Tarrawonga Coal Project

Environmental Assessment

APPENDIX M

SOCIO-ECONOMIC ASSESSMENT

Resource Strategies

Tarrawonga Coal Pty Ltd

Tarrawonga Coal Project
Socio-Economic Assessment

Prepared for

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST ATTACHMENTS

EXECUTIVE SUMMARY

The Tarrawonga Coal Mine is an open cut mining operation located approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in New South Wales (NSW). Tarrawonga Coal Pty Ltd (TCPL) is the owner and operator of the Tarrawonga Coal Mine, which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70% interest) and Boggabri Coal Pty Ltd (BCPL) (a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd) (30% interest). The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Tarrawonga Coal Project (the Project) would involve the continuation and extension of open cut mining operations at the Tarrawonga Coal Mine and would facilitate a ROM coal production rate of up to 3 Mtpa. The proposed life of the Project is 17 years, commencing 1 January 2013. A detailed description of the Project is provided in Section 2 of the Main Report of the Environmental Assessment (EA).

The Project requires the preparation of an EA in accordance with the requirements of the NSW *Environmental Planning and Assessment Act, 1979*. A socio-economic assessment is required as part of the EA.

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

- its economic efficiency (i.e. consideration of the economic costs and benefits of the Project);
- its regional economic impacts (i.e. the economic stimulus that the Project would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations) often considered in terms of the impacts on employment, population and community infrastructure.

A Benefit Cost Analysis (BCA) of the Project indicated that it would have net benefits of $1,116 million (M), comprising net production benefit in the order of $1,138M and net externality costs of $22M.

The BCA has included all costs and benefits that occur from the mining process that takes place in Australia. However, the costs and benefits of the Project may potentially be distributed among a number of different stakeholder groups at the local, State, National and global level. Consideration of these distributional issues is important for two reasons. Firstly, BCA is generally undertaken from a national perspective and hence excludes costs and benefits that accrue outside the National border. Nevertheless, the costs and benefits that accrue outside the National boundary and distribution of costs and benefits within the National border may be of interest to decision-makers.

The net production benefit is distributed amongst a range of stakeholders including:

- TCPL and its shareholders, some of which would accrue at a global level;
- the NSW Government via royalties;
- the Commonwealth Government in the form of Company tax; and
- the local community in the form of contributions to community infrastructure.

The proposed Mineral Resource Rent Tax (if introduced) would not change the net production benefit of the Project but would redistribute some of the net production benefit from TCPL and its shareholders to the Commonwealth Government.

The externalities costs 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 TCPL.

Noise and dust costs occur at a local level, but have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Similarly, surface water and groundwater effects would occur at the local level, but have been incorporated into the analysis via inclusion of purchase costs for relevant licences. Greenhouse gas costs occur at the National and global level and may potentially be internalised in the future through payment of a carbon tax once the Commonwealth Government's proposed carbon tax scheme is implemented. The externality costs associated with the clearing of native vegetation would occur at the State or National level and would be counterbalanced by the biodiversity offset actions proposed by TCPL. Other potential environmental externalities would largely occur at the State or Local level and were found to be minor or negligible. External benefits associated with employment provided by the Project would largely accrue at the Local or State level.

Overall the Project is estimated to have net benefits of $790M from an Australian perspective. Consequently, the Project is desirable and justified from an economic efficiency perspective.

An economic impact analysis, using input-output analysis, estimated that the Project would contribute the following to the Narrabri and Gunnedah economy:

- $490M in annual direct and indirect regional output or business turnover;
- $246M in annual direct and indirect regional value-added;
- $27M in annual direct and indirect household income; and
- 300 direct and indirect jobs.

At the State level the Project would make the following contribution to the economy:

- $901M in annual direct and indirect output or business turnover;
- $442M in annual direct and indirect value-added;
- $147M in annual direct and indirect household income; and
- 1,772 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.

The peak construction period of the Project would last for approximately 12 months and require a workforce of around 20 people. The maximum direct and indirect population associated with this was estimated at 55. Operations at the Project would last for 17 years and require a direct incremental workforce of 34. The maximum direct and indirect population associated with this was estimated at 212.

These maximum potential influxes in population are small in the context of existing populations of the Narrabri and Gunnedah Local Government Areas and only a small proportion of the decline in population between 2001 and 2006. The Project alone is therefore considered likely to have negligible impacts on housing, schools, health or community infrastructure. However, it is recognised that a range of prospective projects in the region may have cumulative impacts with respect to:

- pressure on short-term accommodation for construction workforce – potentially squeezing out tourism, etc.;
- increased demand for housing potentially leading to increased house prices and rental prices leading to displacement of those on low incomes;
- increased demand for health services;
- pressure on school 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
- potentially increased crime during construction phases associated with influx of single males.

TCPL 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 is 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 after 17 years of 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.

Given these uncertainties 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 brings to the region, to strengthen and broaden the region's economic base.

1 INTRODUCTION

The Tarrawonga Coal Mine is an open cut mining operation located approximately 15 kilometres (km) north-east of Boggabri and 42 km north-northwest of Gunnedah in New South Wales (NSW). Tarrawonga Coal Pty Ltd (TCPL) is the owner and operator of the Tarrawonga Coal Mine, which is a joint venture between Whitehaven Coal Mining Pty Ltd (Whitehaven) (70% interest) and Boggabri Coal Pty Ltd (BCPL) (a wholly owned subsidiary of Idemitsu Australia Resources Pty Ltd) (30% interest). The Tarrawonga Coal Mine commenced operations in 2006 and currently produces up to approximately 2 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Tarrawonga Coal Project (the Project) would involve the continuation and extension of open cut mining operations at the Tarrawonga Coal Mine and would facilitate a ROM coal production rate of up to 3 Mtpa. The proposed life of the Project is 17 years, commencing 1 January 2013. A detailed description of the Project is provided in Section 2 in the Main Report of the Environmental Assessment (EA).

TCPL is preparing an EA for the Project in accordance with the requirements of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). The Director-General's Environmental Assessment Requirements for the Project indicate that social and economic assessment is required as part of the EA including:

- *an assessment of the potential impacts of the project on the local and regional community, paying particular attention to the demand it may generate for the provision of additional infrastructure (including housing) and services; and*
- *a detailed assessment of the costs and benefits of the project as a whole, and whether it would result in a net benefit for the NSW community*[1].

In this respect, consideration was given to the relevant aspects of the Planning NSW's (James and Gillespie, 2002) draft *Guideline for Economic Effects and Evaluation in EIA* 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 regional economic impacts of the Project (i.e. the economic stimulus that the Project would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

Planning NSW (James and Gillespie, 2002) draft *Guideline for Economic Effects and Evaluation in EIA* identified economic efficiency as the key consideration of economic analysis. Benefit Cost Analysis (BCA) is the method used to consider the economic efficiency of proposals. The draft guidelines identified BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts.

[1] The BCA for the Project has been prepared on a national basis rather than a NSW basis. This is considered the correct approach both conceptually and pragmatically given the interconnected nature of the Australian economy and society and the spillovers between states, including those associated with the tax system and the movement of resources over state boundaries. Notwithstanding the above, details of the benefits of the Project to the NSW economy are provided in Section 3.3.

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

The draft guidelines also identify 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. This study relates to the preparation of each of the following types of analyses:

- a BCA of the Project;
- a regional economic impact assessment of the Project; and
- an Employment, Population and Community Infrastructure Assessment (EPCIA).

A consultation programme for the EA was undertaken by TCPL and is described in Section 3 in the Main Report of the EA.

2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

For the Project to be economically desirable from a community perspective, it must be more economically efficient than the base case or "without" Project scenario. Technically, a project is more economically efficient than the "without" Project scenario if the benefits to society exceed the costs (James and Gillespie, 2002). For mining projects, the main economic benefit is the producer surplus (net production benefits) generated by the Project and the employment benefits it provides, while the main potential economic costs relate to any environmental, social and cultural costs. The main technique that is used to weigh up these benefits and costs is BCA.

A BCA 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;
- sensitivity testing;
- application of decision criteria; 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 TCPL and its specialist consultants.

2.2 IDENTIFICATION OF THE BASE CASE AND PROJECT

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

In this study, the base case or "without" Project scenario involves continuation of mining up to 2 Mtpa ROM coal at the Tarrawonga Coal Mine to 2017, with site decommissioning and rehabilitation in 2018.

In contrast to the "base case", the main activities associated with the development of the Project would include:

- continued development of mining operations in the Maules Creek Formation to facilitate a Project ROM coal production rate of up to 3 Mtpa, including open cut extensions:
  - to the east within Mining Lease (ML) 1579 and Mining Lease Application (MLA) 2; and
  - to the north within Coal Lease (CL) 368 (MLA 3) which adjoins ML 1579;
- ongoing exploration activities;
- construction and use of a services corridor (including haul road link) directly from the Project open cut mining operation to the upgraded Boggabri Coal Mine Infrastructure Facilities[2];
- use of upgraded Boggabri Coal Mine Infrastructure Facilities for the handling and processing of Project coal and the loading of Project product coal to trains for transport on the Boggabri Coal Mine private rail spur to the Werris Creek Mungindi Railway[2];

[2] Subject to approvals and upgrades being in place for the transfer of Project ROM coal to the Boggabri Coal Mine Infrastructure Facilities.

- construction and use of a new mine facilities area including relocation of existing mine facilities infrastructure and service facilities;
- use of an existing on-site mobile crusher for coal crushing and screening of up to 150,000 tonnes (t) of domestic specification coal per annum for direct collection by customers at the mine site;
- use an existing 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 mine site;
- progressive backfilling of the mine void behind the advancing open cut mining operation with waste rock and minor quantities of coarse reject material;
- continued and expanded placement of waste rock in the Northern Emplacement (including integration with the Boggabri Coal Mine emplacement) and Southern Emplacement, as mining develops;
- progressive development of new haul roads and internal roads, as mining develops;
- realignment of sections of Goonbri Road and construction of new intersections;
- construction of an engineered low permeability barrier to the east and south-east of the open cut to reduce the potential for local drainage of alluvial groundwater into the open cut;
- removal of a section of Goonbri Creek within the Project open cut and the establishment of a permanent Goonbri Creek alignment and associated flood bund to the east and south-east of the open cut;
- progressive development of sediment basins and storage dams, pumps, pipelines and other water management equipment and structures;
- continued development of soil stockpiles, laydown areas and gravel/borrow areas;
- ongoing monitoring and rehabilitation; and
- other associated minor infrastructure, plant, equipment and activities.

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

BCA is concerned with the evaluation of feasible alternatives relative to the alternative of no investment. However, alternatives need to be feasible to the proponent and to this end a number of alternatives to the Project were considered by TCPL in the development of the Project description, including further consideration of alternatives following lodgement of the Project Application. An analysis of two mine plan alternatives is presented in Section 2.7. Section 6.9.1 in the Main Report of the EA provides more detail on the consideration of Project alternatives.

The Project assessed in the EA and evaluated in the BCA was developed to minimise environmental and social impacts, whilst maximising resource recovery and operational efficiency. The Project is considered by TCPL 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 TCPL and was subject to detailed economic analysis.

2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case or “without” Project scenario of mine cessation in 2017, the Project may have the potential incremental economic benefits and costs shown in Table 2.1.

Table 2.1
Potential Economic Benefits and Costs of the Project

Category	Costs	Benefits
Production	• Opportunity cost of land • Opportunity cost of plant • Capital costs of development including ancillary works and sustaining capital • Operating costs, including administration, mining, coal handling and transportation to market • Decommissioning costs	• Value of ROM coal • Value of gravel materials • Residual value of capital and land at the cessation of the Project • Delayed decommissioning and rehabilitation costs of Tarrawonga Coal Mine from 2018 to 2030
Externalities	• Greenhouse gas generation • Agricultural production • Operational noise impacts • Road transport noise impacts • Rail transport noise impacts • Blasting overpressure and vibration impacts • Air quality impacts • Surface water impacts • Groundwater impacts • Flora and fauna impacts • Road transport impacts • Aboriginal heritage impacts • Non-Aboriginal heritage impacts • Visual impacts • Leard State Forest – impacts on timber production and recreation	• Economic and social benefits of employment

It should be noted that the potential external costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.

2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

In accordance with the NSW *Treasury Guidelines for Economic Appraisal* (NSW Treasury, 2007), where competitive market prices are available, they have generally been used as an indicator of economic values. Externality values have been estimated, where relevant, using market data and benefit transfer.

2.4.1 Production Costs and Benefits[3]

Economic Costs

Opportunity Cost of Land

There is an opportunity cost associated with using land at Tarrawonga Coal Mine for continued mining after 2017, instead of its next best use (e.g. agricultural production). An indication of the opportunity cost of the land can be gained from the market value following decommissioning and rehabilitation. This is estimated at $5.6 million (M).

[3] All values reported in this section are undiscounted unless specified.

There is also an opportunity cost associated with current and proposed land acquisitions for properties that may be adversely affected as a result of noise and air quality effects of the Project and for the Project offset. These opportunity costs are estimated at $10.1M.

Opportunity Cost of Plant

Where the mining activity after 2017 would continue to utilise plant and machinery already owned by TCPL, there is an opportunity cost associated with utilising this plant rather than selling it or using it elsewhere. An indication of its opportunity cost can be gained from its current book value (although this is likely to overstate the market value), which is estimated at $18M.

Capital Cost of the Project

Capital costs of the Project include the relocation of the mine facilities area, realignments of Goonbri Road, construction of new intersections, construction of the permanent Goonbri Creek alignment, associated flood bund and low permeability barrier and sustaining capital. These incremental capital costs over the life of the Project are estimated at $114M. These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Mine

The annual operating costs of the Project include those associated with mining, progressive rehabilitation, environmental management and monitoring, ROM coal processing, administration and ROM coal rail transport. Average annual operating costs of the mine (excluding royalties) after 2017 are estimated at $224M.

While royalties are a cost to TCPL they are part of the overall producer surplus benefit of the mining and processing 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 incremental royalties in the order of $35M per annum after 2017, with total incremental royalties over the life of the Project in the order of $478M, or $213M in present value terms.

Decommissioning and Rehabilitation Costs of Facilities

The Tarrawonga Coal Mine would be rehabilitated progressively and site infrastructure would be decommissioned and rehabilitated at the cessation of the Project. These costs are estimated at $9.2M.

Economic Benefits

Avoided Decommissioning and Rehabilitation Costs

With the Project, the decommissioning and rehabilitation costs that would have been incurred by the Tarrawonga Coal Mine in 2018 are avoided. These avoided costs in 2018 are estimated at $7.1M.

Sale Value of Coal

82% of product coal from the Project is estimated to be semi-soft coking coal with the remainder thermal coal, with the price received for these products being influenced by both world supply and demand.

Demand for semi-soft coking and thermal coal is derived demand (i.e. dependent on demand for the end products within which the coal resource is used, such as steel making and electricity). Demand for semi-soft coking and thermal coal therefore fluctuates considerably based on numerous market factors including the demand for steel and the goods and services requiring electricity as an input to production, the price of steel and coal fired electricity, the price of alternatives to steel and electricity, income of consumers, population growth etc.

World supply of semi-soft coking and thermal coal also fluctuates depending on price of steel and electricity, prices of factors of production, prices of related goods, expected future prices, the number of suppliers, technology, greenhouse gas emission policy, etc.

Assumed prices used in the analysis were Australian Dollars (AUD) $161/t for semi-soft coking coal and AUD$102/t for thermal coal.

There is obviously considerable uncertainty around the future sale value of coal from the Project. The sale value of coal would be subject to variations in ROM coal production rates and coal prices. The sale value of coal has been subjected to sensitivity analysis using coal prices (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$ for gravel materials.

Residual Value at End of the Evaluation Period

At the end of the Project, purchased capital equipment and land may have some residual value that could be realised by sale. For this analysis, capital equipment is assumed to have no residual value and rehabilitated land is assumed to have a residual value of $12.2M.

2.4.2 External Costs and Benefits

Greenhouse Gases

The Project is predicted to generate a total of some 3.5 million tonnes (Mt) of direct (scope 1) greenhouse gas emissions associated with mining activities (PAE Holmes, 2011) (Appendix D of the EA). In addition, a total of some 0.6 Mt of indirect (scope 3) greenhouse gas emissions associated with the processing of Project ROM coal (at the Whitehaven Coal Handling and Preparation Plant or the Boggabri Coal Mine Infrastructure Facilities), the transportation of product coal to the Port of Newcastle and on-site diesel usage would be generated (Appendix D of the EA). No scope 2 greenhouse gas emissions would be generated at the Project (Appendix D of the EA). The economic analysis has included these scope 1 and scope 3 emissions as a potential external cost of the Project.

In addition, the Project would result in the loss of carbon sequestration benefits from the clearing of Leard State Forest and other vegetation (397 ha). It is considered that the loss of carbon sequestration benefits associated with the clearance of this vegetation would be offset by the revegetation of approximately 752 ha of revegetation at the Project site.

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$30/t CO_2-e was used, with sensitivity testing from AUD$8/t CO_2-e to AUD$40/t CO_2-e (refer to Attachment A).

The greenhouse gas costs associated with the burning of the coal or downstream manufacturing that uses semi-soft coking coal are omitted. Traditional and continuing practice in BCA is to undertake the analysis from a National perspective. This is based on pragmatic grounds as well as the view that projects should be assessed from the view point of the nation which undertakes the projects, incurs the costs and is responsible for decision-making. In the BCA above, production benefits (value of coal) and costs are valued at the National boundary (e.g. coal is valued at the Newcastle Port [free-on-board], and costs up to and including loading the coal at Newcastle Port have been included).

After coal leaves Australia it becomes an input into different production processes. In the case of thermal coal the production process is concerned with the burning of coal in developing and developed countries to generate electricity. This production process requires approval of the countries purchasing the coal and generating the electricity and has its own set of costs and benefits. Costs of coal fired power generation in other countries include the costs of coal, labour, land and capital inputs, electricity distribution costs and externality costs, such as greenhouse gas generation. Benefits include the financial value of electricity as well as the willingness to pay of the community for electricity above and beyond what they have to pay (i.e. consumer surplus). There may also be externality benefits of electricity for economic development, education, and medical care. All of these costs and benefits are relevant to a consideration of this next stage of the production process, not just the greenhouse gas costs.

The production process typically relevant to the semi-soft coking coal is steel production. As with the thermal coal production process, this production process requires approval of the countries purchasing the coal and has its own set of costs and benefits. Costs of steel production in other countries include the costs of iron ore, coal, labour, land and capital inputs and externality costs, such as greenhouse gas generation. Benefits include the financial value of steel as well as any associated consumer surplus. As with the thermal coal production process, all of these costs and benefits are relevant to a consideration of this next stage of the production process.

However, this production process is not subject to the NSW development approval process and decisions by the NSW Government about whether to supply additional coal for export are likely to have modest consequences for decisions other countries take with regard to coal fired electricity generation and steel production. While NSW is well placed to supply some of the projected additional world demand for coal, 75% of growth in coal production is expected to come from China (US Energy Information Administration, 2010), and with NSW containing approximately 1% of total recoverable coal reserves in the world there are significant coal supply substitution possibilities[4].

[4] US Energy Information Administration (2010) identifies that the total recoverable reserves of coal around the world is 909 billion tonnes and NSW Department of Primary Industries (DPI) (2010) identifies 11.52 billion tonnes of recoverable reserves of coal in NSW.

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. This allowance included in the BCA is considered conservative as it is greater than a detailed estimate of the present value of the forgone agricultural production prepared by Gillespie Economics (2011) (Appendix I of the EA).

Operational Noise

As described in the Noise and Blasting Impact Assessment (Wilkinson Murray, 2011) (Appendix C of the EA), the Tarrawonga Coal Mine contributes to the existing noise environment at nearby private rural residences.

Two rural residences have been identified in Appendix C of the EA as being in the moderate Project noise management zone, where exceedances of 3 to 5 A-weighted decibels (dBA) above applicable noise criteria are predicted. One of these residences is currently under contract for purchase to Whitehaven. 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 capital costs of the Project has been made for potential at receiver mitigation at two residences in the BCA.

Two rural residences and one property have been identified in Appendix C of the EA 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 affection zone would be granted the opportunity to be acquired by TCPL via conditions of the Project Approval. Instead of incorporating the partial property value impact on this property, conservatively, the full cost of acquiring them has been incorporated into the opportunity cost of land associated with the Project[5].

Road Transport Noise

The potential impact of increased Project road traffic on noise levels was also assessed. It was concluded that the Project would have minimal impact on traffic noise on public roads in the vicinity of the Project (Appendix C of the EA), and therefore does not warrant inclusion in the BCA.

Rail Transport Noise

The Project would generate a maximum additional four rail movements per day on the Werris Creek Mungindi Railway from the proposed Boggabri Coal Mine rail spur to Werris Creek and along the Main Northern Railway to the port of Newcastle (Appendix C of the EA).

Appendix C of the EA 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 [m]). 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.

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

Blasting Overpressure and Vibration

Blasting at the Project has the potential to cause structural damage or human discomfort at properties surrounding the Tarrawonga Coal Mine. The potential impacts of blast overpressure and vibration were assessed in Appendix C of the EA. The assessment concluded that 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 EA) indicates that one nearby private vacant lot would be impacted by air quality emissions above relevant criteria. This affected property is also in the noise affectation zone and hence has been included in the opportunity cost of land described above.

Surface Water

The Project would result in changes to flows in local creeks (including the removal of a section of Goonbri Creek) due to the progressive extension of the open cut and associated subsequent capture and re-use of drainage from operational disturbance areas and controlled releases from licensed discharge points.

Prior to the open cut advancing into the existing Goonbri Creek alignment, the permanent Goonbri Creek alignment would be established to the east of the open cut, low permeability barrier and permanent flood bund. The permanent flood bund would be constructed to prevent inundation of the open cut both during operations and post-mining. The capital cost of the permanent Goonbri Creek alignment and associated flood bund have been included in the capital cost for the Project.

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 0.02% (Gilbert & Associates, 2011) (Appendix B of the EA). The opportunity cost of this water has been included in the analysis.

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 baseflow 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 EA) 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 at the Project (Heritage Computing, 2011) (Appendix A of the EA). The porous rock groundwater system includes the coal measures of the Maules Creek Formation and the alluvial groundwater system is associated with the Bollol Creek, Goonbri Creek and Nagero Creek surface drainages to the east, south and west of the Project area.

As mining progresses, the open cut would act as a groundwater sink (Appendix A of the EA). 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 EA).

Groundwater associated with the alluvial groundwater system would be sourced via direct excavation as part of the open cut and indirect depressurisation via enhanced leakage to the underlying porous rock groundwater system (Appendix A of the EA). After the alluvial material in the open cut extent is removed, there would be minimal alluvial groundwater reporting to the open cut and negligible losses from alluvium outside of the low permeability barrier (Appendix A of the EA).

The low permeability barrier between the final void and the alluvial groundwater system would limit flow of any groundwater from the alluvial groundwater system (and associated water quality effects) to the final void which would remain a groundwater sink (Appendix A of the EA).

The capital cost of the low permeability barrier and purchasing and holding relevant groundwater extraction licences has been incorporated into the capital 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 EA). 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 397 ha of predominantly native vegetation, including forest, woodland, derived native grasslands and areas previously disturbed and regenerating (FloraSearch, 2011) (Appendix F of the EA).

Endangered ecological communities and some threatened fauna species were identified in the Project area and surrounds as described in Appendix F of the EA and in Cenwest Environmental Services and Resource Strategies (2011) (Appendix E of the EA). An assessment of the impacts of the Project indicated that despite the likely impacts 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 1,660 ha. The conservation of the proposed biodiversity offset areas would be secured in perpetuity through one of a selection of mechanisms being considered.

With the implementation of the progressive rehabilitation of Project disturbance areas and mine landforms and implementation of the biodiversity offset proposal, it is considered that the potential impacts of the Project on terrestrial fauna and flora would largely be offset and hence no significant economic cost would arise that would warrant inclusion in the BCA. Land opportunity costs and operational expenditure associated with the offset areas have been included in the BCA.

The Project would include the removal of a section of Goonbri Creek. However, it is unlikely to have a significant effect on aquatic ecology given the current condition of the section of Goonbri Creek proposed to be disturbed (Appendix E of the EA) and the proposed management approach including establishment of a permanent Goonbri Creek alignment and revegetation along the downstream (southern extent) sections of Goonbri Creek (i.e. upstream of the existing sized ROM coal haul road crossing) (Appendix F of the EA).

Road Transport

The potential impacts of increased road traffic that would arise due to the Project on local traffic conditions and road safety have been considered by Halcrow (2011) (Appendix H of the EA). It was concluded that no significant impacts on the performance and safety of the road network would be expected to arise as a result of the Project and no specific 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.

Aboriginal Heritage

The Project has the potential to impact Aboriginal heritage sites in Project land disturbance areas. Of the 61 known Aboriginal heritage sites located within the study area, 38 would be subject to direct disturbance and one may be subject to direct disturbance (Kayandel Archaeological Services, 2011) (Appendix K of the EA). 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 Blair Athol Schoolhouse and a survey marker were considered to be potentially of local significance (Heritage Management Consultants, 2011) (Appendix L of the EA). As the Blair Athol Schoolhouse has been relocated to Boggabri in accordance with Narrabri Shire Council consent and the survey marker is located 500 m south-east of the Project disturbance area and over 1 km south east of the open cut, the potential for impacts through direct action, vibration or blasting impact is small (Appendix L of the EA). 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, 2011) (Appendix J of the EA):

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

Visual impacts of the Project would include new and/or increased views of the waste rock emplacements and open cut from local viewpoints. Continuation and extension of night-lighting 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 cease at mine closure.

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 moderate and following rehabilitation, residual impacts would be low (Appendix J of the EA).

There are considered to be no visual impacts that are sufficiently significant that they would warrant inclusion in the BCA.

Leard State Forest – Timber Production and Recreation

The Project would result in disturbance of approximately 145 ha of Leard State Forest which represents approximately 2% of the total Leard State Forest. Forests NSW advises that over a 10 year period timber production has been in the order of $13.25 per ha or $1.32 per ha per year. This figure was extrapolated, in perpetuity, to the 145 ha of Leard State Forest impacted by the Project.

Recreation values associated with Leard State Forest would appear to be limited with no recreation infrastructure (i.e. walking tracks, camping areas, etc.) located within the Leard State Forest (DPI, 2011). While hunting is permitted in Leard State Forest (NSW Game Council, 2011) no information was available on the level of activity. Whitten and Bennett (2001) found that duck hunters participating in a shoot in the Upper South East of South Australia derived an average consumers' surplus of between $42.31 and $62.03. Adjusting for the consumer price index and applying this value to an conservatively high hunter use estimate of two people per weekend (in the section of the Leard State Forest disturbed by the Project), in perpetuity gives a present value of $0.1M.

Social and Economic Value of Employment

Historically the employment benefits of projects have tended to be omitted from BCA on the implicit assumption that labour resources used in a Project would otherwise be employed elsewhere. Where this is not the case, Streeting and Hamilton (1991) and Bennett (1996) outline that otherwise unemployed labour resources utilised in a project should be valued in a BCA at their opportunity cost (wages less social security payments and income tax) rather than the wage rate which has the effect of increasing the net production benefits of the Project. In addition, there may be social costs of unemployment that require the estimation of people's willingness to pay to avoid the trauma created by unemployment. These are non-market values.

It has also been recognised that the broader community may hold non-environmental, non-market values (Portney, 1994) for social outcomes such as employment (Johnson and Desvouges, 1997) and the viability of rural communities (Bennett *et al*., 2004).

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

From 2013 to 2017 the Project would provide an additional 34 operational jobs. The Project would provide an average of 120 direct jobs per year for 12 years from 2018. Using the more conservative Bulli Seam Operation employment value gives an estimated $40M for the employment benefits of the Project. This value has been included in the BCA. In the context of a fully employed economy there may be some contention about the inclusion of this value, particularly as it requires benefit transfer from a study of an existing mining operation in another region of NSW. 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.

Overall the Project is found to have net benefits of $1,116M, comprising net production benefit in the order of $1,138M and net externality costs of $22M.

2.5.2 Distribution of Costs and Benefits

The BCA has included all costs and benefits that occur from the mining process that takes place in Australia. However, the costs and benefits of the Project may potentially be distributed among a number of different stakeholder groups at the local, State, National and global level. Consideration of these distributional issues is important for two reasons. Firstly, BCA is generally undertaken from a National perspective and hence excludes costs and benefits that accrue outside the national border. Nevertheless, the costs and benefits that accrue outside the National boundary and distribution of costs and benefits within the National border may be of interest to decision-makers[6]. Table 2.3 summarises the distribution of costs and benefits.

The net production benefit is distributed amongst a range of stakeholders including:

- TCPL and its shareholders in the form of after tax profits, some of which would accrue at a global level;
- the NSW Government via royalties which are subsequently used to fund provision of government infrastructure and services across the State;
- the Commonwealth Government in the form of Company tax which is subsequently used to fund provision of government infrastructure and services across Australia (including NSW); and
- the local community in the form of contributions to community infrastructure.

The proposed Mineral Resource Rent Tax (if introduced) would not change the net production benefit of the Project but would redistribute some of the net production benefit from TCPL and its shareholders to the Commonwealth Government.

The externalities costs 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 TCPL.

Noise and dust costs occur at a local level, but have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Similarly, surface water and groundwater effects would occur at the local level, but have been incorporated into the analysis via inclusion of purchase costs for relevant licences. Greenhouse gas costs occur at the National and global level and may potentially be internalised in the future through payment of a carbon tax once the Commonwealth Government's proposed carbon tax scheme is implemented.

[6] The analysis is extended beyond that which is strictly relevant from a NSW government perspective. However given the interconnected nature of the Australian economy and society and the spillovers between states, including those associated with the tax system and the movement of resources over state boundaries, this is considered the correct approach both conceptually and pragmatically.

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

	COSTS		BENEFITS	
	Description	**Value**	**Description**	**Value**
Production[1]	Opportunity cost of land	$13M	Value of coal	$2,569M
	Opportunity cost of capital	$10M	Avoided decommissioning and rehabilitation costs of Tarrawonga Coal Mine surface infrastructure in 2018	$3M
	Capital costs of establishment and construction including ancillary works, land acquisition and sustaining capital	$92M	Residual value of capital and land at the cessation of the Project	$1M
	Operating costs, including administration, mining, coal handling, transportation,	$1,319M	Sale value of gravel	$3M
	Decommissioning and rehabilitation costs in 2030	$4M	-	-
	Production Sub-total	***$1,439M***	-	***$2,576M***
	Net Production Benefits	-	-	**$1,138M**
Externalities	Greenhouse gas emissions	$61M	Economic and social benefits of employment	$40M
	Agricultural production	Value included in opportunity cost of land	-	-
	Operational noise	Cost included in opportunity cost of land	-	-
	Road transport noise	Negligible	-	-
	Rail transport noise	Negligible	-	
	Blast overpressure and vibration	Negligible	-	-
	Air quality	Cost included in opportunity cost of land	-	-
	Surface water	Cost included in capital costs and $1M associated with surface water runoff excision	-	
	Groundwater	Cost included in capital costs	-	-
	Flora and fauna	Some loss of values but offset. Cost of offset included in capital costs and operating costs	-	-
	Road transport	Negligible		-
	Aboriginal heritage	Negligible	-	-
	Non-Aboriginal heritage	Negligible	-	-
	Visual impacts	Negligible	-	-
	Leard State Forest – timber production	$0	-	-
	Leard State Forest – recreational use	$0	-	-
	Externalities sub-total	***$62M***	-	***$40M***
	Net externalities with employment benefits	-	-	***-$22M***
	Net externalities without employment benefits	-	-	***-$62M***
NET BENEFITS (including employment benefits)				**$1,116M**
NET BENEFITS (excluding employment benefits)				**$1,076M**

Note: Totals may have minor discrepancies due to rounding.
Production costs and benefits in accordance with data provided by TCPL.

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

Value		Distribution			
		Local	State	National	Global
Benefits					
Net production benefits to TCPL	$647M	✓	✓	✓	✓
Net production benefits to Commonwealth Government – Company tax	$277M	✓	✓	✓	-
Net production benefits to NSW Government – Royalties	$213M	✓	✓	-	-
Social benefit of employment	$40M	✓	✓	-	-
Total	***$1,178M***				
Costs					
Greenhouse gas emissions rest of world[1]	$60M	-	-	-	✓
Greenhouse gas emissions Australia[1]	$1M	✓	✓	✓	-
Agricultural production	Value included in opportunity cost of land	✓	-	-	-
Operational noise	Cost included in opportunity cost of land	✓	-	-	-
Road transport noise	Negligible	✓	-	-	-
Rail transport noise	Negligible	✓			
Blast overpressure and vibration	Negligible	✓	-	-	-
Air quality	Cost included in opportunity cost of land	✓	-	-	-
Surface water	Cost included in capital costs and $1M associated with surface water runoff excision	✓	-	-	-
Groundwater	Cost included in capital costs	✓	-	-	-
Flora and fauna	Some loss of values but offset. Cost of offset included in capital costs and operating costs	✓	✓	✓	-
Road transport	Negligible	✓	-	-	-
Aboriginal heritage	Negligible	✓	-	-	-
Non-Aboriginal heritage	Negligible	✓	-	-	-
Visual impacts	Negligible	✓	-	-	-
Leard State Forest – timber production	$0	✓	-	-	-
Leard State Forest – recreational use	$0	✓	-	-	-
Total	***$62M***				
Net Benefits	**$1,116M**				

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 externality costs associated with the clearing of native vegetation would occur at the State or National level and would be counterbalanced by the offset actions proposed by TCPL. Other potential environmental externalities would largely occur at the State or Local level and were found to be minor or negligible. External benefits associated with employment provided by the Project would largely accrue at the Local or State level[7].

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

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

Overall the Project is estimated to have net benefits of $1,116M. Based on current ownership and tax structures, it is estimated that $790M of these benefits would flow to Australia. Consequently, the Project is desirable and justified from an economic efficiency perspective.

2.6 SENSITIVITY ANALYSIS

The NPV presented in Table 2.3 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 changes to the following variables:

- opportunity cost of land;
- opportunity cost of capital equipment;
- capital costs;
- operating costs;
- value of product coal and gravel;
- decommissioning and rehabilitation costs;
- residual value of land and capital equipment;
- timber values;
- groundwater value;
- surface water value;
- value of Leard State Forest recreation;
- greenhouse gas impacts; and
- social value of employment.

This analysis indicated (Attachment B) that the results of the BCA are not sensitive to reasonable changes in assumptions regarding any of these variables. In particular, significant increases in the values used for external impact such as greenhouse gas costs, or environmental impacts had little impact on the overall economic desirability of the Project.

The results were most sensitive to decreases in the value of product coal, although substantial and sustained reductions in assumed coal prices would be required to make the Project undesirable from an economic efficiency perspective.

2.7 PROJECT ALTERNATIVES

A number of alternatives to the preferred Project evaluated in this BCA were considered by TCPL in the development of the Project description, including further consideration of alternatives following lodgement of the Project Application. An assessment has been completed on two alternatives to the preferred Project evaluated in the EA to examine the change to the Project net production benefits. The two alternatives considered in this assessment included:

- Avoidance of Goonbri Creek by the open cut extent. This alternative would avoid the requirement for the permanent Goonbri Creek alignment, however the low permeability barrier and associated flood bund would still be required.
- Avoidance of Goonbri Creek and implementation of a 150 m buffer between the open cut extent and the alluvium. This alternative would avoid the requirement for the permanent Goonbri Creek alignment and the low permeability barrier and associated flood bund.

This assessment was based on estimation of the incremental production costs and revenues of alternatives relative to the preferred Project evaluated in the EA using estimates of the tonnage of ROM coal sterilised, foregone revenue, capital and operating cost savings and the additional capital and operating costs.

The consideration of alternatives during the mine planning process determined that avoidance of Goonbri Creek by the open cut extent would sterilise approximately 4 Mt of ROM coal and reduce the life of the Project by approximately 18 months. This would reduce the net production benefit of the Project by approximately $79 M.

The implementation of the avoidance of Goonbri Creek and implementation of a 150 m buffer between the open cut extent and the alluvium would sterilise approximately 8 Mt of ROM coal and reduce the life of the Project by approximately two and half years. This would reduce the net production benefit of the Project by approximately $156 M.

It should be noted that this assessment does not take into consideration the potential reduction in costs (externalities) due to the reduction in environmental impacts associated with the two alternatives relative to the preferred Project assessed in the EA.

3 REGIONAL ECONOMIC IMPACT ASSESSMENT

3.1 INTRODUCTION

Regional economic impact assessment is primarily concerned with the effect of an impacting agent on an economy in terms of a number of specific indicators, 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 value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.
- ***Household income*** – the wages paid to employees including imputed wages for self employed and business owners.
- ***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 impact of annual ROM coal production of up to 3 Mtpa at the Project.

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 Project, but not making the economy so large that the impact of the Project becomes trivial (Powell and Chalmers, 1995). The workforce is likely to predominantly reside in either the townships of Gunnedah, Narrabri or Boggabri. Consequently, for this study, the economic impacts of the Project have been estimated for the Australian Bureau of Statistics (ABS) Statistical Local Areas (SLA) of Narrabri and Gunnedah.

A range of methods that can be used to examine the regional 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:

- development 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).

3.2 INPUT OUTPUT TABLE AND ECONOMIC STRUCTURE OF THE REGION

A 2005-06 input-output table of the regional economy (Narrabri SLA and Gunnedah SLA) was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment C) with a 2005-06 input-output table of the NSW economy (developed by Monash University) as the parent table. The 109 sector input-output table of the regional economy was aggregated to 30 sectors and six sectors for the purpose of describing the economies.

A highly aggregated 2005-06 input-output table for the regional economy is provided in Table 3.1. The rows of Table 3.1 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 2005-06 ($'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 Income	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) 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 (Table 3.1).

A total of 9,517 people were working in the region during 2005-06 (Table 3.1).

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.

Figures 3.3 to 3.5 provide a more expansive sectoral distribution of gross regional output, gross value-added, gross regional income, employment, imports and exports, and can be used to provide some more detail in the description of the economic structure of the economy.

From these figures it is evident that in terms of gross regional output and value-added, *grains*, *other agriculture*, *business services* and *retail trade* are the most significant sectors (Figures 3.3). The *retail trade* sector is the most significant sector in terms of regional employment (Figure 3.4) while the *retail trade* sector and *business services* sector are the most significant sectors in terms of income (Figure 3.4). Imports and exports are spread across many sectors with major contributors being the *grains*, *other agriculture*, *food and textile manufacturing*, *retail trade* and *business services* (Figure 3.5).

Figure 3.1
Summary of Aggregated Sectors: Regional Economy (2005-06)

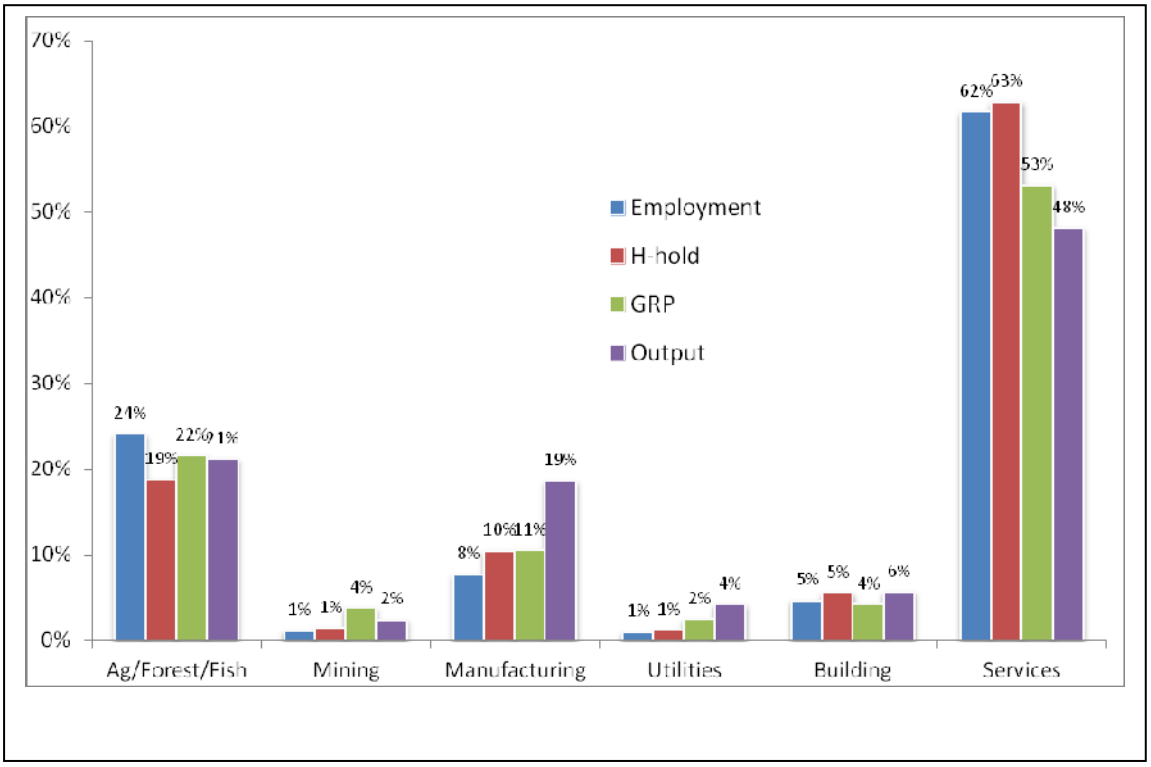


Figure 3.2
Summary of Aggregated Sectors: NSW Economy (2005-06)

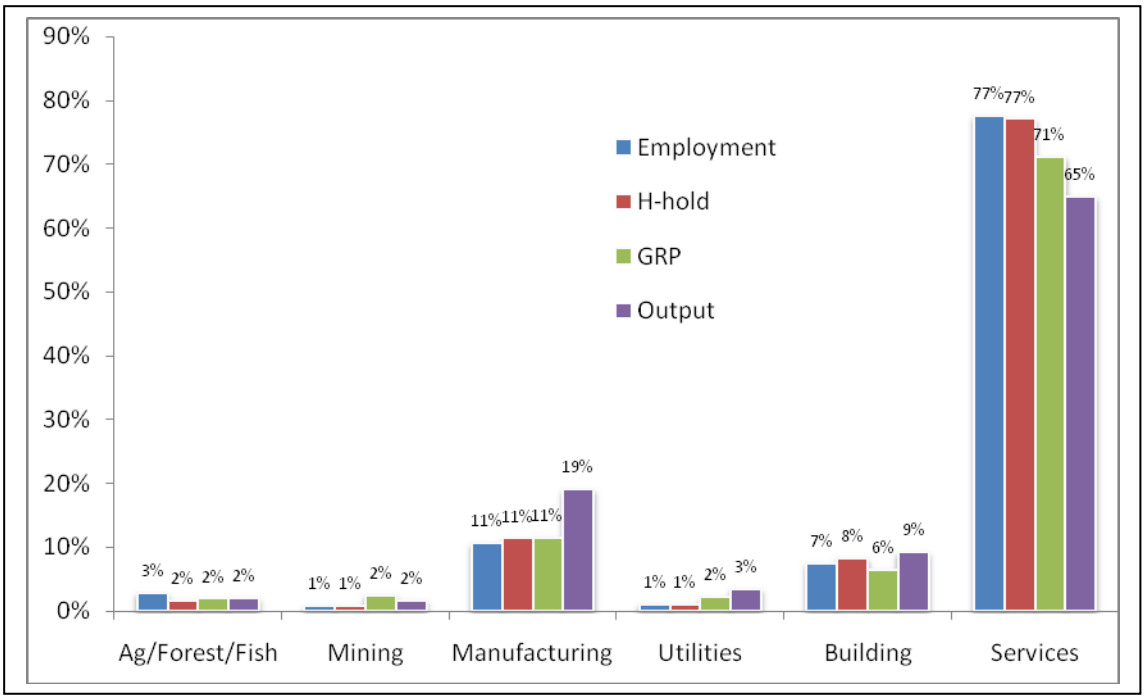
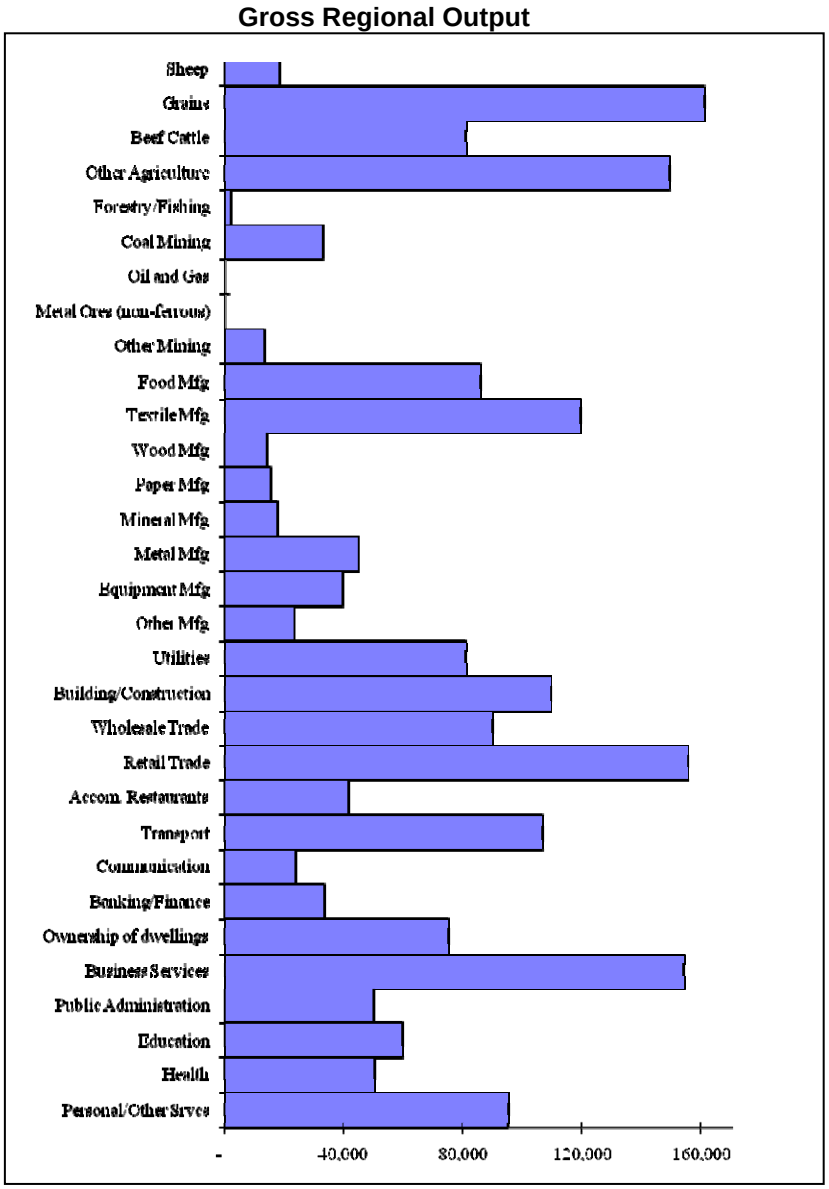


Figure 3.3 Sectoral Distribution of Gross Regional Output and Value-Added ($'000)



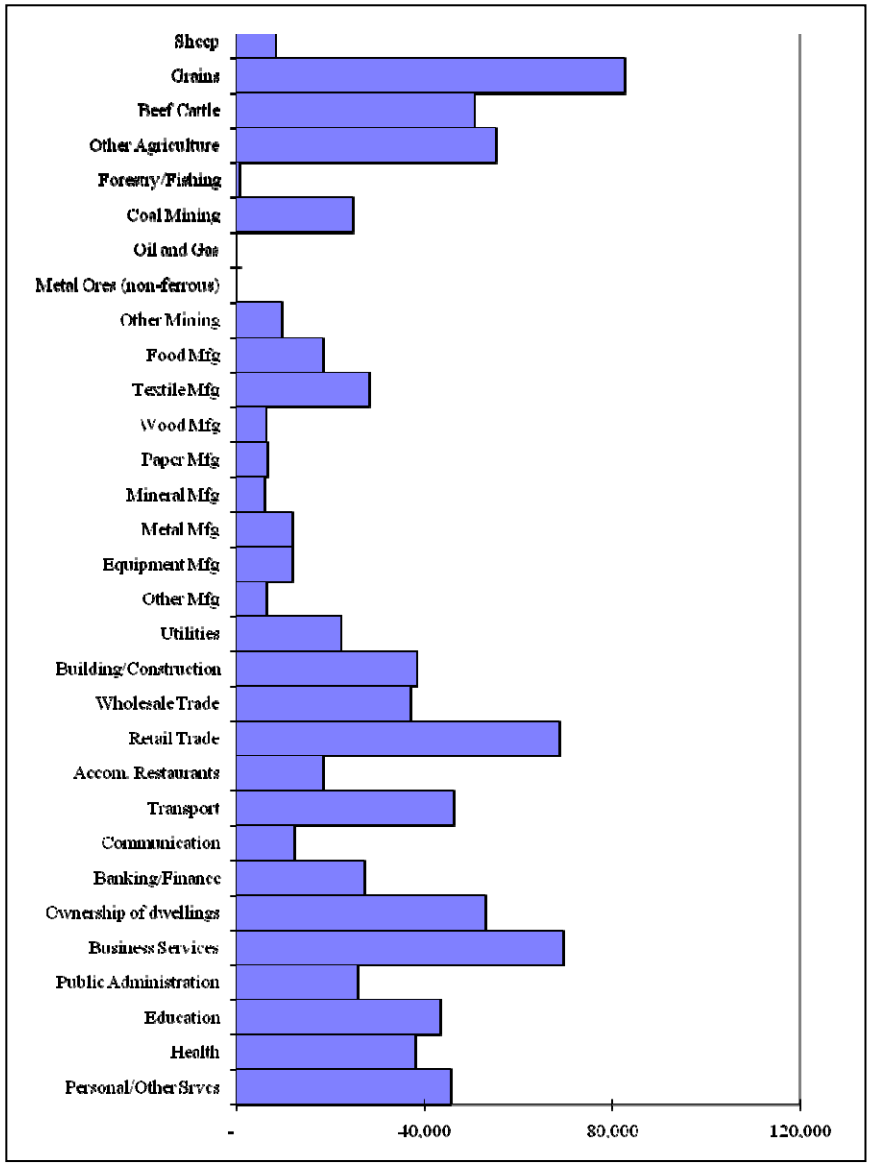
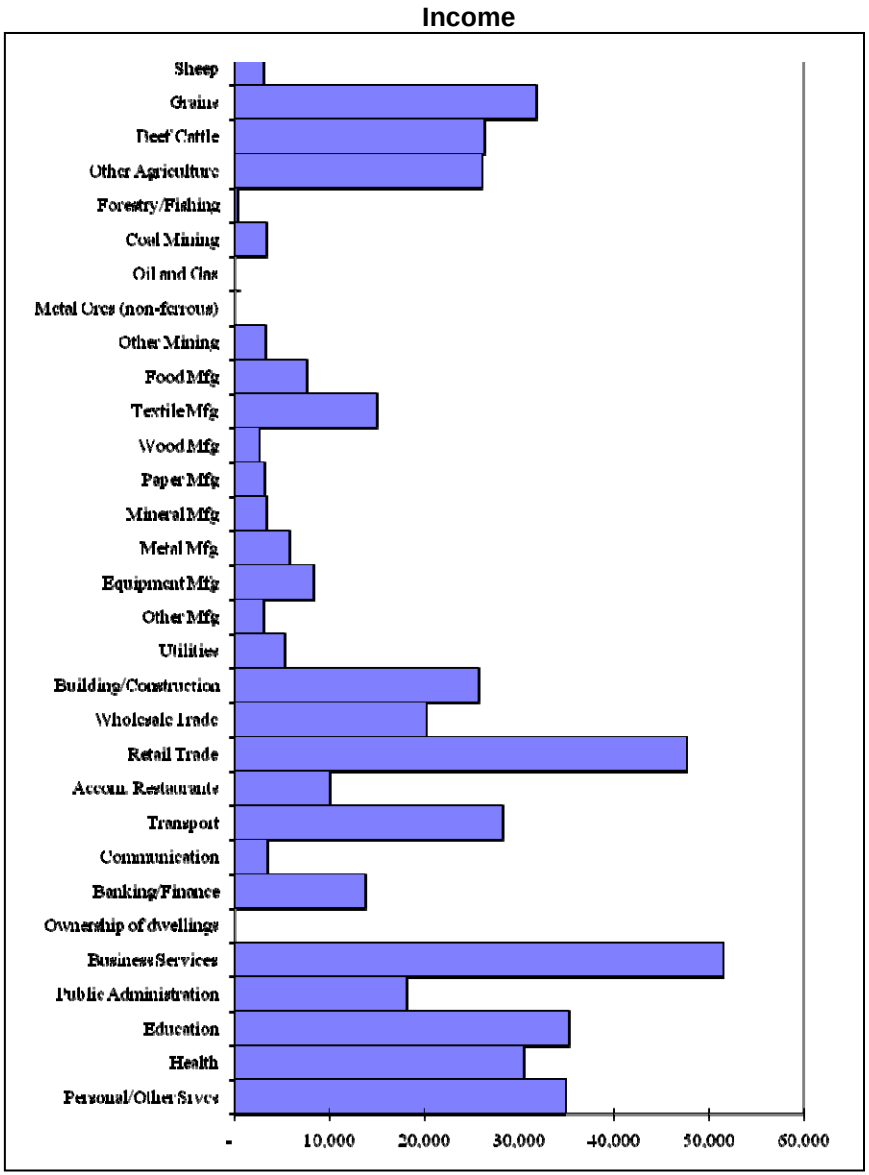


Figure 3.4 Sectoral Distribution of Gross Regional Income ($'000) and Employment (No.)



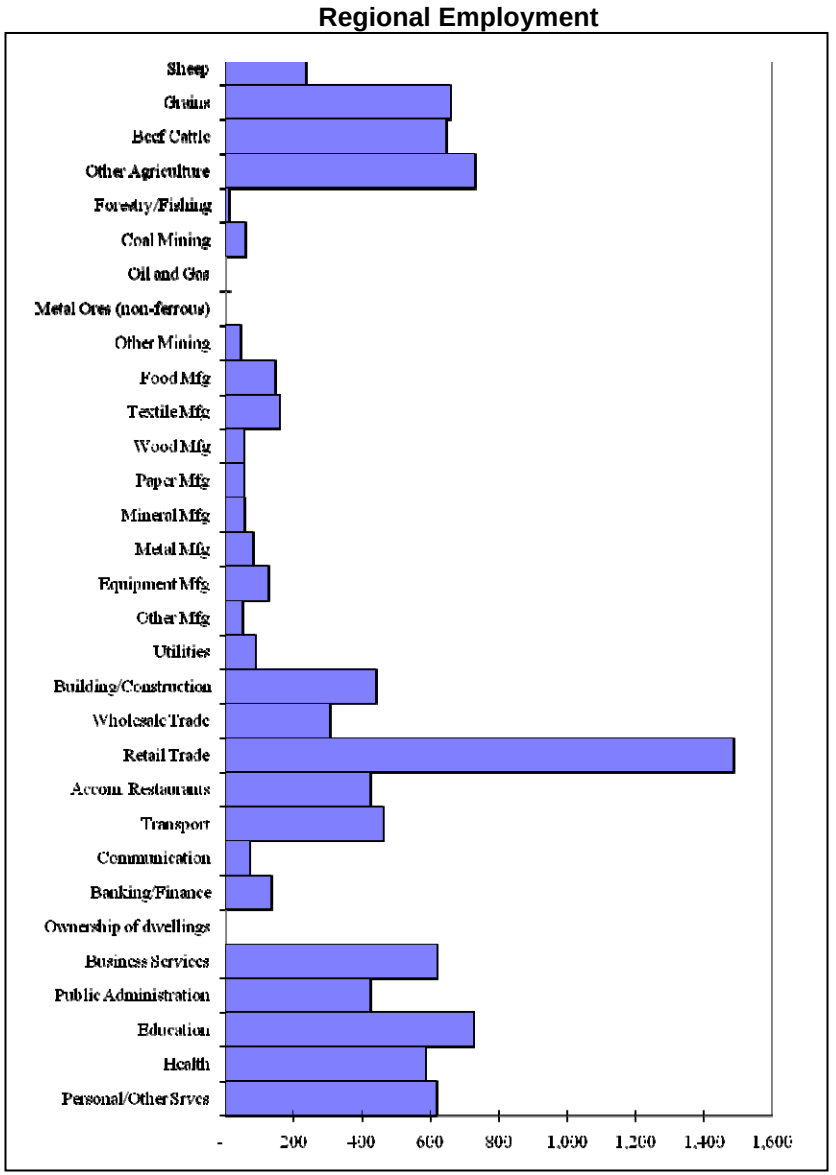
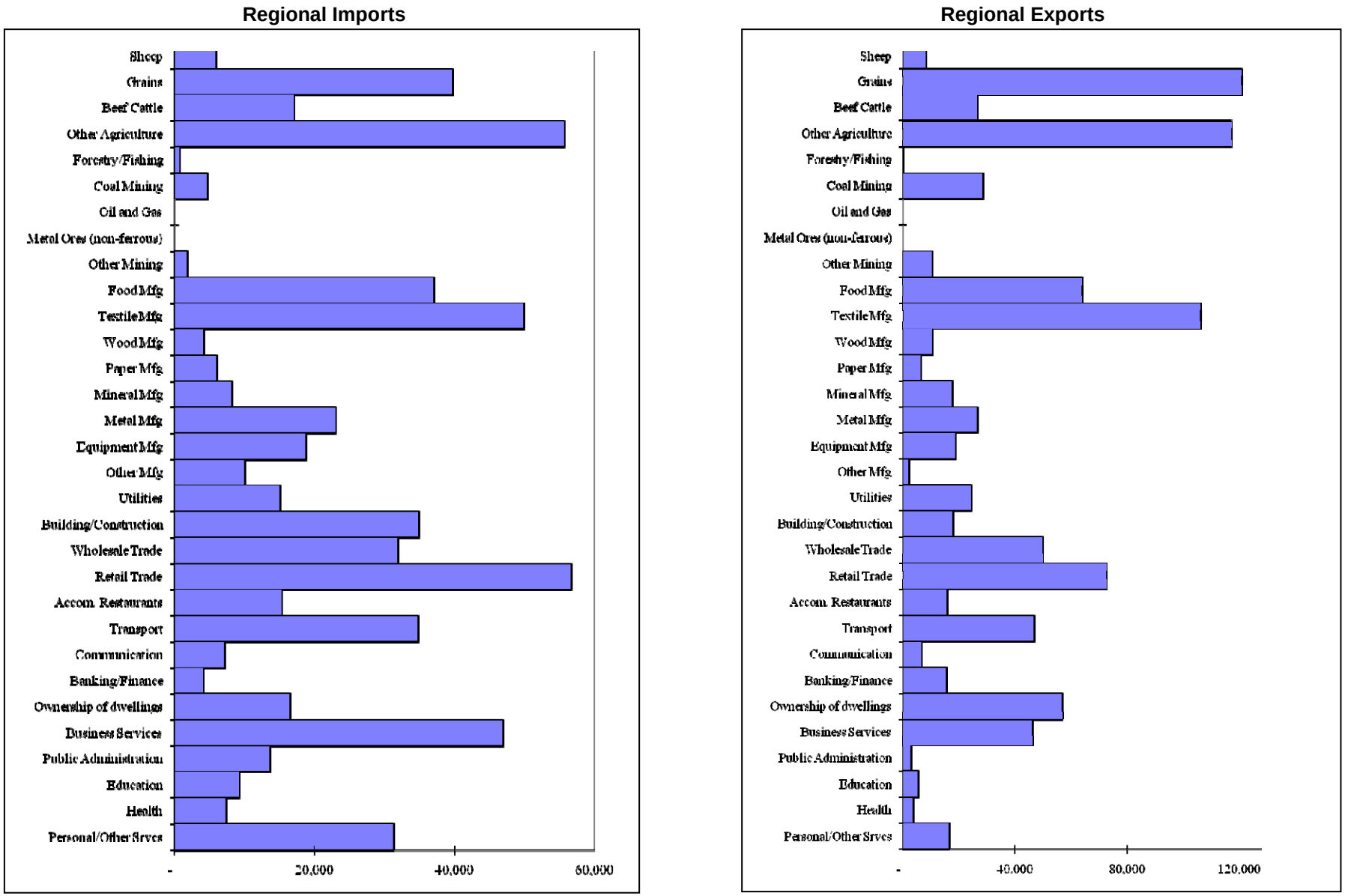


Figure 3.5 Sectoral Distribution of Imports and Exports ($'000)



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.

3.3.1 Construction

Introduction

Economic activity associated with the Project construction is estimated to 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;
- 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 Regional Economy

Given the largely specialist nature of the capital equipment and the relatively small size of the Narrabri and Gunnedah 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*.

It is estimated by TCPL that the construction workforce for the peak construction period would occur in the first year of the Project, with a workforce of up to approximately 20. Other construction/ development phases would be required during the life of the Project, however, these would generally be of short duration and would only result in a workforce slightly above operational employment levels (Section 3.3.2).

Based on the input-output coefficients of the combined *other construction sector* and *construction trade services sector* in the Narrabri/Gunnedah region transactions table (indexed to 2011), in the order of $5M of the capital costs during construction would need to be spent in the combined *other construction sector* and *construction trade services* sector within the region to result in a workforce of 20 people. The direct and indirect regional economic impact of this level of expenditure in the regional economy is reported in Table 3.2.

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 ($'000)	5,019	2,107	997	3,104	8,122
Type 11A Ratio	*1.00*	*0.42*	*0.20*	*0.62*	*1.62*
VALUE ADDED ($'000)	2,041	860	479	1,339	3,380
Type 11A Ratio	*1.00*	*0.42*	*0.24*	*0.66*	*1.66*
INCOME ($'000)	1,381	544	316	860	2,241
Type 11A Ratio	*1.00*	*0.39*	*0.23*	*0.62*	*1.62*
EMPL. (No.)	20	8	6	14	34
Type 11A Ratio	*1.00*	*0.39*	*0.29*	*0.68*	*1.68*

Note: Totals may have minor discrepancies due to rounding.

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 currently 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.

From Table 3.2 it is estimated that the construction of the Project would result in impacts on the regional economy of:

- $8.1M in annual direct and indirect output;
- $3.4M in annual direct and indirect regional value added;
- $2.2M in annual direct and indirect household income; and
- 34 direct and indirect jobs.

Multipliers

Multipliers are summary measures used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry (ABS, 1995). There are many types of multipliers that can be generated from input-output analysis (refer to Attachment C). 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 adjusted Type 11A ratio multipliers for the construction phase of the Project range from 1.62 for output up to 1.68 for employment.

Main Sectors Affected

The input-output analysis indicates that flow-on impacts from the construction of the Project are likely to affect a number of different sectors of the 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 $5M 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 of a 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 ($'000)	5,019	4,605	5,304	9,909	14,927
Type 11A Ratio	*1.00*	*0.92*	*1.06*	*1.97*	*2.97*
VALUE ADDED ($'000)	2,005	1,929	2,700	4,629	6,634
Type 11A Ratio	*1.00*	*0.96*	*1.35*	*2.31*	*3.31*
INCOME ($'000)	1,608	1,425	1,538	2,963	4,572
Type 11A Ratio	*1.00*	*0.89*	*0.96*	*1.84*	*2.84*
EMPL. (No.)	20	15	20	35	55
Type 11A Ratio	*1.00*	*0.75*	*1.00*	*1.75*	*2.75*

Note: Totals may have minor discrepancies due to rounding.

Based on the above approach, expenditure in the *other construction* sector and *construction trade services* sector during construction of the Project would result in impacts on the NSW economy of:

- $14.9M in annual direct and indirect output;
- $6.6M in annual direct and indirect regional value added;
- $4.6M in annual direct and indirect household income; and
- 55 direct and indirect jobs.

The above estimated peak impacts on the NSW economy are likely to be very conservative because expenditures in NSW may not be limited to expenditures in the *other construction* sector and *construction trade services* sector. The 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 regional economy.

3.3.2 Operations

Impact on the Regional Economy

Introduction

The main regional economic impact of the Project is associated with the extension of the life of the Tarrawonga Coal Mine and the increase in mine workforce. Two phases of incremental regional economic impacts can be distinguished:

- incremental impacts associated with the expanded mining activities and increased workforce in Years 1 (2013) to 5 (2017), compared to the existing levels; and
- incremental impacts associated with the extension of the Tarrawonga Coal Mine life (albeit at higher production and workforce levels) from Year 6 (2018) to Year 17 (2029) compared to decommissioning and cessation of operations.

This regional impact assessment examines the potential impacts of the extension of the life of the Tarrawonga Coal Mine. For the analysis of the Project, a Project sector was inserted into the input-output table. For this sector:

- the estimated gross annual revenue once the Project has ramped up was allocated to the o*utput* 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 local expenditure was initially allocated across the relevant *intermediate sectors* in the economy, *imports* and *other value-added* based on advice from TCPL;
- allocation was then further made between *intermediate sectors* in the local economy and *imports* based on regional location quotients;
- purchase prices for expenditure in the each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the National Input-Output Tables;
- the difference between total revenue and total costs was allocated to the *other value-added* row*;* and
- direct employment in the Project that resides in the region was allocated to the *employment* row.

Impacts

The total and disaggregated annual impacts of the average operation of the Project on the regional economy in terms of output, value-added, income and employment (in 2011 dollars) are shown in Table 3.4.

Table 3.4
Annual Regional Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	424,160	53,977	12,016	65,993	490,153
Type 11A Ratio	*1.00*	*0.13*	*0.03*	*0.16*	*1.16*
VALUE-ADDED ($'000)	217,512	22,561	5,774	28,335	245,847
Type 11A Ratio	*1.00*	*0.10*	*0.03*	*0.13*	*1.13*
INCOME ($'000)	12,232	10,972	3,809	14,781	27,013
Type 11A Ratio	*1.00*	*0.90*	*0.31*	*1.21*	*2.21*
EMPLOYMENT (No.)	106[1]	124	70	194	300
Type 11A Ratio	*1.00*	*1.17*	*0.67*	*1.83*	*2.83*

Note: Totals may have minor discrepancies due to rounding.

[1] While the Project would provide 120 direct jobs, only 106 are assumed to reside inside the region (i.e. Narrabri and Gunnedah Local Government Areas [LGAs]) based on existing distribution of employees.

In total, the Project is estimated to make the following contribution to the regional economy (Table 3.4):

- $490M in annual direct and indirect regional output or business turnover;
- $246M in annual direct and indirect regional value-added;
- $27M in annual household income; and
- 300 direct and indirect jobs.

Multipliers

The Type 11A ratio multipliers for the Project range from 1.13 for value-added up to 2.83 for employment.

Capital intensive industries tend to have a high level of linkages 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 relatively high ratio multipliers for employment. A lower ratio multiplier for income (compared to employment) also generally occurs 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 value-added, reflecting the relatively high direct value-added for the Project compared to that in flow-on sectors. The low output ratio multiplier largely reflects the high direct output value of the Project compared to the sectors that experience flow-on effects from the Project.

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	1	1
Mining	106[1]	6	0	112
Manufacturing	0	12	2	14
Utilities	0	1	1	2
Wholesale/Retail	0	23	18	41
Accommodation, cafes, restaurants	0	1	10	11
Building/Construction	0	4	0	4
Transport	0	4	3	7
Services	0	72	35	107
Total	**106**	**124**	**70**	**300**

Note: Totals may have minor discrepancies due to rounding.

[1] While the Project would provide 120 direct jobs, only 106 are assumed to reside inside the region (i.e. Narrabri and Gunnedah LGAs) based on existing distribution of employees.

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 State economic impacts of the Project operation were assessed in the same manner as for estimation of the regional impacts. A new Project sector was inserted into a 2011 NSW input-output table in the same manner described in Section 3.3.1. The primary difference from the Project sector identified for the regional economy was that all employment was assumed to reside in NSW and a greater level of expenditure would therefore be captured by the NSW economy compared to the regional economy.

Impacts

The total and disaggregated average annual impacts of the Project on the NSW economy in terms of output, value-added, income and employment (in 2011 dollars) are shown in Table 3.6.

Table 3.6
Annual State Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	424,160	305,552	170,833	476,384	900,545
Type 11A Ratio	*1.00*	*0.72*	*0.40*	*1.12*	*2.12*
VALUE-ADDED ($'000)	214,292	141,106	87,015	228,121	442,413
Type 11A Ratio	*1.00*	*0.66*	*0.41*	*1.07*	*2.07*
INCOME ($'000)	13,900	83,599	49,796	133,395	147,295
Type 11A Ratio	*1.00*	*6.01*	*3.58*	*9.60*	*10.60*
EMPLOYMENT (No.)	120	966	686	1,652	1,772
Type 11A Ratio	*1.00*	*8.05*	*5.72*	*13.76*	*14.76*

Note: Totals may have minor discrepancies due to rounding.

In total, the Project is estimated to make the following contribution to the NSW economy (Table 3.6):

- $901M in annual direct and indirect output or business turnover;
- $442M in annual direct and indirect value-added;
- $147M in annual household income; and
- 1,772 direct and indirect jobs.

The estimated Project contributions to the NSW economy are substantially greater than for the regional economy, as the NSW economy is able to capture more Project and household expenditure, and there is a greater level of intersectoral linkages in the larger NSW economy.

3.4 PROJECT CESSATION

The establishment and operation of the Project would stimulate demand in the regional and NSW economy 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 15 km north-east of Boggabri and 42 km north-northwest of Gunnedah in NSW. Approximately 34% of the current (86) employees live in the Narrabri LGA (21% in Boggabri and 13% in Narrabri), while 54% live in the Gunnedah LGA. The remaining 12% live outside of the Narrabri and Gunnedah 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 TCPL, the ABS Census (ABS, 2006), 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.

4.2 REGIONAL PROFILE

Population

In 2006, Narrabri LGA had a population of 13,118 and Gunnedah LGA had a population of 11,552, representing approximately 0.20% and 0.18% of the NSW population, respectively (Table 4.1).

Table 4.1
Narrabri, Gunnedah, Northern SD and NSW Population and Growth Rates - 2001 to 2006

Region	Total Population		Population Change	
	2001	2006	People	%
Narrabri LGA	13,932	13,118	-814	-5.8%
Gunnedah LGA	12,090	11,522	-568	-4.7%
Northern SD	173,452	172,397	-1,055	-0.6%
NSW	6,326,579	6,549,177	222,598	3.5%

Source: ABS (2006) (usual place of residence).

The populations of Narrabri and Gunnedah LGAs, and the Northern Statistical Division (SD) within which these LGAs are located, declined between 2001 and 2006 (Table 4.1), illustrating the trend of depopulation of many inland rural areas in NSW.

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 38 and 40, respectively compared to 37 for NSW.

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

Proportion of Total Population	Narrabri			Gunnedah			Northern			NSW		
	1996	2001	2006	1996	2001	2006	1996	2001	2006	1996	2001	2006
Aged 14 years and younger	24%	24%	23%	25%	24%	22%	24%	23%	22%	21%	21%	20%
Aged 15 years to 44 years	42%	41%	37%	40%	37%	34%	41%	39%	37%	45%	43%	42%
Aged 45 years to 64 years	22%	23%	26%	22%	24%	27%	22%	24%	26%	21%	23%	25%
Aged 65 years and over	11%	12%	14%	13%	15%	17%	13%	14%	16%	13%	13%	14%

Source: ABS (2006) Time Series Profile (usual place of residence).

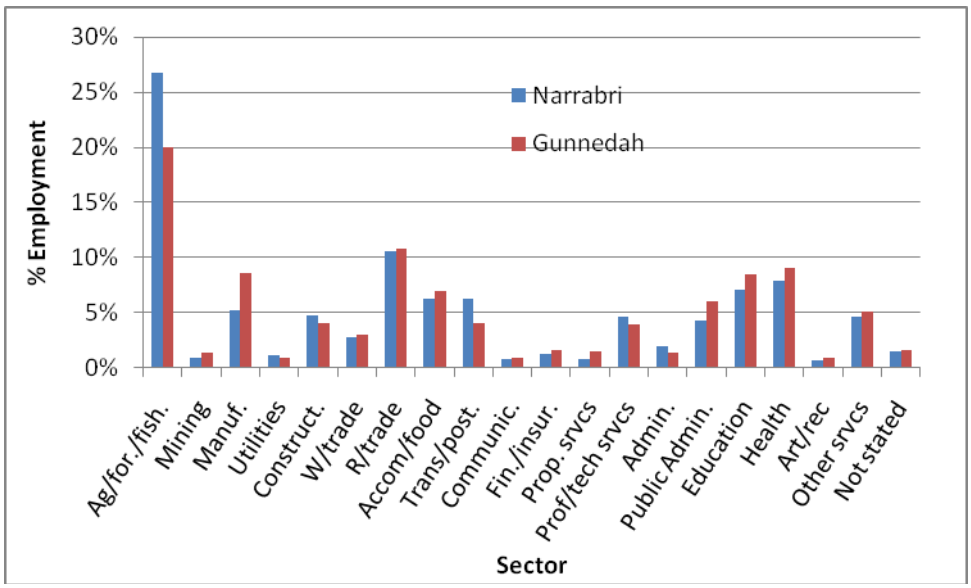
Note: Total percentages may not add to 100% due to rounding.

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



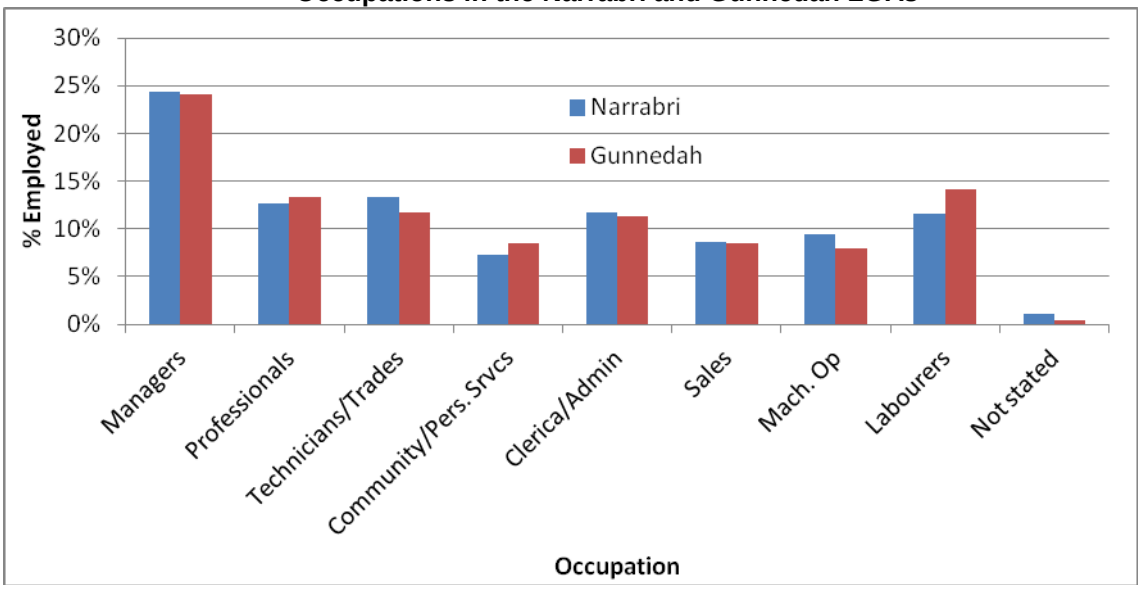
Source: ABS (2006) Place of Employment Profile.

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 18% and 25% lower than that for NSW, respectively. The median individual income and median family income of Gunnedah LGA residents is 23% and 31% lower than that for NSW, respectively (ABS, 2006). Average individual taxable income in 2008 in the Narrabri and Gunnedah LGAs was $35,348 and $38,339, respectively, compared to $34,443 and $45,439 for the Northern SD and NSW, respectively (ABS, 2009a).

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 March 2011 quarter is reported as 408 people (5.2%) for Narrabri LGA and 392 (6.1%) for Gunnedah LGA (Commonwealth Department of Education, Employment and Workplace Relations, 2011).

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%**	-	-	-

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

Housing

In 2006 there were approximately 5,039 private occupied dwellings in the Narrabri LGA and 4,513 in the Gunnedah LGA, about 0.20% 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 88% and 90% respectively, compared with approximately 70% for NSW) and a lower proportion of townhouses/units/flats/apartments (approximately 9% and 8% respectively, compared with 29% in NSW) (Table 4.4).

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

Housing Stock	Narrabri LGA			Gunnedah LGA			Northern SD			NSW
	1996	2001	2006	1996	2001	2006	1996	2001	2006	2006
Total Private Dwellings	5,119	5,190	5,039	4,652	4,510	4,513	63,990	65,471	66,698	2,470,452
% Separate Houses	84%	86%	88%	86%	88%	90%	87%	88%	88%	70%
% Townhouse, Flat, Unit, Apartment	10%	9%	9%	9%	9%	8%	9%	9%	9%	29%
% Other	4%	4%	3%	2%	2%	2%	3%	2%	2%	1%
% Not Stated	2%	1%	0%	2%	1%	0%	1%	1%	0%	0%

Source: ABS (2006) Time Series Profile.
Note: Percentages may not add to 100% due to rounding.

At the 2006 Census, there were 781 unoccupied dwellings in the Narrabri LGA and 500 unoccupied dwellings in the Gunnedah LGA (Table 4.5).

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

Housing Stock	Narrabri (2006)			Gunnedah (2006)		
	Occupied Dwelling	Unoccupied dwelling	Total Dwelling	Occupied Dwelling	Unoccupied dwelling	Total Dwelling
Separate house	4,429	650	5,079	4,069	437	4,506
Semi-detached, row or terrace house, townhouse	27	3	30	41	4	45
Flat, unit or apartment	447	113	560	321	53	374
Other dwelling	130	15	145	72	6	78
Dwelling structure not stated	7	0	7	11	0	11
Total	**5,040**	**781**	**5,821**	**4,514**	**500**	**5,014**

Source: ABS (2006) Census Time Series Profile.

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 70% and 80%, 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) (March Quarter 2011)

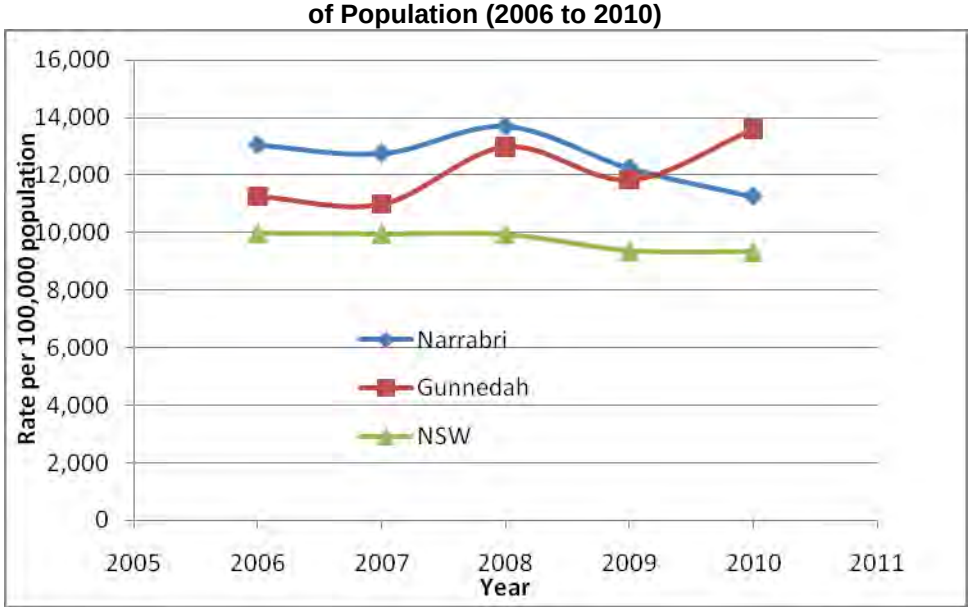
Short Stay Tourism Accommodation	Narrabri	Gunnedah
Establishments	8	6
Rooms	200	138
Beds	635	382
Guest Nights	20,371	10,495
Room Occupancy Rates	79.0%	74.7%
Bed Occupancy Rate	35.6%	30.5%
Accommodation Gross Takings ($)	$1,281,663	$287,896

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

Crime and Safety

NSW Bureau of Crime Statistics and Research (2011) 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). It should be noted that the population of the Narrabri and Gunnedah LGAs is much less than 100,000 people (Table 4.1).

Figure 4.3
Narrabri LGA, Gunnedah LGA and NSW Incidence of Crime per 100,000 Head of Population (2006 to 2010)



Source: NSW Bureau of Crime Statistics and Research (2011).

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	Gunnedah	NSW
17 Major Offences[1]	5,974	7,721	5,342
Other Homicide	0	0	1
Other Assault	73	49	33
Abduction and Kidnapping	0	25	4
Blackmail and Extortion	0	0	2
Harassment, Threatening Behaviour and Private Nuisance	526	888	405
Other Offences against the Person	7	41	19
Other Theft	635	748	571
Arson	51	132	82
Drug Offences	351	822	501
Prohibited and Regulated Weapons Offences	183	156	108
Disorderly Conduct	1,300	880	362
Betting and Gaming Offences	0	0	3
Liquor Offences	613	230	243
Pornography Offences	0	8	3
Prostitution Offences	0	33	4
Against Justice Procedures	927	1,250	669
Transport Regulatory Offences	15	8	756
Other Offences	606	608	215
Total	**11,261**	**13,600**	**9,322**

Source: NSW Bureau of Crime Statistics and Research (2011).

[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 64% and 63% of primary school enrolments and 92% and 60% of secondary school enrolments in 2006, respectively (Table 4.8).

Table 4.8
Education in the Narrabri and Gunnedah LGAs

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

Source: ABS (2006) Time Series Profile, usual place of residence.
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 a generally increasing proportion of enrolments being 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 is currently undergoing 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

	Narrabri		Gunnedah		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 (2009b).
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[8], 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.

[8] 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

It is estimated by TCPL that the construction workforce for the peak construction period would occur in the first year of the Project (i.e. 2013), with a workforce of up to approximately 20. Other construction/development phases would be required during the life of the Project, however, these would generally be of short duration and would result in a workforce only slightly above operational employment levels (Section 4.3.3).

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 20 people to the region. Assuming that they are spread between Narrabri, Boggabri and Gunnedah in the same proportions as the existing operational workforce 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		Direct Construction Effects		Indirect Construction Effects		Total Construction Effects
		Construction Workforce	Direct Population	Construction Workforce	Indirect Population	Total Population
Narrabri LGA	**34%**	**8**	**8**	**5**	**14**	**22**
Narrabri	*13%*	*3*	*3*	*2*	*5*	*8*
Boggabri	*21%*	*5*	*5*	*3*	*8*	*13*
Gunnedah LGA	**54%**	**12**	**12**	**9**	**21**	**33**
Region Sub-total	**88%**	**20**	**20**	**14**	**35**	**55**
Other	**12%**					
Total	**100%**					

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 eight jobs (associated with production-induced flow-ons) and up to six 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 35. 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. Notwithstanding, for the purposes of this assessment, it has conservatively been assumed that all of the flow-on employment would be filled by non-locals.

4.3.3 Operation

Direct Workforce and Population Change

The Project would last for approximately 17 years and require an additional workforce of some 34 employees, bringing the total operational workforce at the Project to 120.

The operational labour force for the Project includes a mix of professionals, managers, administration, trades, plant/equipment operators, labourers and road transport operators. However, it is likely most of the additional 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, if all of the operational labour force 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, then the Project operations 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	**34%**	**12**	**29**	**21**	**53**	**82**
Narrabri	*13%*	*4*	*11*	*8*	*20*	*31*
Boggabri	*21%*	*7*	*18*	*13*	*33*	*51*
Gunnedah LGA	**54%**	**18**	**46**	**34**	**84**	**130**
Region Sub-total	**88%**	**30**	**75**	**55**	**137**	**212**
Other	**12%**	**4**	**10**			
Total	**100%**	**34**	**85**			

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 approximately 75 people.

Indirect Workforce and Population Change

For every direct job generated where the person resides in the region there would be 1.83 flow-on jobs to the region (1.17 associated with production induced flow-ons and 0.67 associated with consumption induced effects) (Section 3.3.2). The Project would result in an additional 30 direct operational jobs where the person resides in the region and therefore it is estimated that 55 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 137 (Table 4.11).

4.3.4 Cumulative Workforce and Population Change

There are a number of major projects that are proposed in the Narrabri and Gunnedah LGAs. The potential interactions between the Project and these other major projects are described in Attachment 3 of the EA.

To enable some consideration of the potential cumulative impacts of the Project it is necessary to consider the potential incremental employment and population impacts associated with the relevant major project proposals. The Continuation of the Boggabri Coal Mine and the Maules Creek Coal Project are considered of particular relevance to this cumulative assessment. Figure 4.4 shows the predicted incremental employee numbers (i.e. above existing employee numbers) for the Project, the Continuation of the Boggabri Coal Mine and the Maules Creek Coal Project.

Figure 4.4
Cumulative Incremental Employment for the
Project, Continuation of the Boggabri Coal Mine and Maules Creek Coal Project

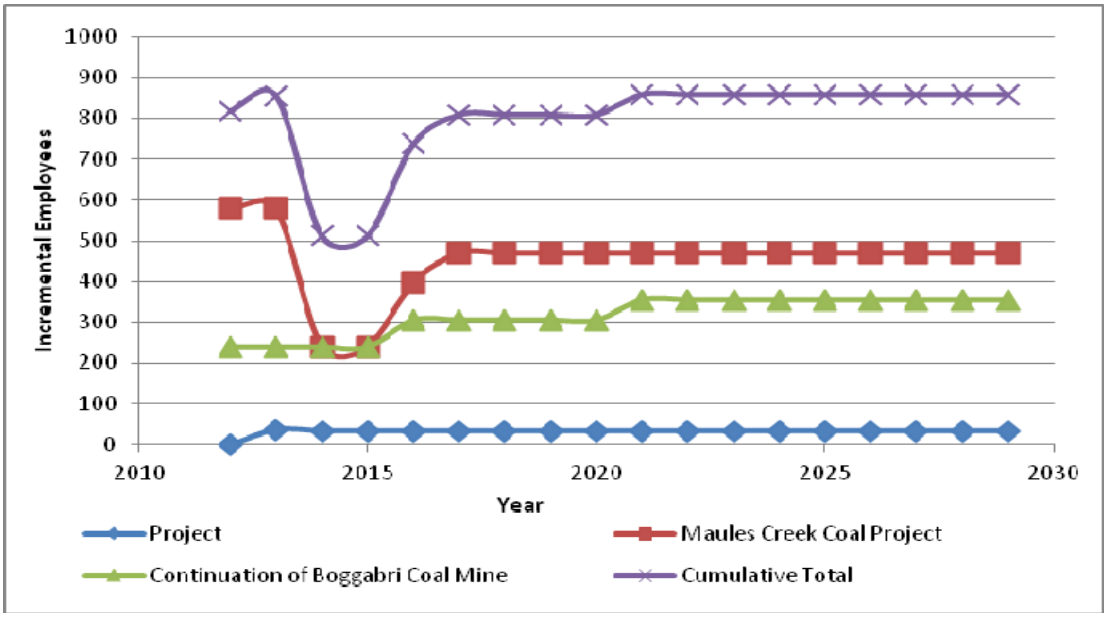


Table 4.12 summarises the key direct incremental employment associated with the three proposed operations during the Project peak construction (i.e. Year 1 or 2013) and an operational stage representative of the greatest cumulative impact (i.e. Year 9 or 2021). Total workforce numbers in Table 4.12 have been adjusted for local hires and non-local hires that would reside outside the region.

Table 4.12
Cumulative Incremental Direct Non-Local Workforce for the
Project, Continuation of the Boggabri Coal Mine and Maules Creek Project

	2013 (Non-local Hires)		2021[1] (Non-local Hires)
Proposal	**Construction**	**Operation**	**Operation**
Project	20	15	30
Continuation of the Boggabri Coal Mine	60	45	181
Maules Creek Coal Project	272	191	376
Total	**352**	**252**	**587**

Source: Hansen Bailey (2010, 2011).
Note: Only includes assumed non-local workforce that is assumed to relocate into the region.
Totals may have minor discrepancies due to rounding.
[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

Using the same assumptions identified above for the Project and the workforce location assumptions identified in the *Continuation of the Boggabri Coal Mine Social Impact Assessment* (Hansen Bailey, 2010) and the *Maules Creek Coal Project Social Impact Assessment* (Hansen Bailey, 2011), the maximum cumulative direct employment and population change is estimated in Table 4.13.

Table 4.13
Cumulative Direct Construction and Operation Workforce and Population Change for the Project, Continuation of the Boggabri Coal Mine and Maules Creek Project

Location	2013				2021[1]	
	Construction		Operation		Operation	
	Workforce	Population	Workforce	Population	Workforce	Population
Narrabri LGA	**319**	**319**	**160**	**399**	**374**	**934**
Narrabri	36	36	132	331	311	777
Boggabri	11	11	27	68	63	157
Boggabri Construction Village	272	272				
Gunnedah LGA	**30**	**30**	**80**	**200**	**185**	**464**
Other – not specified	**3**	**3**	**12**	**30**	**28**	**70**
Region Total	**352**	**352**	**252**	**629**	**587**	**1,467**

Source: Hansen Bailey (2010, 2011).

Note: Totals may have minor discrepancies due to rounding.

[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

Additional indirect effects would also occur as a result of production-induced and consumption-induced flow-ons from the Continuation of the Boggabri Coal Mine and the Maules Creek Coal Project. These indirect effects for the Continuation of the Boggabri Coal Mine and the Maules Creek Coal Project have been estimated using the assumptions outlined in *Continuation of the Boggabri Coal Mine Social Impact Assessment* (Hansen Bailey, 2010) and the *Maules Creek Coal Project Social Impact Assessment* (Hansen Bailey, 2011)[9]. The estimated cumulative indirect employment and population change is presented in Table 4.14. For the purposes of this assessment, it has conservatively been assumed that all of the flow-on employment would be filled by non-locals.

Table 4.14
Cumulative Indirect Workforce and Population Change for the Project, Continuation of the Boggabri Coal Mine and Maules Creek Project

Location	2013				2021[1]	
	Construction		Operation		Operation	
	Workforce	Population	Workforce	Population	Workforce	Population
Narrabri LGA	**391**	**685**	**203**	**508**	**453**	**1,133**
Narrabri	325	568	167	418	374	935
Boggabri	66	116	36	90	80	199
Gunnedah LGA	**196**	**343**	**106**	**264**	**233**	**583**
Other – not specified	**29**	**51**	**15**	**37**	**33**	**83**
Region Total	**616**	**1,078**	**324**	**810**	**720**	**1,799**

Source: Hansen Bailey (2010, 2011).

Note: Totals may have minor discrepancies due to rounding.

[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

[9] No construction multipliers were available for the Maules Creek Coal Project and Boggabri Coal Mine and hence those estimated for the Project were extrapolated to these Projects.

Table 4.15 summarises the total (i.e. direct and indirect) cumulative population change.

Table 4.15
Cumulative Total Population Change
for the Project, Continuation of the Boggabri Coal Mine and Maules Creek Project

Location	2013			2021[1]		
	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**

Note: Totals may have minor discrepancies due to rounding.
[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

The cumulative direct and indirect population impacts identified in Table 4.15 should be considered an upper level estimate as they are underpinned by the inherent assumptions of multipliers (Attachment D).

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 4.16 it is evident that for both the Narrabri LGA and the Gunnedah LGA, the additional maximum direct and indirect population during construction and operation of the Project would help to partially offset historic population decline. The maximum population change associated with construction activities would offset 4% of the 2001 to 2006 population decline in the Narrabri and Gunnedah LGAs. The maximum population change associated with Project operation would offset 15% of the 2001 to 2006 population decline in the Narrabri and Gunnedah LGAs (Table 4.16).

Table 4.16
Maximum Project (Direct and Indirect) Population
in Context of Annual Population Growth

Location	Intercensal Population Decline 2001- 2006	Total Project (Direct and Indirect) Population			
		2013	% of Intercensal Decline 2001-2006	2021[1]	% of Intercensal Decline 2001-2006
Narrabri LGA	-814	22	3%	82	10%
Gunnedah LGA	-568	33	6%	130	23%
Total	**-1382**	**55**	**4%**	**212**	**15%**

Note: Totals may have minor discrepancies due to rounding.
[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

The total population change associated with cumulative projects is estimated at up to 2,869 during 2013 and up to 3,267 during 2021. The cumulative total population increase during 2013 and 2021 are both greater than the intercensal population decline across the Narrabri and Gunnedah LGAs (Table 4.17).

Table 4.17
Maximum Cumulative Population Impact in Context of Annual Population Growth

Location	Intercensal Population Decline 2001- 2006	2013		2021[1]	
		Cumulative Total Population Increase	% of Intercensal Decline 2001-2006	Cumulative Total Population Increase	% of Intercensal Decline 2001-2006
Narrabri LGA	-814	1,911	235%	**2,068**	254%
Gunnedah LGA	-568	838	148%	**1,046**	184%
Other – not specified		**120**		**153**	
Total	**-1382**	**2,869**	208%	**3,267**	236%

Note: Totals may have minor discrepancies due to rounding.
[1] 2021 (Year 9 of the Project) is when the greatest cumulative impact would occur.

4.4.2 Impacts of Construction – 2013

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 onsite 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 potential cumulative direct construction workforce associated with the Project and the other mining projects would result in the demand for up to 352 accommodation units (e.g. houses, units, hotels, etc.). The Project construction workforce would require approximately 20 accommodation units (or 6% of the total cumulative direct demand).

There is considerable short-term accommodation in Narrabri (over 635 beds in 15 or more room accommodation alone) and Gunnedah (over 382 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 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 – 2021

Housing Impacts

The Project and the other mining projects would result in the direct and indirect demand for up to 1,307 accommodation units (e.g. houses, units, etc.) in 2021 (when the greatest cumulative impact would occur) (Table 4.18). During operation of the Project, additional direct and indirect demand is likely to be generated for up to 33 residences in Narrabri LGA and 52 residences in Gunnedah LGA (Table 4.18). The Project contribution represents 6% of the total cumulative direct and indirect demand. While initially, short-term accommodation may house these new families, the demand would be for longer-term rental accommodation or housing purchases.

Table 4.18
Demand for Accommodation[1]

Location	Project Direct and Indirect Demand for Accommodation	Cumulative Direct and Indirect Demand for Accommodation	Average Annual Building Approvals - Total Dwellings (2005-2009)[2]	Total Housing Stock (2006)	Occupied Rental Properties (2006)[1]	Unoccupied Residential Properties (2006)
Narrabri LGA	33	827	32	5,821	1,452	781
Gunnedah LGA	52	419	42	5,014	1,217	500
Other not specified		61				
Total	85	1,307	74	10,835	2,669	1,281

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 largely insignificant 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 4.18). While the Project on its own is unlikely to have any significant housing impacts, combined with a range of other proposed mining projects in the region, new demand for housing in the region is likely to be significant (Table 4.18).

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 maximum 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.

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 4.19 summarises the likely demand for pre-school, infants/primary and high school places.

Table 4.19
Demand for Schooling

	Narrabri			Gunnedah		
School Type	**Direct**	**Indirect**	**Total**	**Direct**	**Indirect**	**Total**
Pre-school	3	5	8	4	8	12
Infants/Primary	4	7	10	6	12	18
High school	3	5	8	5	9	13
Total	**9**	**17**	**27**	**15**	**28**	**43**

Note: Totals may have minor discrepancies due to rounding.

These demands can be compared to the enrolments at the last Census and growth/decline in enrolments between 2001 and 2006 across the region (Table 4.8). In this context, the direct and indirect increase in demand for educational facilities is considerably less than the decline in demand between 2001 and 2006. The exception is demand for preschool in Narrabri where demand increased between 2001 and 2006, and the Project would add to this growing demand.

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 36% of infants/primary students in Narrabri attend non-government schools while in Gunnedah, 37% of infants/primary school students and 40% 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 very 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 (Table 4.15) 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 4.1 the maximum direct and indirect increase in population from the Project is very small, and would contribute to arresting a general population decline. 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.

However, 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 Governments 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.

4.5 MITIGATION AND MANAGEMENT STRATEGIES

From Section 4.4 it is evident that the community infrastructure impacts of the Project, alone, are likely to be negligible. However, it is recognised that a range of prospective projects may have cumulative impacts on the region with respect to:

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

TCPL 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 the current donations policy which supports education, health and community causes.
- Employ local residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation.
- Purchase local non-labour inputs to production preferentially where local producers can be cost and quality competitive.
- Include 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 TCPL.

5 CONCLUSION

A BCA of the Project indicated that it would have net benefits of $1,116M, comprising net production benefit in the order of $1,138M and net externality costs of $22M.

The BCA has included all costs and benefits that occur from the mining process that takes place in Australia. However, the costs and benefits of the Project may potentially be distributed among a number of different stakeholder groups at the local, State, National and global level. Consideration of these distributional issues is important for two reasons. Firstly, BCA is generally undertaken from a national perspective and hence excludes costs and benefits that accrue outside the National border. Nevertheless, the costs and benefits that accrue outside the National boundary and distribution of costs and benefits within the National border may be of interest to decision-makers.

The net production benefit is distributed amongst a range of stakeholders including:

- TCPL and its shareholders, some of which would accrue at a global level;
- the NSW Government via royalties;
- the Commonwealth Government in the form of Company tax; and
- the local community in the form of contributions to community infrastructure.

The proposed Mineral Resource Rent Tax (if introduced) would not change the net production benefit of the Project but would redistribute some of the net production benefit from TCPL and its shareholders to the Commonwealth Government.

The externalities costs 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 TCPL.

Noise and dust costs occur at a local level, but have already been incorporated into the estimation of net production benefits via acquisition costs for nearby affected properties. Similarly, surface water and groundwater effects would occur at the local level, but have been incorporated into the analysis via inclusion of purchase costs for relevant licences. Greenhouse gas costs occur at the National and global level and may potentially be internalised in the future through payment of a carbon tax once the Commonwealth Government's proposed carbon tax scheme is implemented. The externality costs associated with the clearing of native vegetation would occur at the State or National level and would be counterbalanced by the offset actions proposed by TCPL. Other potential environmental externalities would largely occur at the State or Local level and were found to be minor or negligible. External benefits associated with employment provided by the Project would largely accrue at the Local or State level.

Overall the Project is estimated to have net benefits of $790M from an Australian perspective. Consequently, the Project is desirable and justified from an economic efficiency perspective.

An economic impact analysis, using input-output analysis, estimated that the Project would contribute the following to the Narrabri and Gunnedah economy:

- 490M in annual direct and indirect regional output or business turnover;
- $246M in annual direct and indirect regional value-added;
- $27M in annual direct and indirect household income; and
- 300 direct and indirect jobs.

At the State level the Project would make the following contribution to the economy:

- $901M in annual direct and indirect output or business turnover;
- $442M in annual direct and indirect value-added;
- $147M in annual direct and indirect household income; and
- 1,772 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.

The peak construction period of the Project would last for approximately 12 months and require a workforce of around 20 people. The maximum direct and indirect population associated with this was estimated at 55. Operations at the Project would last for 17 years and require a direct incremental workforce of 34. The maximum direct and indirect population associated with this was estimated at 212.

These maximum potential influxes in population are small in the context of existing populations of the Narrabri and Gunnedah LGAs and only a small proportion of the decline in population between 2001 and 2006. The Project alone is therefore considered likely to have negligible impacts on housing, schools, health or community infrastructure. However, it is recognised that all prospective projects in the region may have cumulative impacts with respect to:

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

TCPL 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 is 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 after 17 years of 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.

Given these uncertainties 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 brings to the region, to strengthen and broaden the region's economic base.

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ATTACHMENT A – 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).

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 2008, the price of carbon credits under the European Union Emissions Trading Scheme were around Pounds (£) 24/t CO_2, the equivalent of about US$38/t CO_2 while spot prices in the Chicago Climate Exchange were in the order of US$3.95/t CO_2.

As of July 2008 the spot price under the New South Wales Government Greenhouse Gas Reduction Scheme was Australian Dollars (AUD) $7.25/t CO_2. Prices under the Commonwealth Governments Greenhouse Friendly Voluntary Scheme were AUD$8.30/t CO_2 and Australian Emissions Trading Unit (in advance of the Australian Governments Emissions Trading Scheme) was priced at AUD$21/t CO_2-e (Next Generation Energy Solutions, pers. comms., 24 July 2008).

A National Emissions Trading Scheme is foreshadowed in Australia by 2010. While the ultimate design and hence liabilities under the scheme are still a work in progress, the National Emissions Trading Taskforce cited a carbon permit price of around AUD$35/t CO_2.

The *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future* (Commonwealth of Australia, 2008) cited a carbon permit price of AUD$23/t CO_2-e in 2010 and AUD$35/t CO_2-e in 2020 (in 2005) dollars for a 5% reduction in carbon pollution below 2000 levels by 2020.

Given the above information and the great uncertainty around damage cost estimates, 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 the Socio-Economic Assessment, with a conservatively high central value of AUD$30/t CO_2-e.

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ATTACHMENT B – BCA SENSITIVITY TESTING

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

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$1,569	$1,116	$811
INCREASE 20%			
Opportunity cost of land	$1,567	$1,114	$809
Opportunity cost of capital equipment	$1,566	$1,114	$809
Capital costs	$1,549	$1,097	$793
Operating costs	$1,201	$852	$617
Gravel value	$1,570	$1,116	$811
Coal value	$2,283	$1,630	$1,189
Decommissioning and rehabilitation	$1,568	$1,115	$810
Avoided decommissioning costs	$1,569	$1,116	$811
Residual value of land and capital equipment	$1,570	$1,116	$811
Timber value	$1,569	$1,116	$811
Groundwater	$1,569	$1,116	$811
Surface water	$1,569	$1,116	$811
Leard State Forest recreation	$1,569	$1,116	$811
Employment benefits	$1,577	$1,124	$818
GREENHOUSE COSTS @ $40/TONNE (T)	$1,542	$1,095	$795

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$1,569	$1,116	$811
DECREASE 20%			
Opportunity cost of land	$1,571	$1,118	$813
Opportunity cost of capital	$1,572	$1,118	$812
Capital costs	$1,589	$1,134	$828
Operating costs	$1,937	$1,380	$1,004
Gravel value	$1,568	$1,115	$810
Coal value	$855	$602	$432
Decommissioning and rehabilitation	$1,570	$1,117	$811
Avoided decommissioning costs	$1,569	$1,116	$810
Residual value of land and capital equipment	$1,568	$1,115	$810
Timber value	$1,569	$1,116	$811
Groundwater	$1,569	$1,116	$811
Surface water	$1,569	$1,116	$811
Leard State Forest recreation	$1,569	$1,116	$811
EMPLOYMENT BENEFITS EXCLUDED	$1,528	$1,076	$772
GREENHOUSE COSTS @ $8/T	$1,628	$1,160	$845

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

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$1,100	$790	$581
INCREASE 20%			
Opportunity cost of land	$1,098	$788	$580
Opportunity cost of capital equipment	$1,098	$788	$580
Capital costs	$1,088	$779	$571
Operating costs	$886	$636	$468
Gravel value	$1,100	$790	$581
Coal value	$1,574	$1,131	$832
Decommissioning and rehabilitation	$1,099	$789	$580
Avoided decommissioning costs	$1,100	$790	$581
Residual value of land and capital equipment	$1,100	$790	$581
Timber value	$1,100	$790	$581
Groundwater	$1,100	$789	$581
Surface water	$1,099	$789	$581
Leard State Forest recreation	$1,100	$790	$581
Employment benefits	$1,108	$797	$588
GREENHOUSE COSTS @ $40/TONNE (T)	$1,099	$789	$581

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$1,100	$790	$581
DECREASE 20%			
Opportunity cost of land	$1,101	$791	$582
Opportunity cost of capital	$1,101	$791	$582
Capital costs	$1,111	$800	$591
Operating costs	$1,314	$943	$693
Gravel value	$1,099	$789	$580
Coal value	$625	$448	$329
Decommissioning and rehabilitation	$1,100	$790	$581
Avoided decommissioning costs	$1,099	$789	$581
Residual value of land and capital equipment	$1,099	$789	$580
Timber value	$1,100	$790	$581
Groundwater	$1,100	$790	$581
Surface water	$1,100	$790	$581
Leard State Forest recreation	$1,100	$790	$581
EMPLOYMENT BENEFITS EXCLUDED	$1,059	$750	$542
GREENHOUSE COSTS @ $8/T	$1,100	$790	$581

ATTACHMENT C – 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 non-ferrous metals and building and construction sectors. 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. It also means that the method should be used by an analyst who is familiar with the economy being modelled, or at least someone with that familiarity should be consulted.

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). That 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 GC-1 (Powell and Chalmers, 1995).

Table C-1
The GRIT Method

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

Source: Bayne and West (1988).

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ATTACHMENT D – BACKGROUND TO MULTIPLIERS

The calculation of multipliers from the input-output table is based on the following underlying assumptions:

- "there is a fixed input structure in each industry, described by fixed technological coefficients....;
- 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.....; 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." (Australian Bureau of Statistics [ABS], 1995).

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

Multipliers indicate the total impact of changes in demand for the output of any one industry on all industries in an economy (ABS, 1995). Conventional output, employment, value added and income multipliers show the output, employment, value added and income responses to an initial output stimulus (Jensen and West, 1986).

Components of the conventional output multiplier are as follows:

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

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

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

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

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

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

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

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

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

A description of the different ratio multipliers is given below.

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

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

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

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

Source: Centre for Farm Planning and Land Management, 1989.

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