastructure and services it is necessary to consider the predicted maximum population change within the context of the recent intercensal population change of the region and towns.

From Table 4.13 it is evident that for the Narrabri LGA the additional maximum direct and indirect population during construction and operation of the Project would help to partially offset historic population decline. For Gunnedah LGA the construction and operation population change would be equivalent to 17% and 120%, respectively, of the 2006 to 2011 population growth (Table 4.13).

Table 4.13
Maximum Project (Direct and Indirect) Population
in Context of Annual Population Growth

Location	Intercensal Population Change 2001-2006	Intercensal Population Change 2006-2011	Total Project (Direct and Indirect) Population			
			Construction	% of Intercensal Change 2006-2011	Operation	% of Intercensal Change 2006-2011
Narrabri LGA	-813	-192	57	30%	409	213%
Gunnedah LGA	-565	542	91	17%	649	120%
Total	**-1,378**	**350**	**148**	**42%**	**1,057**	**302%**

Note: Totals may have minor discrepancies due to rounding.

4.4.2 Impacts of Construction

Direct construction employment temporarily migrating into the region is likely to have different demands to operational employment. This is largely because they tend to be single or do not bring families to the region.

The key impact associated with direct construction employment temporarily migrating into the region is increased demand for accommodation. Construction contractors typically use a mix of accommodation including rental houses, apartments, motels, pub hotels and cabins in caravan parks that are located in close proximity to the mine (Narrabri Shire Council, 2011a). Consequently, they are unlikely to have any significant or long-term effect on the owner/occupied residential land market through purchase of properties.

Other than food outlets (hotel, licensed club, etc.) the availability of facilities and services is generally not a major consideration for itinerant workers (Narrabri Shire Council, 2007) and hence the implications for other community infrastructure is likely to be minimal apart from perhaps health care services, which are already identified as requiring augmentation (Schofield and Ferguson, 2005; Narrabri Council, undated).

The influx of single males during the construction phase, who may only partially integrate into the community, can be associated with increased crime levels (Carrington *et al*., 2010). However, random drug and alcohol testing for on-site workers can minimise this effect. There is also potential for the Project to indirectly result in a decrease in crime rates through providing increased employment opportunities to those who are currently unemployed. Given that unemployment is a contributing factor in criminal activity, a decrease in the unemployment rate has the potential to reduce crime rates (Chapman *et al*., 2002).

The Project construction workforce would require approximately 50 accommodation units. There is considerable short-term accommodation in Narrabri (over 635 beds in 15 or more room accommodation alone) and Gunnedah (over 360 beds in 15 or more room accommodation alone) to accommodate the estimated short-term demand for housing (Section 4.2). Furthermore, there is also likely to be considerable opportunity for rentals, given the size of the potential pool of unoccupied properties in Narrabri and Gunnedah (Table 4.5).

The potential cumulative construction workforce associated with the Project and other mining projects in the region will depend on the timing of the construction phase of multiple projects. Based on available information the construction phase of the Project is likely to occur after the peak construction phase of other projects. However, as a result of cumulative impacts there is some potential for short-term accommodation that would otherwise be available for tourism to be occupied by construction workers, potentially squeezing out tourists.

Narrabri Shire Council (2007) recognise this likely increased cumulative demand and identify that commercial accommodation properties in the Narrabri LGA are at capacity and that there are a number of proposals for new motels and apartments. Narrabri Shire Council also recognised the need for additional motel and hotel rooms, apartment/medium density style housing, self contained cabin accommodation in caravan parks, and boarding house/lodge style accommodation for single people looking for short-term accommodation, across Narrabri, Boggabri and Baan Baa.

4.4.3 Impacts of Operation

Housing Impacts

During operation of the Project, additional direct and indirect demand is likely to be generated for up to 163 residences in Narrabri LGA and 260 residences in Gunnedah LGA (Table 4.14). While initially, short-term accommodation may house these new families, the demand would be for longer-term rental accommodation or housing purchases.

Table 4.14
Demand for Accommodation[1]

Location	Project Direct and Indirect Demand for Accommodation	Average Annual Building Approvals - Total Dwellings (2006-2010)[2]	Total Housing Stock (2011)	Occupied Rental Properties (2011)[1]	Unoccupied Residential Properties (2011)
Narrabri LGA	163	35	5,572	1,435	789
Gunnedah LGA	260	47	4,975	1,338	488
Total	423	82	10,547	2,773	1,277

Note: Totals may have minor discrepancies due to rounding.
[1] ABS Regional stats.
[2] ABS Basic Community Profile.

The increased Project-only demand for housing is significant in the context of the total housing stock, rental stock and unoccupied dwellings (potential rental stock) as well as the average annual additions to the residential housing stock (i.e. building approvals) (Table 4.14). Combined with a range of other proposed mining projects in the region, new demand for housing in the region is likely to be more significant (Table 4.14).

Because of higher relative wages in the mining sector, the demand for rental accommodation and to purchase is likely to be at the higher end of the market, where supply is more limited. If places like Narrabri and Gunnedah LGA are to capture the increased workforce associated with the Project and other projects they would need a supply of sufficient quality accommodation.

Where housing supply is insufficient to meet demand, even temporarily, this may manifest itself in increased property prices and higher rent prices. While this may be seen as beneficial for property owners, it can adversely affect existing tenants, particularly those on lower incomes who can be priced out of the market.

While there is sufficient available land across the Narrabri and Gunnedah LGAs to meet this expected level of demand (Section 4.2), and it is understood that there are a number of residential and rural residential subdivisions in various stages of development in the region (Narrabri Shire Council, 2007), there is a requirement for timely and efficient planning by Narrabri and Gunnedah Shire Councils. It is recommended that the Narrabri and Gunnedah Shire Councils undertake an assessment of the existing and potential housing stock available in the region and the likely level of future demand to determine whether additional land may need to be rezoned to allow for sufficient staged growth.

However, even with efficient planning by the Narrabri and Gunnedah Shire Councils, there are potential issues around whether there would be a sufficient supply of investment capital and builders to meet the required housing demand.

Where insufficient housing is available this may lead to an increase in the commuting workforce to the region resulting in a reduction in demand for housing and community infrastructure but also a reduction in the direct and indirect economic activity to the regional economy.

It is noted that a Development Application for an 852 room MAC Village in Boggabri was recently approved by the Northern Joint Regional Planning Panel. The MAC Village aims to support the ever-growing mining industry in the region, particularly the "fly-in, fly-out" workers and help address the shortage of available accommodation.

Education and Training

Workers

The Project workforce employed from within the region and outside the region would have varying skills and experience on which to draw in undertaking their job. Many are likely to have experience in the mining sector, while some may not. Nevertheless, most required training is likely to be undertaken in-house and on the job. The workforce is therefore not expected to place any significant demands on tertiary education institutions in the region.

Workers Children

During operation of the Project incoming workers (both direct and indirect) are expected to exhibit average family structures and hence would be associated with some children creating some increased demand for education facilities within the region. Assuming that the incoming population exhibits the same characteristics as the regional population, Table 4.15 summarises the likely demand for pre-school, infants/primary and high school places.

Table 4.15
Demand for Schooling

	Narrabri			Gunnedah		
School Type	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Pre-school	10	20	30	16	30	46
Infants/Primary	9	18	27	14	27	42
High school	11	20	31	17	34	51
Total	**30**	**58**	**88**	**48**	**91**	**139**

Note: Totals may have minor discrepancies due to rounding.

These demands can be compared to the public school enrolments over time across the region (Table 4.8). In this context, the direct and indirect increase in demand for educational facilities is less than the decline in demand for public school infants/primary and secondary school enrolments over time. The Project would add to the growing demand for preschool in Gunnedah LGA and more than offset the reduction in demand for preschool in Narrabri LGA between 2006 and 2011.

Cumulative potential developments in the region would contribute considerably greater demand for education in both the public and private sectors. Provision of education services is primarily the responsibility of the public sector, although there is an increasing role for the private sector, with planning and development driven by population changes. As the population of school age children grows, potential expansion responses by the Department of Education and Training include use of demountables, operating a network with other schools in the region (so students do not all have to be located in the larger schools to access curriculum), development of new schools or permanent expansion of existing schools if demand is forecast to be more permanent. Non-government education sectors would also respond to identified growth in demand through the expansion or development of education facilities in the region. Already 33% of infants/primary students and 11% of secondary students in Narrabri attend non-government schools while in Gunnedah, 39% of infants/primary school students and 43% of secondary students attend non-government schools.

In other regions where mining has resulted in rapid population growth it has been suggested that increasing child aged population has ultimately had positive education benefits such as more teachers, reduced class sizes and broader curriculum (Gillespie Economics, 2009c).

Health

There is potential for the Project to increase the demand for public health facilities in the region such as for hospitals, General Practitioner Medical Services, Dental, Physiotherapy, Chiropractors, Optometrists, etc., via the anticipated increase in population during both construction and operation phase of the Project.

While the anticipated population increase during construction and operation of the Project is relatively small compared to the total populations of the region, any increase is likely to place some additional demand on existing medical services, which are already considered by the community as being under strain.

Cumulative changes in population levels from other coal mining projects (Table 4.12) and the Project would substantially increase demand for health services and facilities.

Provision of health services is primarily the responsibility of the public sector, although some aspects of these services are also provided by the non-government sector. The driving force for the provision of health services is demand which is primarily a response to population changes. The *Hunter New England Health Service Strategic Plan* (Hunter New England Area Health Service, 2007) recognises that in some parts of the region there is rapid population growth while other parts are stable or declining. One of the strategic initiatives of the *Hunter New England Health Service Strategic Plan* (Hunter New England Area Health Service, 2007) is to *expand community services in areas expected to have significant population growth*. It is anticipated that non-government sectors in health care would also respond to identified growth in demand through the relocation or expansion of private health care practices in the region.

It is recognised that there may be a lag between population growth and the provision of additional health services resulting in temporary health care access issues, but ultimately increased populations result in the provision of more health facilities for the community (Gillespie Economics, 2009c).

The Project also has the potential to indirectly positively impact on public health through the provision of employment opportunities and the reduction in unemployment. Prolonged unemployment can generate a range of personal and social problems including increased drug and alcohol dependency and increased demand for health services (University of NSW, 2006). Providing opportunities to reduce unemployment can therefore be beneficial.

Community Services and Recreation Facilities

Increase in population as a result of the Project would increase demand for community and recreation facilities. However, as indicated in Table 4.11 the maximum direct and indirect increase in population in Narrabri LGA from the Project would contribute to arresting a general population decline in the Narrabri LGA. In this context, rather than imposing additional demand on community services and facilities that may require additional investment by governments, the population increase would simply replace some of the declining demand arising from the population decline. No additional investment in community services and recreation facilities infrastructure would therefore be anticipated and the population increases may help avoid threshold levels for provision of services falling below critical levels.

In Gunnedah LGA, the maximum direct and indirect increase in population from the Project would result in additional population growth and expansion of overall demand for community services and recreation facilities.

In both Narrabri LGA and Gunnedah LGA, developer contributions and the increased rate base associated with the additional population would help to fund any additional demands for community and recreation facilities that are provided by local government.

From a cumulative impact perspective there may be considerable increase in demand for community services and recreation facilities that would require detailed planning by local and State Government agencies.

General Community Impacts

The demand for mining labour can result in skilled labour being bid away from other professions e.g. domestic trade services, which can result in shortages of these services in the region. However, far from being a local phenomena, Australia is experiencing a national skills shortage, with builders, engineers and tradespeople in high demand. The causes of skill shortages are complex but include skilled baby boomers reaching retirement age, negative perceptions of careers in the traditional trades and the difficulties in attracting people, particularly young people, to work in some industries, large infrastructure spending by governments and the mining boom.

However, the solution does not lie in constraining economic growth that utilises trade, building and engineering skills, but rather in adjustments to traditional training and education approaches. In this respect the Federal Government's National Skills Shortages Strategy identified the need for greater flexibility in traditional trade training, including shorter apprenticeships and specialist apprenticeship pathways.

The impact of the Project on skills shortages in the region is likely to be negligible. However, it is anticipated that there would be impacts from the cumulative effects of prospective projects in the region.

Cumulative influxes in populations associated with prospective projects can also potentially contribute to a changing sense of place for existing residents, as towns move away from their historical focus on servicing agricultural and forestry enterprises to an increased focus on servicing mining activities. The high wages in the mining sector relative to other sectors can also potentially result in social divisions between those involved in the mining sector and those who are not. Both these effects can be heightened during construction phases of projects when there are high numbers of unattached construction workforces, who may only partially integrate into the community.

Social Amenity

There is potential for the proposed development to negatively impact on local and regional amenity through increases in road traffic, noise, a reduction in air quality and visual prominence of the site.

The potential impacts of the Project on local traffic conditions and road safety have been considered by GTA (2012) (Appendix F of the EIS) and it was concluded that no significant impacts on the performance and safety of the public road network would be expected to arise as a result of the Project. No specific management or mitigation measures were considered to be warranted.

The Noise and Blasting Impact Assessment (Wilkinson Murray, 2012) (Appendix C of the EIS) identified that four rural residences and one property would be impacted by exceedances of 1 to 5 (dBA) above applicable noise criteria. These impacts would be mitigated and managed through at receiver noise mitigation on request. The Noise and Blasting Impact Assessment also identified that four rural residences and one property would be impacted by noise exceedances greater than 5 dBA above applicable noise criteria. These impacts would be managed through the granting of the opportunity to be acquired by Whitehaven via conditions of the Project Development Consent.

Air Quality and Greenhouse Gas Assessment for the Project (Appendix D of the EIS) indicated that one nearby private vacant lot with an existing Development Application for a dwelling would be impacted by air quality emissions above relevant criteria. However, this property is also adversely affected by noise and therefore included in the noise zone of acquisition.

The Visual Impact Assessment (Appendix H of the EIS) identified that visual impacts would be most appreciable at the nearest privately owned dwellings with views of the Project landforms. The potential impacts at the nearest private dwellings have been assessed as being low to moderate and following rehabilitation, residual impacts are expected to be low. Offsite mitigation measures such as tree screening would be implemented as required. The use of night-lighting would be restricted to minimise potential impacts to private receivers.

Section 4 of the Main Report of the EIS provides a description of various amenity related mitigation and management measures.

4.5 MITIGATION AND MANAGEMENT STRATEGIES

From Section 4.4 it is evident that there may be a number of community infrastructure impacts of the Project, which would be exacerbated by the cumulative impacts of a number of coal mining projects in the region. Potential impacts include:

- pressure on short-term accommodation for construction workforce – potentially squeezing out some tourism;
- increased demand for housing potentially leading to short to medium term increases in house prices and rental prices, leading to some displacement of those on low incomes;
- increased demand for health services;

- increased demand for schools places;
- increased demand for child care facilities;
- increased demand for recreation facilities and other community infrastructure;
- social division;
- changing sense of place;
- labour – skills shortages and difficulty retaining workers in non-mine sectors; and
- increased crime during construction phases associated with influx of single males.

Whitehaven would work in partnership with the Narrabri and Gunnedah Shire Councils and the local community so that the benefits of the projected economic growth in the region are maximised and impacts minimised, as far as possible. In this respect, a range of general and specific social impact mitigation and management measures are proposed and would include:

- Early provision of information to the Narrabri and Gunnedah Shire Councils and relevant State Government agencies regarding employment and population level changes to facilitate early community infrastructure provision responses.
- Continuation of Whitehaven's current donations policy which supports education, health and community causes.
- Employment of local residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation.
- Purchase of local non-labour inputs to production preferentially where local producers can be cost and quality competitive.
- A code of conduct for construction workers with regard to behaviour in Contractor Induction Program.

It is expected that as with other recent coal mining projects in NSW, a planning agreement in accordance with Division 6 or Part 4 of the EP&A Act would be required by the Project Approval for the Project. The planning agreement would be negotiated between the DP&I, Narrabri Shire Council, Gunnedah Shire Council and Whitehaven.

5 CONCLUSION

A BCA of the Project indicated that it would have net production benefits to Australia of $915M. Provided the residual environmental, social and cultural impacts of the Project that accrue to Australia are considered to be valued at less than $915M, 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, surface water and groundwater impacts. These impacts are estimated at $50M globally or $3M 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 $144M. Overall, the Project is estimated to have net benefits to Australia of between $912M and $1,056M 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:

- Whitehaven shareholders in the form of any after tax (and after voluntary contributions) profits;
- the Commonwealth Government in the form of any Company tax payable ($932M in total or $220M present value at 7% discount rate) 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 ($1,144M in total or $386M present value at 7% discount rate) 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.

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 Whitehaven.

The non-market costs that accrue to NSW are estimated at less than $3M. 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:

- $588M in annual direct and indirect regional output or business turnover;
- $271M in annual direct and indirect regional value added;
- $38M in annual direct and indirect household income; and
- 423 direct and indirect jobs.

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

- $1,111M in annual direct and indirect regional output or business turnover;
- $520M in annual direct and indirect regional value added;
- $196M in annual direct and indirect household income; and
- 2,292 direct and indirect jobs.

The peak construction period of the Project would last for approximately 12 months and require an average workforce of around 50 people. The maximum direct and indirect population associated with this was estimated at 148. Operations at the Project would last for 30 years and require an average direct workforce of 193 (145 residing in the region) (with a maximum operational workforce of 250). The maximum direct and indirect population associated with this was estimated at 1,057.

There may be a number of community infrastructure impacts associated with these maximum potential population influxes of the Project, which would be exacerbated by the cumulative impacts of a number of coal mining projects in the region. Potential Project and cumulative impacts include:

- pressure on short-term accommodation for construction workforce – potentially squeezing out some tourism;
- increased demand for housing potentially leading to short to medium term increases in house prices and rental prices, leading to some displacement of those on low incomes;
- increased demand for health services;
- increased demand for schools places;
- increased demand for child care facilities;
- increased demand for recreation facilities and other community infrastructure;
- social division;
- changing sense of place;
- labour – skills shortages and difficulty retaining workers in non-mine sectors; and
- increased crime during construction phases associated with influx of single males.

Whitehaven would work in partnership with the Narrabri and Gunnedah Shire Councils and the local community so that the benefits of the projected economic growth in the region are maximised and impacts minimised, as far as possible. In this respect, a range of general and specific social impact mitigation and management measures are proposed.

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.

6 REFERENCES

Australian Bureau of Statistics (1995) *Information Paper Australian National Accounts Introduction to Input-Output Multipliers*. Cat. No. 5246.0.

Australian Bureau of Statistics (2001) *Housing and Population Census*.

Australian Bureau of Statistics (2006) *Housing and Population Census*.

Australian Bureau of Statistics (2009) *4 Digit Employment by Industry Data for SLA of Workplace*. Website: http://www.abs.gov.au/
Date Accessed: 1 October 2011.

Australian Bureau of Statistics (2011) *Housing and Population Census*.

Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-Benefit Analysis: Concepts and Practice*, Prentice Hall, USA.

Bureau of Industry Economics (1994) *Regional Development: Patterns and Policy Implications*. AGPS, Canberra.

Carrington, K., McIntosh, A. and Scott, J. (2010) Globalization, Frontier Masculinities and Violence: Booze, Blokes and Brawls. *British Journal of Criminology*, 50, 393-413.

Centre for International Economics (2001) *Community Infrastructure Assessment: For the Ginkgo Mineral Sands Project.* Prepared for BEMAX Resources Limited.

Chapman, B., Kapuscinski, C., Roussel, S., Weatherburn, D. and Chilvers, M. (2002) *Unemployment Duration, Schooling and Property Crime*. Paper presented at the Role of Schools in Crime Prevention Conference, Melbourne 30 September 2002. Centre for Health Equity Training, Research and Evaluation. Website: chetre.med.unsw.edu.au/unemployment_&_health.htm.

Department of Education, Employment and Workplace Relations (2012) *Small Area Labour Markets Australia, March Quarter 2012*. Commonwealth of Australia, Canberra.

Economic and Planning Impact Consultants (1989) *The Economic Impact of the Woodchipping Industry in South Eastern NSW.* Report to the Wilderness Society.

Edge Planning (2009) *Narrabri Shire Growth Management Strategy*. Prepared for Narrabri Shire Council.

Evans & Peck (2012) *Vickery Coal Project Surface Water Assessment*. Prepared for Whitehaven Coal Limited.

Gillespie Economics (2008) *Managing the Impacts of a Mine in the Southern Coalfield: A Survey of Community Attitudes*. Prepared for Helensburgh Coal Pty Ltd.

Gillespie Economics (2009a) *Socio-economic assessment: Bulli Seam Operations*. Prepared for BHP Billiton Pty Ltd.

Gillespie Economics (2009b) *Economic Assessment of the Warkworth Project*. Prepared for Coal and Allied Pty Ltd.

Gillespie Economics (2009c) *Cadia-East Project Socio-economic Assessment*.

Gillespie Economics (2011) *Tarrawonga Coal Project Socio-Economic Assessment, prepared for Tarrawonga Coal Pty Ltd.*

Gillespie Economics (2012) *Vickery Coal Project Economic Review of Potential Agricultural Impacts.*

GTA Consultants (2012) *Vickery Coal Project Road Transport Assessment*. Prepared for Whitehaven Coal Limited.

Gunnedah Shire Council (2011a) *Accommodation*.
Website: http://www.infogunnedah.com.au/index.php?pid=118

Gunnedah Shire Council (2011b) *Educational Facilities.*
Website: http://infogunnedah.com.au/community/

Hunter New England Area Health Service (2007) *Hunter New England Health Service Strategic Plan*.
James, D. and Gillespie, R. (2002) *Guidelines for Economic Effects and Evaluation in EIA*. Prepared for NSW Department of Urban Affairs and Planning.

Heritage Computing (2012) *Vickery Coal Project Groundwater Assessment*. Prepared for Whitehaven Coal Limited.

Heritage Management Consultants (2012) *Vickery Coal Project Non-Aboriginal Cultural Heritage Assessment*. Prepared for Whitehaven Coal Limited.

Jensen, R. and West, G. (1986) *Input-output for Practitioners: Theory and Applications*. Prepared for Department of Local Government and Administrative Services, Local Government and Regional Development Division, Australian Government Publishing Service.

Johnson, F. and Desvouges, W. (1997) Estimating Stated Preferences with Rated-Pair Data: Environmental, Health and Employment Effects of Energy Programs. *Journal of Environmental Economics and Management,* 34,. 75-99.

Landskape (2012) *Vickery Coal Project Aboriginal Cultural Heritage Assessment*. Prepared for Whitehaven Coal Limited.

Narrabri Shire Council (2007) *Assessment of Opportunities for Narrabri Shire from Coal Mining & Gas Extraction in the Gunnedah Basin*.

Narrabri Shire Council (2011a) *Accommodation*.
Website: http://www.visitnarrabri.com.au/index.cfm?page_id=1013&page_name=Accommodation

Narrabri Shire Council (2011b) *Community Directory*.
Website: http://www.narrabri.nsw.gov.au/index.cfm?page_id=1138&page_name=Narrabri%20Shire%20Community%20Directory

Narrabri Shire Council (2011c) *Health Services and Community Care.*
Website: http://www.narrabri.nsw.gov.au/index.cfm?page_id=1241

Narrabri Shire Council (undated) *Narrabri Shire Social Plan.*

New South Wales Bureau of Crime Statistics and Research (2012) *Recorded Crime Statistics.*
Website: http://www.lawlink.nsw.gov.au/lawlink/bocsar/ll_bocsar.nsf/pages/bocsar_crime_stats
Date Accessed: 1 October 2012.

New South Wales Treasury (2007) *Treasury Guidelines for Economic Appraisal*. Website: www.treasury.nsw.gov.au Date Accessed: 1 October 2011.

New South Wales Treasury (2011) *Infrastructure Statement 2010-11 Budget Paper No. 4*.

Niche Environment and Heritage (2012) *Vickery Coal Project Ecological Assessment*. Prepared for Whitehaven Coal Limited.

Office of Social Policy (1995) *Techniques for Effective Social Impact Assessment: A Practical Guide*.

PAEHolmes (2012) *Vickery Coal Project Air Quality and Greenhouse Gas Assessment*. Prepared for Whitehaven Coal Limited.

Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care. *Journal of Economic Perspectives* 8:4, 3-18.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.

Powell, R., Jensen, R. and Gibson, A. (1985) *The Economic Impact of Irrigated Agriculture in NSW*. A report to the NSW Irrigators' Council Limited.

RW Corkery & Co (2009) *The Narrabri Coal Mine Stage 2 Environmental Assessment*.

Schofield, J. and Ferguson, S. (2005) *Gunnedah Shire Social Plan*. Prepared for Gunnedah Council.

Streeting, M. and Hamilton, C. (1991) *Economic analysis of the forests of south-eastern Australia*. Prepared for the Resource Assessment Commission.

The Public Practice Pty Ltd (undated) *Gunnedah Economic Portrait*. Prepared for Gunnedah Council.

University of New South Wales (2006) *Centre for Health Equity Training, Research and Evaluation*. Website: http://chetre.med.unsw.edu.au/unemployment & health.htm

Urbis (2012) *Vickery Coal Project Visual Assessment*. Prepared for Whitehaven Coal Limited.

West, G. (1993) *Input-Output Analysis for Practitioners, Version 7.1, User's Guide*.

Wilkinson Murray (2012) *Vickery Coal Project Noise and Blasting Assessment*. Prepared for Whitehaven Coal Limited.

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.

REFERENCES

Department of Climate Change and Energy Efficiency (2011) *Securing a Clean Energy Future: The Australian Government's Climate Change Policy,* Commonwealth of Australia, Canberra.

Nordhaus, W. (2008) *A Question of Balance: Weighing the Options on Global Warming Policies*. Yales University Press, New Haven and London.

Stern, N. (2006) *Stern Review: The Economics of Climate Change.* Cabinet Office – HM Treasury. Website: www.hm-treasury.gov.uk/media/8AC/F7/Executive_Summary.pdf

Tol, R. (2005) *The marginal damage costs of carbon dioxide emissions: an assessment of the uncertainties*. Energy Policy 33 (2005), pp. 2064-2074.

Tol, R. (2006) *The Stern Review of the Economics of Climate Change: A Comment.* Economic and Social Research Institute, Hamburg, Vrije and Carnegie Mellon Universities.

Tol, R. (2011) The Social Cost of Carbon, *Annual Review of Resource Economics*, 3, 419-443.

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	$1,701	$1,056	$690
INCREASE 20%			
Opportunity cost of land	$1,700	$1,055	$689
Capital costs	$1,626	$989	$630
Operating costs	$1,058	$628	$389
Coal value	$2,734	$1,734	$1,160
Level of foreign ownership	$1,625	$1,015	$668
Surface water	$1,700	$1,055	$689
Groundwater	$1,701	$1,056	$690
Employment benefits	$1,730	$1,085	$718
GREENHOUSE COSTS @ $40/TONNE (T)	$1,700	$1,056	$689

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE 20%			
Opportunity cost of land	$1,702	$1,057	$691
Capital costs	$1,776	$1,122	$749
Operating costs	$2,344	$1,483	$990
Coal value	$668	$378	$220
Level of foreign ownership	$1,776	$1,097	$712
Surface water	$1,701	$1,056	$690
Groundwater	$1,701	$1,056	$690
Employment benefits	$1,671	$1,027	$662
GREENHOUSE COSTS @ $8/T	$1,701	$1,056	$690

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

Input-output analysis refers to the study of the effects that different businesses or sectors have on the economy as a whole, for a particular nation or region. This type of economic analysis was originally developed by Wassily Leontief (1905 – 1999), who later won the Nobel Memorial Prize in Economic Sciences for his work on this model.

"Input-output analysis is like general-equilibrium theory in that it encompasses all products and industries, rather than singling out one or a few for study and relegating the others to the pound of ceteris paribus. Thus, the impact of a change in any corner of the economy can conceivably find its way via indirect effects through the input-output chart to every other industry. However, input-output analysis is unlike general equilibrium theory in that it is not in itself an equilibrium system, any more than is any other production function" (West, undated, p.23). The focus of input-output analysis is the economic activity in a region that is **associated** with an impacting agent, ceteris paribus.

"Input-output analysis assumes full employment with no capacity constraints, and thus prices have no role to play in the input-output model (unlike general equilibrium modelling). The application of input-output analysis needs to be viewed in the light of these restrictions. If the area under study is a small open economy relative to the rest of the nation, where factors of production can easily move into and out of the region and local prices gravitate to external prices (subject to transport margins, etc.)[15], then the input-output model would be a reasonable choice.

Conversely, if the economy is closed and there is likely to be 'crowding-out' of factors, then a more complex model is required (such as general equilibrium modelling). However, for small regional economies, it is unlikely that these more complex models will surpass the simpler input-output model. Notwithstanding the small country assumption, given the considerable difficulties associated with estimating a large number of coefficients and parameters when there is virtually no local data available, the increased 'fuzziness' may more than offset the increase in model sophistication. In such cases, the old maxim of 'simple models for simple economies' may be worth keeping in mind" (West, undated, p24).

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.

[15] This is referred to as the 'small country assumption'. It also implies that there is a question of aggregation involved. If there is some product differentiation between local and imported commodities, this assumption becomes less viable.

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" (Australian Bureau of Statistics [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).

REFERENCES

Australian Bureau of Statistics (1995) *Information Paper Australian National Accounts Introduction to Input-Output Multipliers*. Cat. No. 5246.0.

Centre for Farm Planning and Land Management (1989) *Consultants report to State plantations impact study.* CFPLM, University of Melbourne.

Jensen, R. and West, G. (1986) *Input-output for Practitioners: Theory and Applications*. Prepared for Department of Local Government and Administrative Services, Local Government and Regional Development Division, Australian Government Publishing Service.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.

Guy R. West, G. (undated) *Notes On Some Common Misconceptions In Input-Output Impact Methodology***,** Department of Economics, The University of Queensland. http://espace.library.uq.edu.au/eserv.php?pid=UQ:11078&dsID=DP262Oct99.pdf

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).

REFERENCES

Bayne, B. and West, G. (1988) *GRIT – Generation of Regional Input-Output Tables: Users Reference Manual*. Australian Regional Developments No. 15, Office of Local Government, Department of Immigration, Local Government and Ethnic Affairs, AGPS.

Jensen, G. (1980) The concept of accuracy in regional input-output models. *International Regional Science Review*, 5:2, pp.139-54.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.