APPENDIX J

Economic Impact Assessment

Wallarah 2 Coal Project
Economic Impact Assessment

Prepared for

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By

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EXECUTIVE SUMMARY

The Wallarah 2 Coal Project (the Project) involves an investment of some $1.5 billion in the construction and operation of an underground mining operation, extracting up to 5.0 million tonnes per annum of export quality thermal coal. The mine will provide direct employment for 300 people and estimated royalties to the state government of $200M, present value.

This Economic Impact Assessment for the Project has been prepared as part of an Amendment to Development Application SSD-4974 being prepared by Hansen Bailey to support an application for State Significant Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project.

Specifically, the Economic Impact Assessment provides:

- A cost benefit analysis (CBA) which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest;

- A local effects analysis (LEA) using a new methodology introduced by the NSW Department of Planning and Environment in December 2015, to assess some of the impacts of the Project in the locality, specifically:

    - net employment to existing residents;
    - non-labour project expenditure; and
    - environmental and social impacts on the local community.

- A supplementary LEA, using traditional input-output (IO) analysis to assess the broader economic activity project footprint in relation to output, value-added, income and employment.

Cost Benefit Analysis

A CBA of the Project indicated that it would have net production benefits to NSW of $275M (present value at 7% discount rate). Provided the residual environmental, social and cultural impacts of the Project that accrue to NSW are considered to be valued at less than $275M, the Project can be considered to provide an improvement in economic efficiency and relative to the 'without Project' scenario, is justified on economic grounds.

Adverse residual environmental, social and cultural impacts of the Project have been minimised through project design and mitigation, offsetting and compensation measures. The cost of implementing these measures have already been incorporated into the estimate of net production benefits, including the cost of using land and water resources, subsidence impacts, flooding impacts, noise mitigation and acquisition costs in accordance with the Voluntary Land Acquisition and Management Policy (NSW Government, 2014), provision of biodiversity offsets and the cost of intersection upgrades and maintenance. Expert technical investigations indicate no material impacts are envisaged in relation to air quality, Aboriginal heritage, public infrastructure or loss of surplus to other industries. Impacts that were quantified included forestry, agriculture, surface water and greenhouse gas generation, however these are minor compared to the estimated net production benefits of the Project.

There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $211M (present value at 7% discount rate). Overall, the Project is estimated to have net social benefits to NSW of $274M to $485M (present value at 7% discount rate) and hence relative to the 'without Project' scenario, is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $274M to $485M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The key driver of the net social benefits to NSW are the royalties generated. These are a function of Project revenue and are unaffected by assumptions about land opportunity costs, development costs, operating costs, mitigation, offset and compensation costs or effective company tax rates.

The relative magnitude of royalties and unmitigated environmental, cultural and social impacts indicates that even with large changes to the assumed coal price, the net production benefits of the Project to NSW would still outweigh the residual impacts of the Project.

Local Effects Analysis

While the Project will provide direct employment for 300 people, the net impact on local employment will depend on prevailing levels of unemployment and the scope for in-migration of labour. One scenario, sought under the LEA, assumes full regional employment and no in-migration of labour. With current unemployment in the region at 6.6%, and significant movement of labour witnessed in relation to similar projects, these are very restrictive assumptions that will serve to understate actual project employment benefits to the local area.

Nevertheless, the impact of the project under these assumptions is reported in Table ES1, while the impacts under less constraining assumptions are reported in a supplementary LEA below.

Based on the constraining assumptions of the LEA, the Project is estimated to contribute between 79 and 134 net direct full-time equivalent mining jobs to existing residents and direct net regional income to existing residents of between $7.6M and $12.8M per annum.

Table ES1 - Summary of Local Effects

	Project Direct	**Project Direct: Local**	**Net Effect to Existing Residents**	**Total Net Effect (with multiplier)**
Scenario 1				
Employment	300	210	110	312
Net income (M)			$10.6	$18.2
Scenario 2				
Employment	300	150	79	224
Net income (M)			$7.6	$13.1
Scenario 3				
Employment	300	255	134	381
Net income (M)			$12.8	$22.02
Net non-labour expenditure (M)	$65 Mpa			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	Not applicable			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact ($M)**		
Contributions	Local Aboriginal people and community	$5		
Forestry impacts	NSW Forests but compensated	$0		
Agricultural impacts	Impacted farmers but compensated	$0		
Surface water and local water supply	Local surface water users but compensated via purchase of WALs and provision of water back into the catchment	$1		
Subsidence impacts	Local landholders	Compensation via MSL		
Flooding	Local landholders	Mitigation measures included in capital and		

		operating costs
Groundwater	Local groundwater users	If WALs purchased off landholders then they are compensated. If from controlled allocation then no impact.
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Noise impacts	Adjoining landholders	Three properties moderately impacted but mitigation measures included in capital costs
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts
Historic heritage impacts	Local and NSW households	Accounted for through Mine Subsidence Levy
Transport and traffic	Local residents	No material impacts. Costs of mitigation measures included in capital and operating costs
Visual amenity	Adjoining landholders	Minor impacts. Costs of mitigation included in operating costs
Greenhouse gas impacts	Local and NSW households	$0
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts

With multiplier effects included, the annual regional impact for 28 years is estimated at:

- $13M to $22M in direct and indirect household income; and
- 224 to 381 direct and indirect jobs.

Supplementary Local Effects Analysis

The supplementary LEA, using IO analysis, relaxes the restrictive assumptions of the LEA and allows for divergence from full employment, job chains effects and in-migration of labour to the region.

Using this approach it is estimated that the Project would make up to the following annual incremental contribution to the regional economy[1] for up to 28 years:

- $593M in annual direct and indirect regional output or business turnover;
- $342M in annual direct and indirect regional value-added;
- $69M in annual direct and indirect household income; and
- 853 direct and indirect jobs.

The actual regional impact of the Project operation is likely to lie between that assessed in the LEA and the Supplementary LEA.

Additional regional economic activity would be generated during the construction phase of the Project via expenditure of the construction workforce and purchase of equipment.

[1] The Local Government Areas of Wyong, Gosford and Lake Macquarie.

1 INTRODUCTION

1.1 Introduction

Gillespie Economics has been engaged by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Wyong Areas Coal Joint Venture (WACJV) to complete an Economic Impact Assessment for the Wallarah 2 Coal Project (the Project). The purpose of the Economic Impact Assessment is to form part of an Amendment to Development Application SSD-4974 (Amendment Document) being prepared by Hansen Bailey to support an application for State Significant Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project.

1.2 Legislative Context and Guidelines

This Economic Impact Assessment has been carried out in accordance with:

- the Director-General's Requirements (DGRs) for the Project that relate to economics i.e:
  - 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; and
  - potential direct and indirect economic benefits of the project for local and regional communities and the state; and
  - a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the project including any infrastructure improvements, or contributions and/or voluntary planning agreement or similar mechanisms.
- Clause 7(1)(f) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* which requires environmental impact statements to provide "the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations…" Note to Clause 7 (1) (f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- Section 79C of the EP&A Act which requires the following two matters to be taken into consideration by the consent authority in determining a development application:
  - the public interest (taken as the collective public interest of households in NSW); and
  - the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- the following standards, guidelines and policies:
  - NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*; and
  - NSW Treasury (2007) *NSW Government Guidelines for Economic Appraisal*.[2]

[2] Refer to Attachment 1 for the legislative context for economic methods in Environmental Impact Assessment (EIA) in NSW.

To meet the above requirements two types of analysis are needed:

- a cost benefit analysis (CBA) which is the primary way that economists evaluate the net benefits of projects and policies, provide economic justification for a project and address the public interest;

- a local effects analysis (LEA) to assess the impacts of the Project in the locality, specifically:

    - effects relating to local employment;
    - effects relating to non-labour project expenditure; and
    - environmental and social impacts on the local community.[3]

Economic analysis tools such as CBA and LEA are not mechanised decision-making tools, but rather a means of analysis that provides useful information for decision-makers to consider alongside the performance of a project in meeting other government goals and objectives.

1.3 Report Outline

Section 2 outlines the scope of the Project, a summary of the impacts of the Project and the proposed mitigation measures, as described and assessed in the EIS and Amendment Document[4]. This is the information on which the Economic Impact Assessment is based. Section 3 provides an overview of the CBA and LEA approach used in this study. Section 4 and 5 document the CBA and LEA of the Project, respectively. Section 6 provides a supplementary LEA. Conclusions are provided in Section 7.

[3] Refer to Attachment 2 for an introduction to economic methods.
[4] The reader should refer to the EIS and Amendment Document for more detailed qualitative consideration of the scope of the project, project impacts and mitigation measures.

2 PROJECT DESCRIPTION

2.1 Project Description

Key features of the Project include:

- The construction and operation of an underground mining operation extracting up to 5.0 Mtpa of export quality thermal coal by longwall methods at a depth of between 350 m and 690 m below the surface within the underground Extraction Area;
- Mining and related activities will occur 24 hours a day, 7 days a week for a Project duration of 28 years;
- The Tooheys Road Site (located northeast of the intersection of the M1 Motorway and the Motorway Link Road) includes a drift portal, coal handling facilities and stockpiles, water and gas management facilities, small office buildings, workshop, rail spur, train load out facility and connections to the municipal water and sewerage systems;
- The Buttonderry Site (located off Hue Hue Road, north of Sparks Road) includes administration offices, bathhouse, personnel access to the mine, ventilation shafts and water management structures;
- Western Shaft Site (located in the Wyong State Forest) includes a downcast ventilation shaft and water management structures;
- An inclined tunnel (or "drift") constructed from the coal seam beneath the Buttonderry Site to the surface at the Tooheys Road Site;
- Connections to the municipal water supply and sewerage systems;
- Capture of methane, initially for flaring (to manage greenhouse gas emissions) and later for beneficial use (such as for electricity generation at the Tooheys Road Site);
- Transport of coal by rail to the Port of Newcastle; and
- A workforce of approximately 300 full-time company employees.

2.2 Project Impacts and Mitigation Measures

This Section summarises the incremental environmental impacts of the Project based on the technical assessments undertaken for the EIS and the Amendment Document. This Section provides the basis for the economic consideration of impacts in latter parts of this report.

Built Environment and Subsidence

The depth of cover to the coal seam ranges from 345 m up to 690 m (in the elevated western areas).

As described in the EIS and Amendment Document, the key built features within the Project Boundary include:

- the M1 Motorway (formerly the F3 Freeway);
- the Main Northern Rail Line;
- two 330 kV transmission lines, and 29 associated towers;
- 245 residences overlying the underground workings;
- Jilliby Public School; and
- a large number of rural buildings, farm dams and swimming pools.

Generally, tilt and vertical subsidence are not expected to have material impacts within the Subsidence Impact Limit due to the relatively high depth of cover.

The Project has been designed to manage subsidence. The mine layout has been designed to avoid subsidence impacts on the major features such M1 Motorway, Main Northern Rail Line, Jilliby Public School and key water supply dams and infrastructure. WACJV has engaged in ongoing consultations with TransGrid regarding impacts to transmission lines and towers, and has agreed to bear the costs of any mitigation or management measures to reduce potential subsidence impacts.

All of the 245 residences within the Subsidence Impact Limit are located within either the Hue Hue Mine Subsidence District (MSD) or the Wyong MSD, which were proclaimed in 1985 and 1997, respectively. The MSDs are managed by the Mine Subsidence Board (MSB) under the *Mine Subsidence Compensation Act 1961* (MSC Act). The MSB is responsible for reducing the risk of mine subsidence damage to properties within MSDs by assessing the buildings and other improvements proposed to be erected in MSDs and applying particular building standards to them. All houses and other improvements built since the MSDs were proclaimed should therefore have been constructed to the building specifications set by the MSB to limit potential subsidence impacts on the structure. The Project has been designed to meet subsidence criteria for the two MSDs.

The MSB is also responsible for repair or compensation of damage to houses and other improvements as a result of mine subsidence. All landowners should be aware of the potential for underground mining, as MSDs are identified in Section 149 Certificates attached to contracts of sale whenever a residence or land is purchased. WACJV will be required to pay a mine subsidence levy to the MSB. This levy is deposited into a trust account and is used to fund repair works for subsidence related damage to properties.

Groundwater

The only significant groundwater aquifers within the Project Boundary are the alluvia of the Yarramalong and Dooralong Valleys and in the shallow weathered zone of the uppermost strata. The alluvial groundwater systems of the Yarramalong and Dooralong Valleys are characterised by low hydraulic conductivities and increasing salinity with depth. Both the alluvial and hard rock groundwater systems are classified as 'less productive' aquifers for the purposes of assessment against the *NSW Aquifer Interference Policy* (AIP).

For deep groundwater systems, the potential environmental impacts of underground mining are related to strata depressurisation (or 'drawdown') associated with drainage of the fractured subsidence zone above extracted longwall panels. Drawdown of a substantial degree could affect landowner access to water (via registered bores) and/or result in stream baseflow reductions.

For shallow groundwater systems, there are two key potential impacts of underground mining:

- connectivity between surface cracking and the fractured zones above the extracted longwall panels, which can lead to loss of surface flow directly into the mine workings; and
- added infiltration of surface water from cracking of stream beds and rock-bars as a result of tensile fractures and/or bedding shear associated with conventional subsidence or valley closure movements.

Connective Cracking

Due to the significant depths of the proposed underground workings, there is predicted to be a constrained zone (free of highly connected cracking) in the overburden. Therefore, there is not expected to be any connective cracking from the surface to the mine workings.

Surface Cracking

Subsidence has the potential to result in shallow surface cracking, including cracking of the bedrock beneath alluvial sediments. However, it is expected that fine sediment from the alluvium would substantially infill these cracks in the bedrock.

Drawdown
Notwithstanding the expected lack of connective cracking, the Groundwater Impact Assessment (GIA) predicts minor seepage as a result of groundwater depressurisation. The GIA estimates that seepage from the alluvial aquifers of the Yarramalong and Dooralong valleys would be approximately 0.02 ML/day (2 millilitres/m^2/day) and seepage from shallow hardrock areas would be approximately 0.04.ML/day (4 millilitres/m^2/day). In comparison, rainfall is predicted to average 130 millilitres/m^2/day. Consequently, rainfall recharge is expected to restore these minor losses of water through seepage.

The GIA predicts total groundwater inflow to the mine workings to be approximately 26,500 ML over the 28-year life of the Project.

As there is currently no Groundwater Water Sharing Plan under the *Water Management Act 2000* (WM Act) in place in this area, WACJV will be required to acquire appropriate licences for the extraction of groundwater under Part 5 of the *Water Act 1912*. However, there is not expected to be any significant impacts on registered groundwater users in the area, since the majority of groundwater inflow to the mine workings is sourced from the coal seam or the deep overburden strata within the fractured zone. Existing bores and wells would not be significantly affected due to the lack of connective cracking. Nevertheless, WACJV has committed to ongoing consultation with registered groundwater users, and restoration or replacement of water supply (if necessary).

Ongoing Groundwater Monitoring and Management
WACJV has committed to implementing a comprehensive groundwater monitoring program, including construction of at least 20 piezometers and 8 pore pressure transducers. This network of monitoring boreholes would be focused on the initial proposed longwall panels in the eastern extent of the Extraction Area. If it is determined from these initial bores that adverse impacts may occur in either the alluvial lands or the elevated western areas, WACJV proposes to adjust the mine plan to reduce subsidence effects to an acceptable level.

A Water Management Plan (WMP) will also be prepared in consultation with DPI Water and EPA, as part of the Extraction Plan process. The WMP must be prepared and approved prior to any longwall extraction of coal and include details about the proposed monitoring program and management measures.

Surface Water

The EIS and Amendment Document identify five key watercourses that are predicted to be affected by subsidence, including the Wyong River, Jilliby Jilliby Creek, Little Jilliby Jilliby Creek, Myrtle Creek and Armstrong Creek.

There are three key potential subsidence-related impacts on streams within the Subsidence Impact Limit:

- increased levels of ponding and scouring;
- changes to stream alignment; and
- fracturing of the bedrock and surface water flow diversions.

Ponding and Scouring
The key streams in the Subsidence Impact Limit, which meander through floodplains, are dynamic and experience natural processes of erosion and scouring during storm and flood events, which would indicate an ability to adapt to changed gradients and natural ponding.

Changes in Alignment
The key streams within the Subsidence Impact Limit naturally experience extensive changes in surface water flow depths and widths as a result of flooding events, which are likely to have greater consequences than any mining-induced tilts. Further, the meandering nature of the streams within their floodplains indicates that the stream beds are themselves dynamic.

Subsidence Impacts
The stream beds are directly underlain by deep alluvium (in the valleys) or the Patonga Claystone (in the forested hills), which is too weak to form rock-bars. There may be mining-induced fracturing of the bedrock beneath the alluvium, however these cracks would be quickly infilled with sediment and displaced groundwater. As discussed above, surface cracks are not expected to result in any loss of water to deeper aquifers due to the low permeability of the rock strata and the lack of connective cracking.

There are two Water Sharing Plans (the Jilliby Jilliby Creek Water Source WSP and Central Coast Unregulated Water Sources WSP) that apply to the surface water sources within the Project Boundary. WACJV would be required to acquire the appropriate water access licences under the WM Act for any surface water take. In other words, it would be required to operate, along with other surface water users in the area, in accordance with the sustainable water limits of the various Water Sharing Plans.

Subsidence has the potential to temporarily increase the storage capacity of the alluvium. The result is that greater volumes of water become stored in the alluvial aquifers, resulting in reduced runoff to streams. A maximum annual volume of 270 ML/year could potentially be taken (into temporary storage) from the Jilliby Jilliby Creek Water Source and 30 ML/year from the Central Coast Unregulated Water Source.

At a broader catchment level, the maximum annual water take represents less than 0.7% of the current system yield of 45,600 ML/year. DPI Water has identified that there are sufficient licences available for WACJV to purchase, including 88 transferable licences with 4,107 shares of unregulated river category licences in the Wyong Water Source and 26 transferable licences with 1,029 shares of unregulated river category licences in the Jilliby Jilliby Water Source.

Potable Water Requirements
WACJV has proposed a water treatment plant to treat all mine water generated by mining operations. The treated water will be used to satisfy operational water requirements wherever possible, thereby minimising the Project's reliance on external water supplies. However, the Project will require potable water from the municipal water supply for some applications. The requirement for external water peaks at 52 ML/year in Year 1 of the Project. The requirement for potable water ranges from 20 ML/year to 49 ML/day for the remainder of the Project duration.

Water Discharges

Treated water will be reused onsite for operational purposes wherever possible. It is predicted that there will be a surplus of treated water (i.e. more water than necessary for operational activities). In accordance with the recommendations of the PAC (2014), surplus treated water will be provided to the Central Coast water supply scheme to compensate for predicted impacts to catchment yield as a result of subsidence. Surplus treated water will be provided to the water supply scheme during the period of subsidence impacts to the alluvial aquifers. The remaining surplus treated water is proposed to be discharged to Wallarah Creek.

The discharges to Wallarah Creek are predicted to peak in Year 7. Depending on the climatic conditions in that year, the volume of discharge may range from 50 ML/year in a median rainfall year to more than 500 ML/year under very wet conditions. This represents an increase in the flow volumes in Wallarah Creek of approximately 2% in wet conditions and 3% in dry conditions. The quality of

treated mine water would be comparable to the background water quality of the receiving waters within Wallarah Creek. Discharges would be subject to quantity and quality limits implemented through an Environment Protection Licence (EPL) to be issued by the Environmental Protection Authority under the *Protection of the Environment Operations Act 1997*.

WACJV will prepare and implement a Surface Facilities Water Management Plan (SFWMP) in consultation with DPI Water and EPA, which includes details about the proposed monitoring and management measures.

Wallarah Creek does not form part of the Central Coast water supply scheme. The surface facilities are located outside of the drinking water catchment.

The water treatment plant will produce brine as a byproduct of the reverse osmosis process. In the first 14 years of the Project, the brine will be dewatered to produce a partly dried salt mixture. Approximately, 52,590 m^3 of salt will be produced during this period. The salt mixture will be stored in the underground sump. From Year 14 onwards, the brine will be stored within the goafs of completed longwall panels. The brine volumes requiring storage underground are predicted to range from approximately 18 ML/year to 25 ML/year. By storing the salt mixture and brine in the underground workings, the salts are essentially being returned to their place of origin.

The salt that is proposed to be stored underground will ultimately migrate towards the surface. The velocity of migration is predicted to be extremely slow, resulting in a travel time of more than 8,000 years before any increase in salinity might be observed near the surface. The salts would re-emerge at the outcrops of coal measures, which is already a natural source of upwelling saline groundwater.

The post-mining recovery of water levels and pore pressures is also predicted to be extremely slow. As a result, the underground mine is predicted to behave as a groundwater sink for at least 500 years after mining, which would inhibit the highly saline brine from migrating outwards from the mine workings. Due to the high density of the salt mixture and the very slow rate of groundwater recovery, the storage of brine and salt is not predicted to have any measurable impacts on water quality.

WACJV will prepare a Brine Treatment Management Plan, in consultation with EPA and DPI Water, as part of its Water Management Plan prior to construction of the surface facilities. The Brine Treatment Management Plan will provide further quantification of the volumes of salt and brine, and the proposed mitigation and management measures.

Forestry Production

The Project will result in up to 3.2 ha of clearing in the Wyong State Forest for the construction and operation of the Western Ventilation Shaft. WACJV has committed to a range of appropriate mitigation and management measures and calculated compensation arrangements, based on its consultations with the NSW Forestry Corporation.

Agricultural Production

The main agricultural land uses overlying the Extraction Area are turf farming, beef cattle grazing/breeding and equine breeding, training and agistment. The Agricultural Impact Statement (AIS) predicts that there would be potential subsidence impacts on one turf farm for up to 2 years (occurring no earlier than 22 years into the Project). However, the AIS considers that the subsidence impacts could be mitigated and/or remediated (after subsidence has settled) through re-levelling of the land, such that the farm could return to pre-mining conditions.

These impacts will be managed under the Extraction Plan and any required compensation to the affected farmer would be dealt with through either the requirements of consent, or the compensation provisions in the *Mining Act 1992*.

There may also be minor loss of agricultural value from the cleared land required for the surface facilities and the biodiversity offset areas.

Local Water Supply Scheme

The Project has been designed to minimise impacts to surface water and groundwater systems. Groundwater modelling has shown that effects on the alluvial groundwater system will be minor and transient. The Extraction Area of the Project covers only a small percentage of the entire combined Central Coast Water Supply (CCWS) catchment area.

Nevertheless, there will be some loss of water from the CCWS catchment area. Water in this catchment is managed under Water Sharing Plans (WSPs) and there is a market for shares of available water (transferable licences). The WACJV has purchased some of these shares and would have access to others sufficient to account for all of its impacts on water resources. In addition, to ensure no net impact on water availability in the catchment under all climatic conditions, WACJV will provide water to CCWS to offset the potential impacts on catchment yield. As explained above, there is expected to be a surplus of treated water in most years of the Project. The surplus treated water can be supplied to the water supply scheme.

Flooding

Subsidence has the potential to alter local aspects of topography within a floodplain by creating small ridges and swales, which in turn can alter local flood flow directions and speeds. However, more generally (i.e. across the whole floodplain), subsidence results in lower actual flood levels, as the same amount of water is carried across a lowered landscape. Even so, flood depths would increase within subsided areas, insofar as it now represents a 'pond' within the overall landscape.

The Flood Impact Assessment (FIA) predicts that flood behaviour in the Yarramalong Valley, would not change significantly as a result of subsidence. Only one residence would experience an increase in flood depth, which would be minor (0.17 m) and below the existing floor level of the dwelling. There would also not be any significant access interruptions due to flooding impacts in the Yarramalong Valley.

In the Dooralong Valley, the FIA predicts a number of changes to flood behaviours. Overall, an additional 33.2 ha of land is expected to be flooded during a 100 year ARI event, however, 4.9 ha of land would no longer be inundated, resulting in a net increase in inundation of approximately 28.3 ha.

Of the 88 structures located within the floodplains of the Yarramalong and Dooralong Valleys, 36 dwellings are expected to be beneficially affected and 33 are expected to be adversely affected. Four of the 33 adversely affected residences are not currently subject to flooding. An additional 15 roads and bridges are predicted to be affected by flood impacts, which would affect access to residences by increasing the period of inundation.

WACJV has committed to mitigation and management measures to prevent or reduce impacts to properties that are adversely affected by mining-induced flood impacts. These measures can include house raising, house relocation, flood proofing, compensation or acquisition.

The FIA has also identified measures to ensure that roads are altered to prevent adverse flood impacts include raising bridges, raising low sections of roads, and improving the hydraulic capacity of channels in some locations.

The proposed rail spur will require bridge and culvert crossings of Spring Creek (and its tributaries). These crossings will be located immediately downstream of the bridges for the Main Northern Rail Line. The proposed bridges for the rail spur will result in minor impediment of flows. Under a 1 in 100

year flood scenario, water levels are predicted to increase by 0.01 m and 0.03 m at the locations of the two proposed bridges. The increases in flood levels are less than the available freeboard, so the Project will not result in inundation of the Main Northern Rail Line during a 1 in 100 year flood event.

The Water Management Plan which must be prepared as part of any Extraction Plan, will include a program to monitor flooding (including updated flood modelling); minimise, manage and mitigate flood impacts on residences, private properties, roads and other infrastructure. If mitigation measures are not reasonable or feasible, the property owner will be appropriate compensated.

Air quality

The Project is an underground mine with minimal coal processing. As a result, the Project is unlikely to lead to any significant particulate emissions (as would be expected from an open cut mine). The primary sources of dust emissions would be from coal stockpiles, coal transfers by conveyor, coal loading and rail movements. WACJV has committed to a variety of management measures including fixed water sprays on all stockpiles, wind shielding of conveyors, belt cleaning and spillage minimisation, a variable height stack and a telescopic chute with water sprayers. WACJV has committed to augmenting the existing air quality monitoring network with a continuous monitor at a location representative of receivers that may experience short term elevated dust concentrations.

The Air Quality and Greenhouse Gas Assessment (AQGHGA) found that annual average dust deposition and concentrations of particulate matter (PM) would be within the relevant air quality criteria. There are occasionally days where background concentrations are higher than the criteria for 24-hr average PM concentrations. The Project will not result in any additional days where the cumulative PM concentration exceeds the criteria for 24-hr average PM concentrations.

Particulate emissions during construction are estimated to be less than emissions during operations. Given that air quality impacts during operations are predicted to be within the relevant criteria, the emissions during construction are also expected to comply with the relevant criteria. Emissions from rail haulage are also predicted to be below levels that are known to cause adverse impacts on amenity.

The AQGGA predicts that one privately-owned receiver in the vicinity of the Buttonderry Site is predicted to experience odour impacts above the most stringent assessment criterion of 2 odour units (OU). However, this criterion is the level that is considered to be acceptable for a whole population and an isolated and occasional level of 3 OU at one privately-owned receiver is not likely to cause any significant adverse impact, especially given that there is likely to be existing odours from WSC's nearby Buttonderry waste facility.

An assessment of health risks associated with the predicted air quality impacts, including risks of lung cancer, heart disease and other respiratory diseases calculated that the predicted statistical increases resulting from the Project would be negligible.

An Air Quality and Greenhouse Gas Management Plan (AQGGMP) will be prepared in consultation with EPA and NSW Health, which would ensure that best practice management measures are undertaken and that appropriate Trigger Action Response Plans (TARPs) are developed.

Noise and Vibration

Construction Noise and Vibration

Construction noise was assessed in accordance with the Interim Construction Noise Guideline (ICNG). The ICNG prescribes Construction Noise Management Levels (CNMLs) for Standard Hours and Work Outside Standard Hours. The noise model predicts exceedances of the CNMLs for Standard Hours at three private residences (P14, P15 and P16). The CNMLs for Work Outside Standard Hours are also predicted to be exceeded at these three residences, as well as at residence P13. Work Outside

Standard Hours will generally be kept to a minimum. These residences are located in the vicinity of the proposed rail spur. Private residences near other areas of the Tooheys Road Site and the Buttonderry Site are not expected to experience any exceedances of the CNMLs.

The mobile plant used during construction will generate ground vibration. The vibration levels generated by the Project are predicted to be within the criteria for structural damage and human comfort.

A Construction Noise and Vibration Management Plan will be developed to manage the predicted short term exceedances of the CNMLs.

Operational Noise
Operational noise was assessed in accordance with the Industrial Noise Policy. Noise levels that are 3-5 dBA above the Project Specific Noise Criteria (PSNC) are categorised as 'moderate' impacts. Three private residences (P14, P15 and P16) are predicted to experience moderate impacts. Moderate impacts will require acoustic treatment of the affected residences, but do not give rise to any acquisition requirements.

Noise levels that are up to 2 dBA above the PSNC are categorised as 'negligible' impacts. There are 67 lots in South Wyee that are predicted to experience negligible impacts. There is no management action required for negligible impacts. Noise levels at all other private residences in the vicinity of the Project are predicted to comply with the PSNC.

WACJV has adopted a number of noise controls to limit intermittent noise sources. As a result, the Project is not expected to result in any exceedances of the sleep disturbance criteria.

The additional train movements generated by the Project are predicted to increase the $L_{Aeq,\ 24\ hour}$ noise levels on the Main Northern Rail Line by up to 1.6 dBA. The criteria for $L_{Aeq,\ 24\ hour}$ (60 dBA) is predicted to be satisfied at distances of greater than 70 m from the rail line. The Project is not expected to increase the existing L_{Amax} noise levels.

Road Traffic Noise
Road traffic noise generated by the Project is predicted to be within the criteria for road traffic noise. Construction of the rail spur will occur in close proximity to residences P14 and P15 along Thompson Vale Road. To reduce the vehicle movements in the vicinity of these residences, construction personnel will be transported by bus to the site of the proposed rail spur. In addition, WACJV has committed to establishing a leading practice noise monitoring network surrounding the Tooheys Road and Buttonderry Sites, including real time noise monitors.

Ecology and Biodiversity

Terrestrial
The Ecological Impact Assessment (EIA) calculated that approximately 75.2 ha of vegetation (including 10.5 ha of Endangered Ecological Communities) would be directly impacted as a result of the Project. The affected vegetation consists of remnant and regenerating woodland communities and large areas of open grassland. This is a reduction in ecological impacts compared to the previous application described in the EIS.

To mitigate residual impacts to biodiversity values, an area of 259.8 ha is proposed to be conserved as ecological offsets. The offset areas contain 207.0 ha of existing native vegetation (including 82.8 ha of EEC).

Aquatic
There is potential for subsidence-related ponding as longwalls progress beneath the floodplains of the major watercourses. However, this is unlikely to have a significant additional impact on aquatic

species due to the existing variability in stream geomorphology and flows. Further, the project's mine plan provides for a significantly attenuated subsidence profile which mitigates this ponding risk.

WACJV has committed to ongoing monitoring to identify mining-related ponding events and the implementation of appropriate adaptive management measures, such as drainage or re-levelling.

A Biodiversity Management Plan will be prepared in consultation with OEH, which would ensure that adequate aquatic ecology monitoring would be undertaken and that appropriate Trigger Action Response Plans (TARPs) are developed.

Subsidence Impacts on GDEs and Threatened Frog Species
The EIA identified four potential Groundwater Dependent Ecosystems (GDEs) within the Subsidence Impact Limit, including 239.2 ha of Coachwood-Crabapple rainforest, 28 ha of Woollybutt-Paperbark sedge forest, 1.2 ha of *Phragmites australis* and *Typha orientalis* wetland and 0.7 ha of Swamp Mahogany forest. These are all listed as Endangered Ecological Communities (EECs). There are six threatened frog species that have the potential to occur within the Project Boundary.

It is likely that there would be temporary, localised changes to the water table levels, particularly in elevated areas where subsidence-induced tilts are predicted to be highest. However, it also considers that there would not be any significant impacts on GDEs, given the low permeability of the alluvial materials, the low reliance on the water table in elevated areas and the rapid recharge from rainfall.

A Water Management Plan will be prepared as part of an Extraction Plan which will consider potential impacts on GDEs and other riparian vegetation, and describe how the relevant performance criteria would be met. This Plan will be prepared in consultation with DPI Water and OEH, and approved by the Department of Planning and Environment prior to longwall mining.

Aboriginal Heritage

The Aboriginal Cultural Heritage Assessment (ACHA) identified a total of 11 sites of Aboriginal heritage significance, of which only one would be directly impacted by construction of the surface facilities and five may be subject to subsidence impacts.

The ACHA found that one open artefact scatter (WC-OS2) will be directly impacted by the Project. This artefact scatter is of low archaeological and aesthetic significance because the distribution, low density and nature of the items reflect a random scatter, rather than a concentrated site. Nevertheless, WACJV has committed to protecting this scatter as much as practicable through fencing and other management strategies. An Aboriginal Cultural Heritage Management Plan (ACHMP) will be prepared for approval prior to construction. In addition to the ACHMP, WACJV has committed to preparing a Land Disturbance Protocol, which would include appropriate induction information for employees and contractors involved in ground disturbing works.

Five axe grinding groove sites are located within the Subsidence Impact Limit. It is difficult to definitively predict the impacts of subsidence on Aboriginal heritage sites. However, the Subsidence Predictions and Impact Assessments found that it is unlikely that the five axe grinding groove sites would be affected by surface subsidence. A performance criterion requiring no greater than negligible subsidence impacts or environmental consequences on these sites is proposed. A Heritage Management Plan to address any potential subsidence impacts (as a component of the Extraction Plan), will be prepared in conjunction with OEH and local Aboriginal stakeholders, and approved prior to any longwall extraction of coal.

Historic Heritage

The Historic Heritage Assessment (HHA) identified 32 sites with potential historic heritage value. However, through ground-truthing, it found that nine of these had no heritage value. The HHA found

that none of 23 sites possessing historic heritage value will be directly impacted (i.e. through disturbance). Four items of local heritage significance are located within the Subsidence Impact Limit. A performance criterion requiring no greater than negligible loss of heritage value has been proposed. A Heritage Management Plan (as a component of the Extraction Plan) will be prepared prior to any longwall mining. The Heritage Management Plan will provide details of mitigation and management measures to ensure that such a criterion is met.

Traffic and Transport

The designs of the access points at the Tooheys Road Site, Buttonderry Site and Western Shaft Site have taken road safety into consideration.

The peak construction period (Year 2 of the Project) is expected to generate 600 two-way trips per day at the Tooheys Road Site and 300 two-way trips per day at the Buttonderry Site. The peak operational period (Year 12) is expected to generate 500 two-way trips per day at the Tooheys Road Site and 42 two-way trips per day at the Buttonderry Site.

The ability of each of the key intersections to cater for existing and future traffic forecasts was investigated using the SIDRA software modelling package. While there are various intersections that would not perform at acceptable levels during peak times, this is primarily due to overall peak traffic volumes. The contribution of the Project is very low, with a maximum of 4.6% during construction and 0.9% during operation.

There are a number of approved and proposed developments in the area surrounding the surface facilities sites, including the Woolworths Retail Facility, Wyong Employment Zone and Warner Industrial Park. These approvals and background growth rates will force many of the intersections in the area to perform or continue to perform at unacceptable levels in the future. The Project alone is not responsible for the predicted poor performance at these intersections, as the contribution of the Project to traffic volumes is minor.

A Traffic Management Plan will be prepared in consultation with RMS and WSC, including details about WACJV's contribution to mitigation measures for road network deficiencies.

Rail Transport

The main rail network to the coal export terminals at Newcastle is managed by ARTC, while the rail network from Wyong to Newcastle (Main Northern Rail Line) is managed by RailCorp. The Project would occur at the same time as the Northern Sydney Freight Corridor (NSFC) Stage 1 project, which aims to improve capacity and reliability for freight trains on the Main Northern Rail Line between Sydney and Newcastle.

The EIS and Amendment Document predict that the Project will require up to 4 train movements per day, which is within the line's capacity for a maximum of 6 trains per day. RailCorp (part of TfNSW) and ARTC have both been consulted over the Project and have no residual concerns.

Visual Amenity

Visual impacts of the Project can potentially arise from the Tooheys Road Site, the Buttonderry Site and Western Ventilation Shaft. The Visual Impact Assessment (VIA) concluded that the visual impacts associated with the Tooheys Road Site would be generally restricted to motorists on the M1 Motorway and Motorway Link Road, and commuters on the Main Northern Rail Line. Motorists and train commuters will be exposed to views of the Project for very short periods of time. Due to the short fleeting views, the visual impact rating for motorists and train commuters is 'Moderate'.

Two private residences would have limited views of the top of the coal stockpile. WACJV has committed to landscape mitigation measures around the perimeter zones of the site and additional measures at the two residences if requested by affected landowners.

The Buttonderry Site would not be visible from adjoining private properties due to screening provided by vegetation and topography. The Buttonderry Site may be visible from parts of the proposed Wyong Employment Zone (WEZ). However the visual character of the site would be light industrial, which is similar to the character of the WEZ.

The Western Ventilation Shaft is not predicted to give rise to any adverse visual impacts.

Greenhouse Gas Generation

The Greenhouse Gas (GHG) assessment calculates direct and indirect GHG emissions associated with the Project, including 'Scope 1' emissions (i.e. direct GHG emissions from sources controlled by WACJV), 'Scope 2' emissions (i.e. indirect emissions associated with the import of electricity for use by the Project) and 'Scope 3' emissions (i.e. other indirect emissions, such as those associated with the downstream combustion of the product coal). The assessment indicates that the vast majority (97.8%) of the total GHG emissions generated as a consequence of the Project are those associated with the downstream burning of the product coal for energy production purposes (Scope 3 indirect emissions). These are not relevant to a CBA of a mining project (NSW Government 2015b).

The predicted Scope 1 and Scope 2 GHG emissions over the Project life are shown in Table 2.1.

Table 2.1 -
Predicted Greenhouse Gas Emissions

Class of Emissions	Quantity of Emissions (t CO_2-e)
Scope 1	4,643,046
Scope 2	1,061,992

It must be noted that if the Project was not allowed to proceed, the resultant gap in the thermal coal supply would be almost certainly filled by another coal resource, sourced either from elsewhere in NSW, Australia or overseas. In other words, preventing GHG emissions from the Project would not result in any decrease in global CO_2 emissions. This point illustrates the reality that the key response to the issue of climate change needs to be made at a national and international policy or strategic planning level, rather than as part of a project assessment process in NSW.

The EIS and Amendment Document propose a number of GHG mitigation measures, including using low-sulphur diesel fuel for mobile equipment, installing energy efficient appliances (e.g. lighting and hot water) and undertaking enclosed flaring of mine drainage gas (i.e. methane). WACV has also committed to undertaking an options study for methane capture and utilisation within three years of the commencement of longwall mining.

WACJV will implement all reasonable and feasible measures to minimise the direct release of GHGs, and prepare an AQGGMP describing the measures to be implemented to minimise the release of GHG emissions.

Public Infrastructure

No additional public infrastructure will be utilised by the Project apart from road and rail requirements outlined above.

2.3 Other Mitigation Measures

WACJV proposes to work in partnership with local government and the local community to maximise the benefits and minimise the impacts of the Project as far as possible. In this respect, a range of general and specific economic impact mitigation and management measures are proposed and would include:

Potential Environmental, Cultural and Social Impacts

- A range of measures to mitigate, offset and compensate for potential environmental, cultural and social impacts of the Project, as summarised above and described in the EIS and Amendment Document.

Local employment, training and engagement

- WACJV will ensure that preference is given to local employees.
- WACJV will provide ongoing training and certification opportunities for local community members to ensure they have the necessary skills to work in mining.
- WACJV will actively engage with the local community and affected individuals and groups and address any complaints and feedback on mining operations.
- As part of a formal agreement with Guringai Tribal Link Aboriginal Corporation (Guringai) which also features training and education for local Indigenous youth and support for Indigenous businesses, the Project has committed to a 10% Indigenous employment target during operations.

Potential Business Impacts

- WACJV will use local or regional contractors and suppliers where this presents a cost effective and feasible option.

3 ECONOMIC ASSESSMENT METHODS

3.1 Introduction

The economic methods used to assess the Project and its impacts (as summarised in Section 2) are outlined below.

3.2 Cost Benefit Analysis

3.2.1 Background

Economic impact assessment (EIA) is primarily concerned with identifying changes in aggregate community welfare, associated with alternative resource use patterns. CBA is the standard technique applied to estimate these wealth changes.

CBA has its theoretical underpinnings in neoclassical welfare economics. CBA applications in NSW are guided by these theoretical foundations as well as NSW Treasury (2007). CBA applications within the NSW EIA framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals*.

CBA is concerned with a single objective of the EP&A Act and governments, i.e. economic efficiency. It provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These benefits and costs are defined and valued based on the microeconomic underpinnings of CBA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), a project is considered to improve the well-being of society and hence relative to the 'without Project' scenario is desirable from an economic efficiency perspective.

3.2.2 Definition of Society

CBA includes the consideration of costs and benefits to all members of society i.e. consumers, producers and the broader society as represented by the government.

The most inclusive definition of society includes all people, no matter where they live or to which government they owe allegiance too (Boardman et al. 2001). However, in practice most analysts define society at the national level based on the notion that the citizens of a country share a common constitution that sets out fundamental values and rules for making collective choices and that the citizens of other countries have their own constitutions that make them distinct societies (Boardman et al. 2001).

While most applications of CBA are performed at the national level, "to incorporate national distinctions in a CBA is far easier said than done. Thus many CBAs end up estimating the net benefits for global society, if only implicitly" (Bureau of Transport Economics 1999, p. 2).

With respect to the application of CBA in relation to coal mining and coal seam gas proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW. The DGRs for the Project also refer to the requirement to provide "a detailed assessment of the costs and benefits of the development **as a whole**, and whether it would result in a net benefit for the NSW community".

Consequently, the CBA is initially undertaken from a global perspective i.e. including all the costs and benefits of a project, no matter who they accrue to, and then truncated to assess whether there are net benefits to Australia and NSW.

3.2.3 Definition of the Project Scope

The definition of the project for which approval is being sought has important implications for the identification of the costs and benefits of a project. Even when a CBA is undertaken from a global perspective, and includes costs and benefits of a project that accrue outside the national border, only the costs and benefits associated with the defined project are relevant. For mining projects, typically only the costs and benefits from mining and delivery to port, are relevant.

Mine products are intermediate goods i.e. are inputs to other production processes such as steel manufacturing or electricity generation. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects (NSW Treasury, 2007). The definition of the Project, including its impacts and mitigation measures, is summarised in Section 2.

3.2.4 Net Production Benefits

CBA of mining projects invariably involves a trade-off between:

- The net production benefits of a project to society including royalties, company tax and net producer surplus and any economic benefits to existing landholders, workers, and suppliers; and
- The environmental, social and cultural impacts including net public infrastructure costs.

Net production benefits can be estimated based on market data on the projected financial[5] value of the resource less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of the proponent. This is normally based on commercial-in-confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

3.2.5 Environmental, Social and Cultural Impacts

The consideration of externality impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts. The EIA process results in detailed (non-monetary) consideration of the environmental, social and cultural impacts of a project and the proposed means of mitigating the impacts.

At its simplest level, CBA may summarise the consequences of the environmental, social and cultural impacts of a project (based on the assessments in the EIS), for people's well-being. These qualitatively described impacts can then be considered alongside the quantified net production benefits, providing important information to the decision-maker about the economic efficiency trade-offs involved with a project.

At the next level of analysis, attempts may be made to value some of the environmental, social and cultural impacts. These environmental, social and cultural impacts generally fall into three categories, those which:

- Can be readily identified, measured in physical terms and valued in monetary terms;
- Can be identified and measured in physical terms but cannot easily be valued in money terms; and
- Are known to exist but cannot be precisely identified, measured or valued (NSW Treasury, 2007).

Impacts in the first and second category can potentially be valued in monetary terms using benefit transfer or, subject to available resources, primary non-market valuation methods. Benefit transfer involves using information on the physical magnitude of impacts and applying per unit value estimates obtained from non-market valuation studies undertaken in other contexts.

[5] In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the resource.

Primary non-market valuation methods include choice modelling and the contingent valuation method where a sample of the community is surveyed to ascertain their willingness to pay to avoid a unit change in the level of a biophysical attribute. Other methods include the property valuation approach where changes in environmental quality may result in changes in property value.

In addition to biophysical externalities, payments to landholders or workers over and above their opportunity cost can represent an economic benefit to landholders and workers, respectively. Where this occurs it can be estimated using market data on payments to be made and opportunity costs.

Where a project imposes a cost on public infrastructure in excess of payments made for that infrastructure, there is an additional social cost for inclusion in CBA. These costs can potentially be estimated based on analysis of infrastructure costs and payments.

In attempting to value the impacts of a project on the well-being of people, there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government, 2012). NSW Government (2012) suggests that values that are less than 5% of the quantified net present value of a project are unlikely to be material. Where benefits and costs cannot be quantified, these items should be included in the analysis in a qualitative manner (NSW Treasury, 2007; NSW Government, 2015).

The principle of proportionality also applies to CBA, and so the scope of Economic Impact Assessment will need to be tailored to reflect the scale of a project.

3.2.6 Consideration of Net Social Benefits

The consideration of the net social benefits of a project combines the value estimate of net production benefits and the qualitative and quantitative estimates of the environmental, social and cultural impacts.

In combining these considerations, it should be noted that the estimates of net production benefits of a project generally includes accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. This includes the costs of purchasing properties adversely affected by noise and dust, providing mitigation measures for properties moderately impacted by noise and dust or experiencing visual impacts, the costs of providing ecological offsets, the cost of purchasing groundwater and surface water entitlements in the water market and the costs of public infrastructure impacts. Including these costs in the capital and operating costs of a project effectively internalises the respective and otherwise, non-monetary environmental, social and cultural costs of a project, because by including these costs, often larger social costs are minimised or avoided. To avoid double counting of impacts, only residual impacts, after mitigation, offset and compensation, require additional consideration.

Even when no quantitative valuation is undertaken of the environmental, social and cultural impacts of a project, the threshold value approach can be utilised to inform the decision-maker of the economic efficiency trade-offs. The estimated net production benefits of a project provides the threshold value that the non-quantified environmental, social and cultural impacts of a project (based on the assessments in the EIS), after mitigation, offset and compensation by the proponent, would need to exceed for them to outweigh the net production benefits.

Where the main environmental, social and cultural impacts of a project are valued in monetary terms, stronger conclusions can be drawn about the economic efficiency of a project i.e. the well-being of society.

Any other residual environmental, cultural or social costs that remain unquantified in the analysis[6] can also be considered using the threshold value approach. The costs of these unquantified environmental, cultural and social impacts would need to be valued by society at greater than the quantified net social benefit of a project to make it questionable from an economic efficiency perspective.

3.2.7 Consideration of the Distribution of Costs and Benefits

While CBA, undertaken at different scales, can provide qualitative and quantitative information on how costs and benefits are distributed, welfare economics and CBA are explicitly neutral on intra and intergenerational distribution of costs and benefits. There is no welfare criterion in economics for determining what constitutes a fair and equitable distribution of costs and benefits. Judgements about intra and intergenerational equity are subjective and are therefore left to decision-makers.

Nevertheless, it should be noted that the costs and benefits in CBA are defined and valued based on the values held by individuals in the current generation. There is no way to measure the value that future generations hold for impacts of current day projects as they are not here to express it. However, as identified by Boardman *et al.,* (2001) this is not considered a serious problem for CBA because:

- Few policies involve impacts that only appear in the far future. Consequently, the willingness to pay of people alive today can be used to predict how future generations will value them;
- Most people alive today care about the well-being of their children, grandchildren and great grandchildren, whether or not they have yet been born. They are therefore likely to include the interests of these generations to some extent in their own valuations of impacts. Because people cannot predict with certainty the place that their future offspring will hold in society, they are likely to take a very broad view of future impacts; and
- Discounting used in CBA also reduces the influence of costs and benefits that occur a long way into the future.

Furthermore, increased wealth (e.g. royalties and taxes) generated by projects that have a net benefit to the current society can be used to improve the services (e.g. health, school and community services) and environment (e.g. protected areas) that are passed on to future generations.

As identified by the Productivity Commission (2006), a policy option that provides the highest net benefit, as indicated by CBA, would also be consistent with the principles of ecologically sustainable development.

3.2.8 Consideration of other Objectives of Government

CBA does not address other objectives of the EP&A Act and governments. Decision-makers therefore need to consider the economic efficiency implications of a project, as indicated by CBA, alongside the performance of a project in meeting other conflicting goals and objectives of the EP&A Act and government policy more widely.

[6] Including potential impacts that were unknown at the time of the preparation of the EIS or arise during the EIA process due to differences in technical opinions.

3.2.9 Key steps in Cost Benefit Analysis

The key steps in CBA are summarised in Box 1.

Box 1: Key steps in a CBA
Step 1: Establish the base case against which to assess the potential economic, social and environmental impacts of changes due to the project.
Step 2: Define the project including all significant inputs required to achieve the project's objectives.
Step 3: Quantify the changes from the base case resulting from the project. This will focus on the incremental changes to a range of factors (for example, environmental, economic, social) resulting from the project.
Step 4: Estimate the monetary value of these changes and aggregate these values in a consistent manner to assess the outcomes. Where market prices exist, they are a starting point for valuations of both outputs and of inputs used for production. For non-market goods, as for many environmental impacts and some social impacts, the aim is to value them as they would be valued in monetary terms by the individuals who experience them.
Step 5: Estimate the Net Present Value (NPV) of the project's future net benefits, using an appropriate discount rate.
Step 6: Undertake sensitivity analysis on the key range of variables, particularly given the uncertainties related to specific benefits and costs.
Step 7: Assess the distribution of costs and benefits across different groups.
Step 8: Report CBA results, including all major unquantified impacts so the appraisal addresses and incorporates all material relevant to the decision maker**.**

Source: NSW Government (2015)

Section 4 reports on the CBA of the Project based on the financial, technical and environmental advice provided by WACJV and its' specialist consultants.

3.3 Local Effects Analysis

3.3.1 Introduction

LEA aims to address the consequences of the proposal in its "locality" as required by Section 79C of the EP&A Act. It is intended to complement CBA by translating effects at the NSW level to impacts on the communities located near the project site. It also provides additional information to describe changes that are anticipated within a locality, such as employment changes. LEA is intended to inform the scale of change rather than being representative of costs and benefits to the local community.

For the purpose of a LEA the locality is defined as the Statistical Area Level 3[7] (SA3) that contains the proposed project. The relevant population group is defined as those people ordinarily resident in the locality at the time of the proposal.

The local effects required to be analysed in a LEA are:

- local employment and income effects
- other local industry effects, for example on suppliers; and
- environmental and social change in the local community.

3.3.2 Direct Effects Relating to Local Employment

The guidelines (NSW Government 2015) prescribe that only employment of people ordinarily resident in the region at the time of the proposal should be included in the initial estimation of direct local employment increases.[8]

[7] In this case the Gosford, Wyong and Lake Macquarie LGAs have been chosen to represent the locality.
[8] Employment filled by those migrating into a region to live are excluded as are jobs filled by those who reside outside the region.

The guidelines assume that these people would otherwise be employed in the region and so the increased disposable wages for the region as a result of a project is the difference between the average net income of these people in the mining industry and the average net income in other industries.[9]

The incremental full time equivalent direct employment from a project to the locality is estimated as the increase in net income divided by the average net income in the mining industry.

The aim of this approach is to gauge the incremental impacts for existing residents of the locality. However, as a direct measure of regional employment and wages for existing residents, LEA is likely to understate effects because it assumes that:

- existing local residents employed by a project are already employed in the region i.e. they are not unemployed or coming from new participants in the labour force;
- jobs vacancies in the region created by those filling the positions in a project remain unfilled for the duration of the project i.e. it essentially assumes that the regional economy and the wider Australian economy is at full employment. Refer to Attachment 3 for a discussion of the trickle-down effect and a comparison to input-output (IO) analysis.

From a regional economy perspective (rather than focused on existing residents) it is also likely to understate effects since it does not take into account the income spending of those who migrate into the region and are employed by the project.

3.3.3 Estimating Effects Related to Non-labour Project Expenditure

In addition to the incremental direct regional employment and wages generated by a project, the other major economic effect will be expenditure in the region on other, non-labour inputs. These can be estimated for construction and operation phases of a project. Identified local expenditure may not all accrue to the region, particularly for margin sectors such as wholesale and retail trade purchases where only the margin would accrue to the regional business entities unless products are also manufactured locally.

3.3.4 Second Round/Flow-on Effects

The guidelines (NSW Government 2015) identify that flow-on effects can also be extremely important for local communities and should therefore also be considered either qualitatively or using techniques such as IO analysis or computable general equilibrium (CGE) modelling (suitable for larger projects), provided the assumptions and limitations of the methods are identified. As well as being supported in the NSW Government Guidelines (2015) for *Economic assessment of mining and coal seam gas proposals*, IO analysis is identified by the World Bank economist Mustafa Dinc (2015) as providing a solid framework to analyse the interdependence of industries in an economy and one of the most widely used tools in regional economic analysis. The method is further supported by independent peer reviews (commissioned by the NSW Department of Planning and Environment) of economic assessments of mining proposals. A comparison of IO analysis and CGE modelling is provided in Attachment 4. This Attachment also provides a detailed response to the criticisms that have been inappropriately levelled against the IO methodology.

[9] Wages paid to those migrating into a region to live are excluded as a wages benefit to the region.

3.3.5 Effects on Other Local Industries

The LEA should also give consideration to potential impacts such as:

- displacement of other land uses, where the mining project uses land that would otherwise be used for other purposes;
- where the mining project affects choices of external parties, particularly tourism and business travel; and
- where the mining project creates temporary effects on other industries that cause short run market adjustments in the cost of living for local residents, particularly food and housing markets.

3.3.6 Environmental and Social Impacts on the Local Community (Externalities)

Finally, every LEA should assess positive and negative externalities created by the proposed project on the locality, with a focus on material, unmitigated effects. This information is available from the EIS and Amendment Document and summarised in the CBA.

3.3.7 Input-output Analysis

Section 5 undertakes a LEA as identified above and consistent with the NSW Government Guidelines (2015). In addition, an IO analysis (refer to Attachment 4) of the Project is undertaken to identify the gross incremental regional economic activity that the Project will provide to the region. As identified in Attachment 3, incorporation of consideration of the "trickle down" effect means that the direct incremental employment and income to a region approximates the total income of those employed in the region who already reside in the region or migrate into the region to live i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect.

IO analysis essentially involves two steps:

- Construction of an appropriate IO 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 IO equations so that the IO multipliers and flow-on effects can then be estimated (West, 1993).

The IO method is based on a number of assumptions that are outlined in Attachment 5. Most notably IO analysis assumes that the regional economy has access to sufficient labour and capital resources (from both inside and outside the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions (“crowding out”) of economic activity in other sectors in the same region. Any "crowding" out is assumed to occur outside the region where the Project is concentrated and the regional impact analysis is focused. A dynamic CGE approach may overcome the limitation of IO analysis but is unlikely to be warranted at local or regional scale or with small scale impacts.

The consequence of the assumptions of IO analysis, is that IO modelling results provide an upper bound economic activity impact estimate.

IO analysis identifies the economic activity of a project on the economy in terms of four main indicators:

- 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. These costs exclude income costs;

- Income – the wages paid to employees including imputed wages for self employed and business owners; and
- Employment – the number of people employed (including self-employed, full-time and part-time).

These indicators of economic activity are not equivalent to the economic measures of consumer and producer surplus that are relevant in the CBA framework.

Gross regional output is a measure of total revenue or turnover. All costs of production would need to be subtracted to make it approximate the measure of producer surplus. Value-added is an indicator of net value to producers, but unlike the producer surplus measure, it does not take account of all production costs – only non-labour costs are subtracted from revenue. Income or wages paid to employees is a cost to the producer in the CBA framework and is one of the costs subtracted from revenue or output to calculate the producer surplus or net benefit to producers. Employment is a non-financial indicator identifying the physical number of jobs associated with an activity.

Unlike CBA there are no decision rules to identify whether an increase or decrease in economic activity is desirable, although it is often implicitly assumed that more economic activity is good and less economic activity is bad. However, not all economic activity is desirable from a community welfare perspective since it may be associated with, for example, environmental degradation, crime, etc.

As well as providing an indication of gross economic activity in a region, economic activity analysis can have important links to social impact assessment since changes in income and employment levels can impact population levels and their ability to maintain community infrastructure (schools, hospitals, housing etc), broader community and cultural value systems and inter-relationships.

4 COST BENEFIT ANALYSIS OF THE PROJECT

4.1 Introduction

This Section reports on a CBA of the Project based on financial, technical and environmental advice provided by WACJV and its specialist consultants.

4.2 Identification of the Base Case and Project

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

In this Economic Impact Assessment, the base case or "without Project" scenario involves the continuation of existing rural residential, forestry and other land uses in the Project Boundary. In contrast to the "base case", the Project is as outlined in Section 2.

CBA is primarily concerned with the evaluation of a Project relative to the counterfactual of the "without Project" scenario. Where there are a number of alternatives to a project, these can also be evaluated using CBA. However, alternatives need to be feasible to the proponent and to this end a number of alternatives to the Project were considered by WACJV in the development of the current Project. The Wallarah 2 EIS and Amendment Document provide more detail on the alternatives considered.

The Project assessed in the Wallarah 2 EIS and Amendment Document and evaluated in the CBA is considered by WACJV to be a feasible alternative for minimising environmental, cultural and social impacts whilst maximising resource recovery and operational efficiency. It is therefore this alternative that is proposed by WACJV and was subject to detailed economic analysis.

4.3 Identification of Benefits and Costs

Relative to the base case or "without Project" scenario, the Project may have the potential incremental economic benefits and costs shown in Table 4.1. The main potential economic benefit is the producer surplus (net production benefits) generated by the Project and any wage benefits to employment, nonmarket benefits to employment, economic benefits to existing landholders or benefits to suppliers, while the main potential economic costs relate to any environmental, social and cultural costs, including any net public infrastructure costs and loss of surpluses to other industries.

Table 4.1
Potential Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits	• Opportunity costs of capital equipment • Opportunity cost of land • Development costs including labour, capital equipment, sustaining capital, and acquisition costs for impacted properties and biodiversity offsets[1] • Operating costs, including administration, mining, coal handling, transportation to port, port charges, labour costs and mitigation, offsetting and compensation measures • Decommissioning and rehabilitation costs at cessation of the Project	• Value of coal • Residual value of capital and land at the cessation of the Project
Potential environmental, social and cultural impacts	• Forestry impacts • Surface water and Local Water Supply Scheme • Flooding impacts • Groundwater impacts • Air quality impacts • Noise and vibration impacts • Ecology and biodiversity impacts • Aboriginal heritage impacts • Historic heritage impacts • Traffic and transport impacts • Visual amenity impacts • Greenhouse gas generation • Agricultural impacts • Net public infrastructure costs • Loss of surplus to other industries	• Wage benefits to employment • Non-market benefits of employment • Economic benefits to existing landholders • Economic benefits to suppliers

[1] The value of foregone agricultural production is included in the value of land.
[2] Subsidence impacts manifest themselves from an economic perspective in impacts on flooding, water, ecology, agriculture and infrastructure. They are therefore omitted as a separate impact in the above table.

Framed in another but equivalent way the potential incremental costs and benefits of the Project are as per Table 4.2

Table 4.2
Alternative Frame of Potential Economic Benefits and Costs of the Project

Costs	Benefits
Net environmental, social, cultural and transport related costs	Net production benefits
Net public infrastructure costs	*Royalties*
	Company tax
	Net producer surplus
	Wage benefits to employment
	Non-market benefits of employment
	Economic benefits to existing landholders
	Economic benefits to suppliers

It should be noted that the potential environmental, social and cultural costs listed in Table 4.1 and Table 4.2 are only economic costs to the extent that they affect individual and community well-being. If the potential impacts do not occur or are mitigated, compensated or offset to the extent where community wellbeing is insignificantly affected (i.e. costs are borne by the proponent), then no environmental, social or cultural economic costs should be included in the Project CBA apart from the mitigation, compensation or offsetting costs.

4.4 Quantification/Valuation of Benefits and Costs

Consistent with NSW Government (2015) and NSW Treasury (2007) the analysis was undertaken in 2015 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%.

The analysis period is 30 years, coinciding with the Project life plus two years pre-Project commencement. Any impacts that occur after this period are included in the final year of the analysis as a terminal value.

Where competitive market prices are available, they have generally been used as an indicator of economic values. Environmental, cultural and social impacts have initially been left unquantified and interpreted using the threshold value method.

An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[10] and incorporate them into an estimate of the net social benefit of the Project. This estimated net social benefit of the Project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the Project questionable from an economic efficiency perspective.

4.4.1 Production Costs and Benefits[11]

Production Costs

Opportunity Cost of Capital

No existing capital equipment in WACJV ownership will be carried forward into the Project. All capital equipment required for the Project will be purchased and is included in the development costs of the Project.

Opportunity Cost of Land

The majority of the land required for the Project is already in WACJV ownership. There is an opportunity cost associated with using land that is already in WACJV ownership for the Project instead of its next best use (e.g. other industrial purposes). An indication of the opportunity cost of the land can be gained from the land's market value. This is estimated by WACJV at $25 million (M) based on the land acquisition costs.

Development Cost of the Project

The development costs of the Project include design and project management, capital equipment, mine development, coal handling infrastructure, a coal conveyor, a rail loader, powerlines, gas plant, water treatment plant, associated minor infrastructure, land acquisitions for properties adversely affected by noise, dust, vibration and for properties required for biodiversity offsets. These capital costs over the life of the Project are estimated by WACJV at $1.5 billion (B) based on WACJV updates to the original feasibility study prepared by BHP Billiton. These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Project

The annual operating costs of the Project include those associated with mining, environmental management and monitoring, ROM coal processing, water treatment, administration and coal rail transport. Average annual operating costs of the Project (excluding royalties) are estimated at $192M. These are based on WACJV updates to the original feasibility study by BHP Billiton.

[10] Benefit transfer refers to transferring economic values that have been determined for other study sites.
[11] All values reported in this section are undiscounted Australian dollars unless otherwise specified.

While royalties are a cost to WACJV, they are part of the overall producer surplus benefit of the Project that is paid to and then redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project. Nevertheless, it should be noted that the Project would generate total royalties over its life in the order of $661M, or $200M in present value terms (at 7% discount rate). The correct method for estimating royalties is provided in Attachment 10. It should be noted that previous claims of the overstatement of royalties from this and other Projects because of the failure to account for deductions are erroneous. Where deductions do apply, these reduce the revenue that the royalty rate is applied to and hence make very little impact to royalty calculations. Notably, for mining developments where no washing of the coal is proposed, such as in the case of the Project, royalty deductions are minimal, and the NSW Government Guidelines (2015) in any case do not require consideration of deductions in the calculations of royalties. Other criticisms of royalty calculations relate to the issue of whether projects operate at full capacity over their life. However, the estimation of royalty revenues is based on an average annual production rate of 3,974 Mtpa over the 28 year Project life, not the maximum potential annual production of 5 Mtpa.

Decommissioning and Rehabilitation Costs of Facilities

The Project infrastructure would be decommissioned and rehabilitated, or decommissioned and on sold for industrial uses at the cessation of the Project. No estimate is available of the decommissioning and rehabilitation costs, however for the purpose of the CBA it is assumed that these are offset by the residual value of land and capital equipment at the end of the Project life. Notwithstanding, it should be noted that WACJV is required to pay a rehabilitation security deposit to the NSW Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy (DTIRIS-DRE). Since decommissioning and rehabilitation costs would occur in the final year of the analysis, discounting reduces their significance on the outcome of the CBA.

Production Benefits

Value of Coal

The main economic benefit of the Project is the market value of the coal that is produced. This reflects the production profile, coal price which is quoted in USD and the USD/AUD exchange rate.

Total coal production is estimated at 103 Mt, with annual production of up to 5 Mtpa but averaging 3.9Mtpa over a 28 year mining period.

It should be noted that it is not current or historic coal prices that are relevant to the analysis but forecast prices during the 28 years of the mining operation, where coal production would not commence until around 2020. Hence the relevant coal price is the price from 2020 onwards.

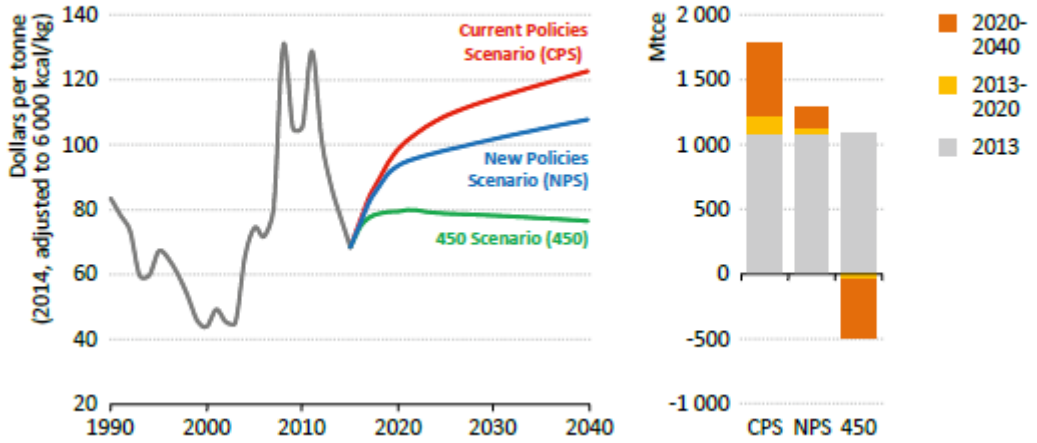
The coal is export quality and has higher calorific content than Newcastle export benchmark coal (i.e. 6,536 kcal/kg), but an ash content that increases over time (from 13.5% to 21%) to be higher than for Newcastle export benchmark coal. For the purpose of the analysis, in the first four years of production when the ash content is less <14%, the Wood Mackenzie[12] benchmark price forecasts for 6,000 kcal/kg and <14% ash is used and subsequent to this the Wood Mackenzie benchmark price forecasts for 5,500 kcal/kg which has <23% ash is used. This is considered conservative given the high calorific content of the Project's coal. An USD/AUD exchange rate of 0.72 is used (Westpac, 2015).

Based on this approach, an average coal value of AUD99 over the life of the operation of the Project i.e. from 2020 to 2045, is used although much lower prices are used in the early years of the Project with coal prices increasing over time in line with Wood Mackenzie forecasts. This information is proprietary and hence unable to be published. However, an increase in coal prices over time is consistent with other credible forecasts of coal prices.

[12] Wood Mackenzie is a leading global energy, metals and mining research and consultancy group.

The IEA (2015) World Energy Outlook under the Current Policy Scenario and New Policy Scenario[13] forecasts thermal coal prices increasing rapidly until 2020 followed by divergence in price under the New Policy and Current Policy Scenario (refer to Figure 4.1). Under the Current Policy Scenario and New Policy Scenario and an AUD/USD exchange rate of 0.72, the free-on-board thermal coal price in 2020[14] is predicted to be AUD102/t and AUD121/t, respectively (in 2014 dollars).

Figure 4.1
Average OECD Steam Coal Import Prices and Global Coal Trade by Scenario



Source: IEA (2015) Work Energy Outlook, p. 274

The NSW 2015-2016 Government budget papers forecast the price of thermal coal in 2019 at AUD103, assuming an exchange rate of 0.72.

In its recent assessment of the Mount Owen mine extension, the NSW Department of Trade and Investment has suggested medium to long term export thermal prices in the range of AUD97 to AUD117 per tonne[15].

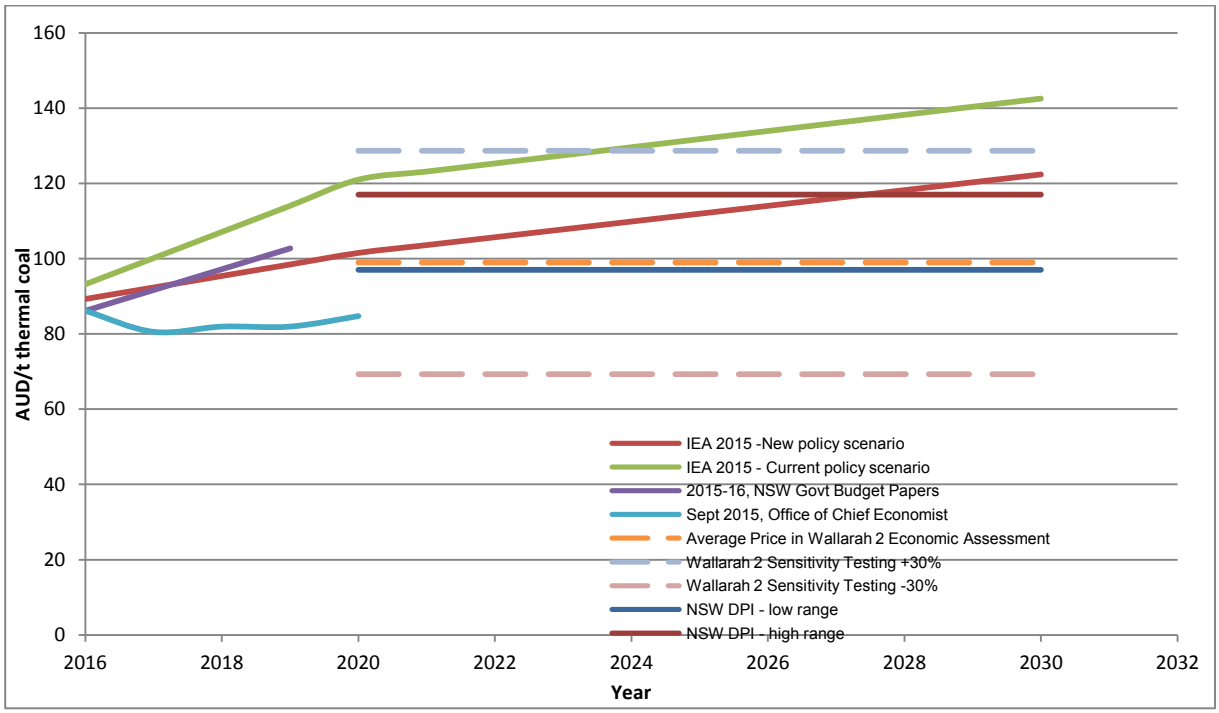
In contrast to these forecasts, the Office of the Chief Economist, Resources and Energy Quarterly, September Quarter 2015 has predicted thermal coal prices of USD61 (AUD85 at 0.72 AUD/USD exchange rate) in 2020, although this forecast does not extend to the period of the Project operation.

The varying forecasts of thermal coal prices are shown in Figure 4.2. The Wood Mackenzie forecast coal prices used in this analysis are at the lower end of most coal price forecasts.

It is recognised that there is uncertainty around future coal prices (valued in USD) as well as the USD/AUD exchange rate. Therefore, the assumed coal prices (in AUD) have been subjected to sensitivity testing for +/- 30% changes in AUD coal price as part of this assessment (see Section 4.8). This encompasses even the most pessimistic price forecasts from the Office of the Chief Economist.

[13] The New Policy Scenario takes account of broad policy commitments and plans that have been announced by countries, including national pledges to reduce greenhouse-gas emissions and plans to phase out fossil-energy subsidies, even if the measures to implement these commitments have yet to be identified or announced. The Current Policy Scenario assumes no changes in policies.
[14] Adjusting IEA figures which are import prices for sea freight costs to convert them to export prices.
[15] As reported in CIE (2015) Peer review of economic assessment, Bylong Coal project.

Figure 4.2
Thermal Coal Price Forecasts



Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land (excluding environmental offsets) will have some residual value that could be realised by sale or alternative use. As identified above, this is assumed to offset the decommissioning and rehabilitation of surface infrastructure areas at the end of the Project life.

4.4.2 Environmental Social and Cultural Costs and Benefits

Forestry Production

The Project will result in up to 3.2 ha of clearing in the Wyong State Forest for the construction and operation of the Western Ventilation Shaft. There is an opportunity cost associated with using this land for the Ventilation Shaft instead of forestry. The typical "average" standing timber value of Wyong State Forest, assuming the removal of 100% of the harvestable timber, has been estimated at $3,600 per ha (GHD 2012). Therefore for the 3.2 ha of affected land, the value of standing timber is estimated at $11,520 in royalties. No harvesting and haulage costs were estimated and hence this value could be considered to be a maximum estimate of the net value of foregone timber as a result of the Project.

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 infrastructure areas and offsets, has therefore been incorporated in the CBA through inclusion of its market value in the opportunity cost of land and development costs of the Project.

An additional potential agricultural impact relates to potential subsidence impacts on a turf farm which may result in some lost production while subsidence effects are remedied. The cost of foregone production (under a worst case scenario of lost production for 2-years) and remediation action was included in the CBA (Scott Barnett and Associates 2012). The present value of this foregone net production value and remediation is estimated at $0.3M, present value at 7% discount rate.

Surface Water and the Local Water Supply Scheme

The Project has been designed to safeguard surface and underground water regimes. Groundwater modelling has shown that effects on the alluvial groundwater system will be minor and transient. The Extraction Area of the Project covers only a small percentage of the entire combined Gosford Wyong Water Supply Scheme catchment area, the majority of which lies within the Wyong State Forest. There will be some minor alterations to flows of drainage lines in these areas as a result of subsidence. However, the overall impact to the water supply will be negligible. Nevertheless, WACJV will obtain WALs for 300 ML which is the maximum amount of redirected surface runoff which will be temporarily stored in alluvial soils over longwall panels, thereby reducing potential runoff contributions until such time as the alluvial areas equilibrate and near normal runoff is re-established.

There is an opportunity cost of holding these WALs which is reflected in their market value. Conservatively assuming a market value of $2,000/ML, which is higher than the unit purchase cost experienced by WACJV to date, holding 300 ML of WALs would have an opportunity cost of $0.6M. Conservatively, no residual value for these WALs is included in the CBA.

The Planning Assessment Commission has also stipulated a requirement for WACJV to provide water to the Central Coast Water Authority to compensate for the 300 ML of redirected surface runoff which will be temporarily stored in alluvial sediments over longwall panels. This is a financial cost to WACJV. However, from an economic perspective inclusion of the cost of this in a CBA is double counting, since by purchasing WALs, WACJV is already bearing the economic cost of its water take. By purchasing WALs from other users the Project will result in no additional water take from the catchment. To include the cost of providing 300 ML/year of water to Central Coast Water Authority would be double counting.

Subsidence Impacts

The Extraction Area of the Project will occur completely within two Mine Subsidence Districts and has been designed to minimise subsidence and to meet subsidence criteria for these areas. The Project is predicted to result in some serviceability impacts on houses from tilt, curvature and strain (Wyong Areas Coal Joint Venture 2012; Mine Subsidence Engineering Consultants 2013). Conceptually, property damage costs from subsidence can be estimated by combining the probability of damage occurring with an estimate of the cost of damage, for each year of the analysis. In the absence of this detailed information, an alternative approach to making some allowance for subsidence damage to houses and other property was via inclusion of the Mine Subsidence Fund contributions in the economic costs of the Project. These payments seek to meet the probability weighted incidence costs to properties and infrastructure at a State level, and so provide a sound basis for valuation. To allow for the uncertainty about how accurately these contributions reflect the actual impacts of the Project, sensitivity analysis around the operating costs of the Project (including Mine Subsidence Fund contributions) is undertaken in Section 4.8.

Flooding

The Project will result in some subsidence–induced topographic changes near water courses and floodplains. There will be a net increase of 28.3 ha of land expected to be flooded during a 100 year ARI event. Due to the changes in flood levels, 36 dwellings are expected to be beneficially affected and 33 are expected to be adversely affected.

Options available to mitigate impacts on adversely affected dwellings include minor channel improvements, construction of individual flood levees, raising houses in-situ and relocating or reconstruction of houses on higher ground within the property.

An additional 15 roads and bridges are predicted to be affected by flood impacts, which would affect access to residences by increasing the period of inundation. Options available to mitigate these

impacts include raising bridges, raising low sections of roads, and improving the hydraulic capacity of channels in some locations.

There would be economic benefits to owners of dwellings beneficially affected and economic costs to dwelling owners adversely affected and residences affected by reduced access during periods of inundation.

The CBA includes an allowance for mitigation measures in the capital and operating costs of the Project and sensitivity analysis on capital and operating costs is sufficient to allow for substantial variations in the cost of these measures.

Groundwater

Groundwater ingress into the underground working of the Project is estimated at a maximum of 1,132 ML per annum. WACJV has applied for a licence under the Water Act to take this quantity of groundwater. It is proposed this groundwater will be pumped to the surface and treated in the water treatment plant in accordance with the Site Water Management Plan. The reject stream will be disposed of in the underground workings and the treated water product will be used for operational purposes and / or discharged into adjoining streams in accordance with an appropriate Environmental Protection Licence. Groundwater modelling has shown that effects on the alluvial groundwater system will be minor and result in negligible effects on stream flows. No impacts are expected from the Project on groundwater users within the regional aquifers (Mackie Environmental Research 2013).

Consequently, no economic implications associated with the Project's impacts on groundwater have been included in the CBA.

Air Quality

The results of the dispersion modelling indicate that the predicted incremental ground level concentrations for PM_{10}, $PM_{2.5}$, TSP and dust deposition at the closest residential receptors during construction and operation of the Project are all below the impact assessment criteria. A cumulative assessment, incorporating existing background levels, indicates that the Project is unlikely to result in any additional exceedances of relevant impact assessment criteria at the neighbouring receivers. Cumulative impacts from NO_2 as a result of flaring were found to be minor when added to existing background levels (PAEHolmes 2012).

A detailed assessment of health risks associated with the Project's anticipated air quality impacts, including risks of lung cancer, heart disease and other respiratory diseases calculated that the predicted statistical increases resulting from the Project would be negligible. NSW Health has considered this information and has no residual concerns.

Consequently, no economic implications associated with air quality have therefore been identified for inclusion in the CBA.

Noise and Vibration

Impacts of the Project potentially arise from operational noise, road traffic noise, rail traffic noise and construction noise and vibration. Noise modelling indicates that four properties are predicted to experience exceedances during construction. However a Construction Noise and Vibration Management Plan will be prepared to manage these and hence temporary impacts should be largely mitigated. An allowance for the costs of preparation and implementation of this Plan is included in the capital and operating costs of the Project. Three private residences will be moderately impacted during the operation of the Project and would be eligible for acoustic treatments to reduce impacts. An allowance for the cost of these is included in the capital costs of the Project. In addition, 67 lots are predicted to experience negligible impacts that are not discernible by the average listener.

No significant operational road traffic noise impacts, rail traffic noise impacts or construction noise and vibration impacts are predicted as a result of the Project and hence no additional economic costs are included in the CBA.

Ecology and Biodiversity

The Project will directly impact approximately 75.2 ha of vegetation (including 10.5 ha of Endangered Ecological Communities). The proposed offset areas contain 207.0 ha of existing native vegetation (including 82.8 ha of EEC).

The impacted vegetation and associated fauna is likely to have non-use values to the community that can potentially be estimated using non-market valuation methods. Similarly, the provision of offsets is also likely to have non-use values to the community. The cost of providing offsets is included in the opportunity cost of land estimate (as existing WACJV-owned land would be involved) and operating cost estimates. Sensitivity testing of these costs in Section 4.8 is sufficient to incorporate substantial changes in the costs of offsets. To the extent that the offsets provide community values that are equivalent to the values lost from clearing, there will be no net loss in community values.

No material impacts on aquatic species or GDEs are predicted. However, a range of planning and mitigation measures are proposed in the event of impacts being identified. These costs are included in the capital and operating costs of the Project.

Aboriginal Heritage

Any impacts on Aboriginal heritage sites may impact the well-being of the Aboriginal community. However, monetisation of these impacts is problematic and so these impacts are best left to consideration as part of the preparation of the Aboriginal Heritage Impact Assessment.

Impacts on highly significant Aboriginal heritage sites have also been shown to affect the well-being of the broader community (Gillespie Economics 2009a, 2009b, 2010). However, no Aboriginal heritage sites of high scientific significance are predicted to be directly or indirectly impacted by the Project (OzArk Environmental & Heritage Management Pty Ltd 2012a). Consequently, no economic implications associated with heritage have been included in the CBA.

Historic Heritage

No items of Historic heritage will be directly impacted by the Project (OzArk Environmental & Heritage Management Pty Ltd 2012b). Historic heritage sites above the underground workings will be considered in subsidence management planning with appropriate adaptive management plans prepared. Indirect impacts on Historic heritage are therefore included in the consideration of subsidence impacts, above.

Traffic and Transport

The Traffic and Transport Impact Assessment (Parsons Brinckerhoff 2013) found that the Project would not impose any adverse impacts on the surrounding road network as a result of the increased traffic associated with construction and operational activities. The main contributor to future traffic volumes is the Wyong Employment Zone, scheduled to be in operation in 2018. A Traffic Management Plan will be prepared in consultation with Roads and Maritime Services and Wyong Shire Council, including details about WACJV's contribution to mitigation measures for road deficiencies. An allowance for contribution to these costs is part of the capital costs of the Project. No additional economic costs associated with traffic and transport have been included in the CBA.

Visual Amenity

Visual impacts of the Project can potentially arise from the Tooheys Road Site, the Buttonderry Site and Western Ventilation Shaft. However, the Visual Impact Assessment found that the potential for visual impacts at the Tooheys Road Site are generally restricted to motorists and train commuters and that the visual impact rating is 'Moderate'. Potential views of the top of the coal stockpile from two private residences would be mitigated via landscape measures.

The proposed development at the Buttonderry Site would not be visible from adjoining private properties due to screening provided by vegetation and topography. No negative visual impacts were identified as a result of the Western Ventilation Shaft. The Economic Impact Assessment has included the costs of landscaping to minimise visual impacts.

Greenhouse Gas Generation

The Project will generate in the order of 5.7 million tonnes (Mt) of Scope 1 and 2 and 0.3 Mt of Scope 3 GHG emissions from mining and transport of product coal by rail to the port[16] (Pacific Environment 2016).

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. Three shadow prices were used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US EPA Social Cost of Carbon. Under these shadow prices the present value of greenhouse gas emission cost is between $27M and $121M dollars, present value. This is a global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the Guidelines (NSW Government 2015), the focus of this CBA of mining projects is on costs and benefits to the population of NSW. In the absence of any studies that have focused on the social damage cost of carbon emissions to NSW residents, some means of apportioning global damage costs borne by Australians is required. For the purpose of the Economic Impact Assessment this has been undertaken using Australia's share of the global population (around 0.3%) and NSWs share of the Australian population (32%).

On this basis the present value of the cost of greenhouse gas emissions from the Project to Australia and NSW is estimated at between $78,000 and $356,000 dollars and $25,000 and $114,000 (present value), respectively.

Market Benefits to Workers

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project.

Estimation of this economic value of employment from the Project requires a number of assumptions such as what proportion of the Project workforce that would otherwise be unemployed or underemployed, the duration of time that this would occur and the opportunity cost of labour in an unemployed or underemployed state (i.e. the reservation wage rate).

[16] It should be noted that greenhouse gas generation associated with sea transport and usage of the product coal is considered to be outside of the scope of the CBA of the Project. Only Scope 3 emissions associated with rail transport of coal to port are included..

Some indication of the potential magnitude of these benefits can be gained by making a number of assumptions. Following the approach of Streeting and Hamilton (1991)[17] if it were assumed that 50% of the direct workforce of the Project[18] (150 out of a total of 300 jobs) would otherwise be unemployed for three years and that the reservation wage for these people was $52,000[19] compared to a mining wage of $134,000, then the market employment benefit in terms of income would be $25M present value, at a 7% discount rate. Values at alternate discount rates and percentages of unemployed are provided in the following table.

Table 4.3
Potential Economic Benefits to Workers Under Alternative Assumptions ($M)

	Discount Rate		
% Unemployed for 3 years	**4%**	**7%**	**10%**
50%	$29	$25	$21
25%	$15	$12	$10
75%	$44	$37	$31
Wage premium benefit	$329	$215	$149

If alternatively the economic benefit to workers is taken as the difference between the average wage in the region[20] $55,460 (ABS 2016) and the wage in the Project i.e. $134,000 pa, over the life of the Project, then the potential economic benefit to workers would be $215M, present value at 7% discount rate. These calculations exclude any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

The likelihood of wage benefits from the Project are enhanced by the proposed closure of underground mines in the region such as West Wallsend. The unemployment rate for the locality has escalated from 5.1% in December 2010 to 6.6% in December 2015 (Department of Employment 2015) with unemployment in the mining sector even higher (The Minerals Institute 2015).

Non-market Value of Employment

The above treatment of employment in CBA relate to the impacts on the unemployed individuals themselves. However, there may also be spillover effects and externalities to third parties. These are public good values. Spill-over effects referred to in the literature relate to empathy based losses to family or friends (close associates) of impacted workers because of the workers being unemployed and increased crime and community dislocation (Haveman and Weimer 2015: Streeting and Hamilton 1991). Empathy based impacts may also spill over more broadly into the existence values of others in the community who feel sympathy for the unemployed. As identified by Portney (1994), the concept of existence values should be interpreted more broadly than just relating to environmental resources and may also apply to the employment of others. Refer to Attachment 7 for further discussion on non-market values of employment.

Empirical evidence for these values was found in three choice modelling studies of mining projects in NSW. In a study of the Metropolitan Colliery in the NSW Southern Coalfields, Gillespie Economics (2008) estimated the value the community would hold for the 320 jobs provided over 23 years at $756M (present value). In a similar study of the Bulli Seam Operations, Gillespie Economics (2009a) estimated the value the community would hold for the 1,170 jobs provided over 30 years at $870M (present value). In a study of for the Warkworth Mine extension, Gillespie Economics (2009b)

[17] Streeting and Hamilton (1991) *An Economic Analysis of the Forests of South-Eastern Australia*, Resource Assessment Commission, Research Paper Number 5.
[18] All sourced from NSW.
[19] As estimated by the unemployment benefits plus income tax payable on a mining wage, following the reservation wage rate approach used by Streeting and Hamilton (1991).
[20] ABS does no publish data on average wages by industry sector and therefore it is not possible to estimate the average wage of those not in the mining or quarrying industry.

estimated the value the community would hold for 951 jobs from 2022 to 2031 at $286M (present value). These studies are considered reasonable for benefit transfer since they relate to resource extraction in NSW with the population sampled being NSW households.

The Project will provide an estimated 300 direct jobs, initially for 25 years. Using the more conservative Bulli Seam Operation employment value gives an estimated $186M for the employment benefits of the Project. In the context of a fully employed economy there may be some contention about the inclusion of this value. Even though the economy could not be considered to be at full employment, the results have conservatively been reported "with" and "without" employment benefits.

Economic Benefits to Existing Landholders

Payments by the proponent for the purchase of land, that exceed the opportunity cost of the land, are an economic benefit to the landholder. Most of the land required for the Project is already owned by the proponent and has been for some time. While historic land purchase costs may have been in excess of opportunity costs these can be considered "sunk" and do not vary with or without the Project. Notwithstanding, the market value of land owned by WACJV is included in the CBA as an opportunity cost. WACJV is currently negotiating the purchase of additional land for the Project, the cost of which is included in the capital costs of the Project. To the extent that the ultimate purchase price exceeds the opportunity cost of the land and the consumer surplus of the owner then resource costs of the Project may be overstated and some benefits may accrue to the current landholder. However, conservatively these potential benefits are excluded from the CBA.

Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. This is because in a competitive market, all resources are assumed to be fully employed, and so increases in the production of goods and services required as inputs to the project will withdraw labour and raw materials from other industries. The additional net benefits (surpluses) to suppliers to the Project will be offset by decreases in net benefits in other industries and so there is no net secondary benefit to the economy as a whole.

For CBA undertaken at a sub-national perspective some secondary benefits to suppliers may accrue if net benefits that accrue to firms within NSW (for example) are offset by a reduction in economic activity outside NSW. However, no economic benefits to suppliers are included in this analysis.

Net Public Infrastructure Impacts

Potential impacts of the Project on infrastructure include incremental impacts on road infrastructure and the use of utilities. The Voluntary Planning Agreement with Wyong Shire Council includes payments for provision of water and sewerage infrastructure to the Buttonderry and Tooheys Road Sites, road and intersection upgrades and annual contributions for local roads and community infrastructure impacted by the Project. The use of utilities will be paid for by user fees which are included in the Project operating costs. Consequently, no net infrastructure costs to government are envisaged as a result of the Project.

Loss of Surplus to Other Industries

The land that is the proposed site of the infrastructure area has limited potential for agricultural, hobby farm or rural residential uses. However, the land has not been used for the purpose for over five years and under both the base case and Project case there is no intention of using the land for grazing. The opportunity cost of using this land for mining instead of agriculture or other uses is reflected in the market value which is included as an opportunity cost (as described earlier). This opportunity cost is borne by WACJV, as owner of the land.

4.5 Consolidation of Value Estimates

4.5.1 Global results

The present value of costs and benefits, using a 7% discount rate, is provided in Table 4.4. The top half of the table identifies production costs and benefits of the Project, which includes capital and operating costs associated with the mitigation, offset and compensation of environmental, social and cultural impacts. The bottom of the table summarises the residual environmental, social and cultural impacts of the Project after mitigation, offsetting and compensation. Specific mitigation, offsetting and compensation costs are commercial-in-confidence and hence not separated out from the capital and operating costs of the Project. However, they are a very small proportion of the capital and operating costs of the Project and even substantive changes in them have only modest impacts on the Project. Sensitivity testing of overall capital and operating costs in provided in Section 4.8.

The Project is estimated to have total net production benefits of $585M (present value at 7% discount rate). Residual environmental, cultural and social impacts of the Project are estimated at $122M present value. In addition, there are potential employment benefits of $211M. In total, the Project is estimated to have net social benefits of between $463M and $774M.

4.5.1 National results

Not all of the identified net social benefits accrue to Australia. WACJV is 100% foreign owned and hence the net production benefits that accrue to Australia are limited to royalties, company tax and voluntary contributions (without any nexus to infrastructure demand generated by the Project). Royalties are estimated based on the depth of mining and application of the appropriate royalty rate to the estimated value of production. Value of production is equal to the total revenue from the sale of the coal less allowable deductions[21]. Company tax from the Project was estimated based on a discounted cash flow analysis of the Project adjusted for depreciation, and the application of a 30% tax rate to estimated taxable income. Voluntary contributions not linked to infrastructure demand generated by the Project were identified from the Voluntary Planning Agreement.

On this basis, the net production benefits that accrue to Australia are estimated at $425M (present value at 7% discount rate), comprising $200M in royalties, $220M in company tax and $5M in voluntary contributions.

The estimated net production benefits that accrue to Australia can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, compensation and offsetting, may be assessed. It is a minimum threshold value as it conservatively omits potential employment benefits of the Project. This minimum threshold value is the opportunity cost to Australia of not proceeding with the Project.

For the Project to be questionable from an Australian economic efficiency perspective, all incremental residual environmental, social and cultural impacts from the Project, that impact Australia[22], would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $425M in present value terms.

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to quantitatively consider the environmental, social and cultural impacts of the Project. From Table 4.4 it can be seen that most of the potential impacts are internalised into the capital and operating costs of the proponent via mitigation, offset or compensation, and hence are incorporated into the estimate of

[21] Refer to Attachment 10 for a detailed explanation of royalties and a response to previous criticisms of royalty calculations.

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

net production benefits. Other quantified impacts to Australia are estimated at less than $2M, considerably less than the estimated $425M net production benefits of the Project to Australia.

Overall, the Project is estimated to have net social benefits to Australia of between $423M and $634M (the latter incorporating the benefits of employment), and hence relative to the “without Project” scenario is desirable and justified from an economic efficiency perspective.

While the major environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $423M and $634M for the Project to be questionable from an Australian economic perspective.

Table 4.4
Global and National Cost Benefit Analysis Results of the Project (Present Values @7% discount rate)

	Costs	**$M**	**Benefits**	**$M**
Production	Opportunity cost of land	$23	Sale value of coal	$3,069
	Opportunity cost of capital	$0	Residual value of land and capital	
	Development costs	$785		
	Operating costs ex royalties	$1,676		
	Rehabilitation and decommissioning costs	Offset by residual value of land and capital		Offset by rehabilitation and decommissioning costs
	Production Sub-total	***$2,484***		***$3,069***
	Net Production Benefit			**$585 ($425)**
	Forestry impacts	$0**	Wage benefits to employment	$25
	Agricultural impacts	$0*** Also in opportunity cost of land above	Non-market benefits of employment	$186
Externalities	Surface water and local water supply	$1	Economic benefits to existing landholders	Not quantified
	Subsidence impacts	Accounted for through Mine Subsidence Levy.	Economic benefits to suppliers	No material impacts
	Flooding	Mitigation measures included in capital and operating costs		
	Groundwater	Licence costs included in capital costs. No material impacts.		
	Air quality	No material impacts		
	Noise and vibration	Costs of mitigation included in capital costs		
	Ecology and biodiversity	Some loss of values but offset. Cost of offset included in opportunity cost of land and operating costs		
	Aboriginal heritage	No material impacts		
	Historic heritage	Accounted for through Mine Subsidence Levy		
	Transport and traffic	No material impacts. Costs of mitigation measures included in capital and operating costs		
	Visual amenity	Costs of mitigation included in operating costs		
	Greenhouse gas	$121 ($1****)		
	Net public infrastructure costs	No material impacts		
	Loss of surplus to other industries	No material impacts		
	Externality sub-total	***$122 ($2)***		***$211***
NET SOCIAL BENEFITS – including employment benefits				**$774 ($634)**
NET SOCIAL BENEFITS – excluding employment benefits				**$463 ($423)**

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

"No material impacts" does not mean that there will be no impacts but impacts are not likely to amount to more than 5% of the quantified net production benefits of the Project.

**The value is estimated at $0.01M but is rounded down.

***The value is estimated at $0.3M but is rounded down.

**** The value is estimated at $0.4M but is rounded down. Greenhouse gas impacts are the maximum estimated.

4.6 NSW Costs and Benefits

The NSW Government (2015) guidelines have a particular focus on the costs and benefits to NSW. Table 4.5 identifies the costs and benefits to NSW. Impacts that have a national or global dimension are apportioned to NSW, in particular:

- 32% of the estimated company tax generated from the Project is attributed to NSW (NSW Guidelines 2015);
- none of the residual net producer surplus i.e. net production benefits minus company tax minus royalties, is attributed to NSW based on 100% foreign ownership of WACJV;
- 100% of potential wages benefits are attributable to NSW based on an assumption that all incremental employment will be filled by NSW residents;
- 100% of the potential nonmarket values of employment are attributable to NSW based on benefit transfer from a study that surveyed the NSW population;
- greenhouse gas impacts (which accrue globally) are attributed to NSW based on NSW's share of the global population;
- all other potential environmental, social and cultural impacts would accrue to NSW households. However, in accordance with Government policy and regulation these impacts are largely mitigated, compensated or offset by the proponent.
- 100% of contributions not linked to infrastructure demands created by the Project have been allocated to NSW. These include the Wallarah 2 Community Grants and Guringai Tribal Link Aboriginal Corporation Mutual Advancement Agreement (Guringai MAC) valued together at $100,000 per annum, the Wallarah 2 Apprenticeship program valued at $120,000 per annum and the Voluntary Planning Agreement with Wyong Shire council with a Community and Environment Component value of $4M over the life of the Project.

On this basis, the costs and the benefits of the Project to NSW are summarised in Table 4.5. The estimated Net Social Benefits of the Project to NSW are $274M and $485M, present value at 7% discount rate (the latter including employment benefits). Consequently, as well as resulting in net benefits to Australia, the Project would also result in net benefits to NSW.

Any unquantified residual impacts of the Project to NSW after mitigation, offsetting and compensation would need to be valued at greater than $274M and $485M, present value for the Project to be questionable from a NSW economic efficiency perspective.

Table 4.5
NSW Cost Benefit Analysis Results of the Project (Present Values @7% discount rate)

COSTS	VALUE ($M)	BENEFITS	VALUE ($M)
Environmental, social and cultural impacts		***Share of Net Production Benefits***	
Forestry impacts	$0**	Royalties	$200
Agricultural impacts	$0*** Also in opportunity cost of land above	Company tax	$70
Surface water and local water supply	$1	Net producer surplus	$0
Subsidence impacts	Accounted for through Mine Subsidence Levy.	Contributions not linked to demand	$5
Flooding	Mitigation measures included in capital and operating costs	***Sub-total***	***$275***
Groundwater	Licence costs included in capital costs. No material impacts.	***Additional benefits***	
Air quality	No material impacts	Wage benefits to employment	$25
Noise and vibration	Costs of mitigation included capital costs	Non-market benefits of employment	$186
Ecology and biodiversity	Some loss of values but offset. Cost of offset included in opportunity cost of land and operating costs	Economic benefits to existing landholders	Not quantified
Aboriginal heritage	No material impacts	Economic benefits to suppliers	No material impacts
Historic heritage	Accounted for through Mine Subsidence Levy		
Transport and traffic	No material impacts. Costs of mitigation measures included in capital and operating costs		
Visual amenity	Costs of mitigation included in capital and operating costs		
Greenhouse gas	$0****		
Net public infrastructure costs	No material impacts		
Loss of surplus to other industries	No material impacts		
Total	**$1**	***Sub-total***	***$211***
NET SOCIAL BENEFITS – including employment benefits			**$485**
NET SOCIAL BENEFITS – excluding employment benefits			**$274**

* "No material impacts" does not mean that there will be no impacts but impacts are not likely to amount to more than 5% of the quantified net production benefits of the Project.
Errors in total are due to rounding.
**The value is estimated at $0.01M but is rounded down.
***The value is estimated at $0.3M but is rounded down.
**** The value for NSW is estimated at $0.1M but is rounded down. Greenhouse gas impacts are the maximum estimated.

4.7 Distribution of NSW Costs and Benefits

As identified in Section 3, CBA is only concerned with the single objective of economic efficiency. CBA and welfare economics provide no guidance on what is a fair, equitable or preferable distribution of costs and benefits. Nevertheless, CBA can provide qualitative and quantitative information for the decision-maker on how economic efficiency costs and benefits are distributed

The costs and benefits of the Project to NSW are potentially distributed among a range of stakeholders as identified in Table 4.6.

Table 4.6
Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	MAGNITUDE OF IMPACT ($M)
Share of Net Production Benefits		
Royalties	NSW Government and NSW households	$200
Company tax	NSW Government and NSW households	$70
Contributions without a nexus	Gosford, Wyong and Lake Macquarie LGAs and residents of these LGAs	$5
Additional benefits		
Wage benefits to employment	Some of the local and NSW labour force	$25
Non-market benefits of employment	NSW households	$186
Economic benefits to existing landholders	Local landholders who sell land required for Project including buffer land	Not quantified
Economic benefits to suppliers	Regional and State suppliers of inputs to production	No material impacts
Environmental, social and cultural costs*		
Forestry impacts	NSW Forests but compensated	$0
Agricultural impacts	Impacted farmers but compensated	$0
Surface water and local water supply	Local surface water users but compensated via purchase of WALs	$1
Subsidence impacts	Local landholders	Compensation via MSL
Flooding	Local landholders	Mitigation measures included in capital and operating costs
Groundwater	Local groundwater users	If WALs purchased off landholders then they are compensated. If from controlled allocation then no impact.
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Noise impacts	Adjoining landholders	Mitigation measures included in capital costs
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts
Historic heritage impacts	Local and NSW households	Accounted for through Mine Subsidence Levy
Transport and traffic	Local residents	No material impacts. Costs of mitigation measures included in capital and operating costs
Visual amenity	Adjoining landholders	Mitigation measures included in capital and operating costs
Greenhouse gas impacts	Local and NSW households	$0
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts

* NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures perfectly mitigate, offset or compensate then no residual impacts occur and all impacts are borne by the proponent. This table identifies who bears residual impacts where mitigation, offset and compensation is imperfect.

4.8 Risk and Sensitivity Analysis

The main areas of environmental risks associated with mining projects relate to:

- the financial viability of a project from unexpected downturns in prices and any consequent environmental impacts from premature cessation of operations;
- ecological risk associated with whether the biodiversity offsets will adequately compensate for the direct ecological impacts;
- other environmental, social and cultural impacts estimations and required mitigation measures.

The NSW Department of Planning and Environment has previously identified that the financial viability of projects is a risk assumed by the project owners. Nevertheless, it should be noted that it is highly unlikely that WACJV would invest in the Project if it were not financial viable. However, any risk that the Project may commence and then cease operation for financial reasons leaving unmet rehabilitation liabilities is mitigated by the fact that WACJV is required to pay a rehabilitation security deposit to the NSW Department of Trade and Investment, Regional Infrastructure and Services – Division of Resources and Energy (DTIRIS-DRE) as the holder of a mining authority under the Mining Act. This security deposit is held by DTIRIS-DRE to ensure that the legal obligations in relation to rehabilitation and safety of the site can be met following mine closure. If rehabilitation obligations are not met to the satisfaction of the Minister, then the security funds would be used by DTIRIS-DRE to meet the relevant requirements.

The provision of biodiversity offsets can be associated with a number risks, including in relation to the biodiversity benefits of additional management of offsets, success in reconstruction of ecological communities, time-lags between impacts and provision of offsets as well as between management actions and achievement of ecological outcomes. These risks are mitigated through offset ratio requirements in the provision of offsets and commitment to the offset actions prior to the commencement of works under approval. The biodiversity offset package, with an appropriate offset ratio to account for ecological risks is being developed in consultation with the NSW Office of Environment and Heritage, and will be committed to prior to the commencement of the Project.

There is some risk associated with the estimation of environmental, social and cultural impacts of the Project and the level of mitigation measures proposed. However, it should be noted that impacts have generally been assessed based on the maximum annual levels of production and hence are likely to be overstated. Ongoing monitoring will ensure that appropriate mitigation measures are implemented as required.

The net present value of the Project to NSW (presented in Table 4.5) is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a CBA 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[23].

In this sensitivity analysis, the CBA results for NSW were tested for changes to the following variables at a 4%, 7% and 10% discount rate:

- Opportunity costs of land;
- Development costs;
- Operating costs;
- Value of coal;
- Effective company tax rate;
- Production levels;
- Forestry, surface water and agricultural impacts;
- Greenhouse costs.

Results are reported in Tables 4.7. What this analysis indicates is that CBA is most sensitive to changes in revenue (reflecting production levels, the value of coal in USD and the AUD/USD exchange rate). This is because the net benefit of the Project to NSW is dominated by royalties which are based on the Project revenue and are unaffected by assumptions regarding land opportunity costs,

[23] Quantitative risk analysis could also potentially be undertaken. However, this requires information on the probability distributions for input variables in the analysis. This information is not available and so the sensitivity testing is limited to uncertainty analysis.

development costs, operating costs and mitigation, offsetting and compensation costs. Variations in these costs impact company tax estimates, only a portion of which accrue to NSW, and the residual net producer surplus which accrues to WACJV and is outside the scope of the NSW CBA.

With respect to revenue, it should be noted that the estimated revenue from the Project is based on an assumed coal price over the life of the Project of AUD99 which is at the low end of the price forecasts from NSW DPI and well below those of the IEA. In addition, the production profile assessed for the purpose of the CBA was considerably less than the maximum level for which approval is sought, which again suggests that revenue estimates may be conservative.

The sensitivity analysis indicated that the CBA results are not sensitive to changes in capital costs, operating costs, opportunity costs of land and capital equipment or environmental costs that have not already been internalised into production costs, such as greenhouse gas, forestry, agricultural and surface water impacts. Since mitigation, offset and compensation costs are a small component of the capital and operating costs of the Project and changes in these have no impact on the royalty component of NSW net social benefits, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Under all scenarios examined, the Project has net social benefits to NSW.

Table 4.7
NSW CBA Sensitivity Testing (Present Value $Millions) (Excluding Employment Benefits)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	**$450**	**$274**	**$168**
INCREASE			
Opportunity cost of land - 20%	$450	$274	$168
Development costs - 20%	$441	$269	$165
Operating costs or production levels - 20%	$403	$246	$150
Value of coal - 30%	$679	$414	$257
Forestry, surface water and agricultural costs - 100%	$449	$273	$168
Australian Treasury Clean Energy Future Policy Scenario	$450	$274	$168

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE			
Opportunity cost of land - 20%	$450	$274	$168
Development costs - 20%	$464	$283	$174
Operating costs or production levels - 20%	$497	$303	$186
Value of coal -30%	$233	$148	$91
Company tax - 20% of taxable income	$407	$251	$155
Forestry, surface water and agricultural costs - 20%	$450	$274	$168
Forecast European Union Emission Allowance Units price	$450	$274	$168

5 LOCAL EFFECTS ANALYSIS

5.1 Introduction

The CBA in Section 4 is concerned with whether the incremental benefits of the Project exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' the Project compared to 'without' it. This section and Section 6 examines local effects using two different methods.

The Local Area is defined as the LGAs of Gosford, Wyong and Lake Macquarie, within which the Project is located.

5.2 Direct Effects Related to Employment

The Project will provide:

- a construction workforce of up to 450 during the peak year of construction with 50% assumed to already reside in the local area; and
- an operational workforce of 300 per year over the life of the Project. The Social Impact Assessment considers two scenarios for local hires i.e. 210 and 150. However, given the imminent closure of the West Wallsend mine and the increasing unemployment rate for those with underground mining skills the percentage of local hires may be even greater. A third scenario where 85% of the operational workforce are local hires is considered.

Assuming that future employees residing in the local area are already employed and that job vacancies created by these people filling the construction and mining positions remain unfilled, the incremental disposable wages accruing to the region is $4.8M during the peak year of construction and between $7.6M and $12.9M during Project operations. This is equivalent to 72 direct full time equivalent (FTE) jobs during the peak year of construction and between 79 and 134 direct FTE jobs during operations. This is a minimum estimate as it assumes full employment and no in-migration of labour.

Table 5.1
Analysis of Net Income Increase and FTE Job Increase

	Construction	Operations		
		Scenario 1	Scenario 2	Scenario 3
a) Direct employment during operations phase	**450**	300	300	**300**
Number that already reside in the region	225	210	150	255
b) Average net income in mining	$67,300	$96,473	$96,473	$96,473
c) Average net income in other industries*	$45,889	$45,889	$45,889	$45,889
d) Average increase in net income per job (b-c)	$21,411	$50,584	$50,584	$50,584
e) Increase in net income per year due to direct employment	$4,817,503	$10,622,708	$7,587,649	$12,899,003
f) FTE (e/b)	72	110	79	134

*This information is not available from the ABS and hence average income across all sectors is used.

5.3 Direct Effects Related to Non-labour Expenditure

The total annual non-labour expenditure (operating costs of the Project after subtraction of wages to employees) is in the order of $188M, per annum (once production has ramped up).

However, not all of this expenditure will accrue to the local area. From the location quotient analysis and allocation of margins and taxes undertaken by Gillespie Economics for Section 6, $65M pa of non-labour Project expenditure is estimated to accrue to the local area.

5.4 Second Round and Flow-on Effects

The incremental expenditure by employees and non-labour expenditure that is captured by the local area provides flow-on economic activity to the local economy, which can be estimated in terms of economic activity indicators of output, value-added, income and employment. Section 6 provides a full assessment of flow-on effects arising from both labour expenditure and non-labour expenditure. From this analysis, the Type 11A employment and income multiplier for incremental impacts is 2.84 and 1.72, respectively. Applying these multipliers to the direct net employment and net income effects calculated above in accordance with the NSW Guideline (2015) results in the Project operation contributing between $13M and $22M per annum in total net local income and between 224 and 381 net local jobs.

While net non-labour expenditure would also provide flow-on effects, there is no "expenditure multiplier". Its effects, estimated in terms of output, value-added, income and employment would need to be estimated using IO analysis or similar - refer to Section 6.

Table 5.2
Flow-on Effects Associated with Net Direct Employment and Income

	Net Direct	Flow-on	Total
Scenario 1			
Employment	110	202	312
Net income (M)	$10.6	$7.6	$18.2
Scenario 2			
Employment	79	145	224
Net income (M)	$7.6	$5.5	$13.1
Scenario 3			
Employment	134	247	381
Net income (M)	12.9	$9.3	$22.2
Net non-labour expenditure (M)	**$65**		

5.5 Effects on Other Industries

5.5.1 Regional Economic Impacts of Displaced Agriculture

The Project could potentially result in a reduction in agricultural activity from land directly impacted through land disturbance, conservation (i.e. the biodiversity offset area), the purchase of groundwater WALs and temporary subsidence impacts on a turf farm operation. However, the magnitude of these impacts is very small with the foregone annual gross value of production from the disturbance area and biodiversity offsets area estimated by Barnett and Associates (2012) at $14,900 and $2,739, respectively. Impacts on the turf farm, should they occur, would be temporary and result in a foregone annual gross value of $1.2M for a period of 2 years. The purchase of surface WALs from farmers may also result in some reduction in economic activity, however, is not expected to be significant.

Consequently, agricultural impacts of the Project are expected to be minimal.

5.5.2 Wage Impacts

In the short-run, increased regional demand for labour as a result of the Project (relative to the “without Project” scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the region and the availability and mobility of labour from outside the region. The incremental direct employment and income impacts of the Project, as estimated in Section 6, will contribute in the order of 0.2% and 0.5% of direct regional employment and direct regional wages, respectively. The contribution is smaller using the LEA approach above. As shown in Figure 6.6, the main employment sectors in the regional economy have on average 11% of their labour residing outside the region, reflecting the mobility of labour. Unemployment in the region

was at 17,644 people or 6.6% in December 2015 (Department of Employment, 2015). Wage impacts are therefore not likely to be significant. Where upward pressure on regional wages occurs, it represents an economic transfer between employers and owners of skills and would attract skilled labour to the region leading to downward pressure on wages.

5.5.3 Housing Impacts

The Project will generate some migration of workers and their families into the local area and hence increase demand for housing. However, given the surplus labour in the region, the level of increased demand is modest in comparison to the existing population and forecast growth in population over time. Consequently, the impact on housing prices is expected to be negligible.

Negative impacts on house prices due to potential subsidence impacts are also expected to be negligible given that potentially impacted houses are located within declared MSDs and mechanisms exist to remedy any adverse impacts.

5.6 Contributions to the Local Area

Contributions to the local area as a result of the Project include the Wallarah 2 Community Grants and Guringai Tribal Link Aboriginal Corporation Mutual Advancement Agreement (Guringai MAC) valued together at $100,000 per annum, the Wallarah 2 Apprenticeship program valued at $120,000 per annum and the Voluntary Planning Agreement with Wyong Shire Council, which has a Community and Environment Component value of $4M over the life of the Project. In present value terms, these contributions are estimated at $5.2M.

5.7 Environmental and Social Impacts on the Local Community (Externalities)

The main externalities that potentially accrue to the local area are summarised in Table 5.3.

Table 5.3
Environmental and Social Impacts on the Local Community

Environmental, social and cultural costs	Incidence of Impacts	Magnitude of Impact ($M)
Forestry impacts	NSW Forests but compensated	$0*
Agricultural impacts	Impacted farmers but compensated	$0*
Surface water and local water supply	Local surface water users but compensated via purchase of WALs	$1
Subsidence impacts	Local landholders	Compensation via Mine Subsidence Levy
Flooding	Local landholders	Mitigation measures included in capital and operating costs
Groundwater	Local groundwater users	If WALs purchased off landholders then they are compensated. If from controlled allocation then no impact.
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Noise impacts	Adjoining landholders	Three properties moderately impacted but mitigation measures included in capital costs
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts
Historic heritage impacts	Local and NSW households	Accounted for through Mine Subsidence Levy
Transport and traffic	Local residents	No material impacts. Costs of mitigation measures included in capital and operating costs
Visual amenity	Adjoining landholders	Minor impacts. Mitigation measures included in capital costs
Greenhouse gas impacts	Local and NSW households	$0*
Net public infrastructure costs	NSW Government and NSW households	No material impacts
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts

* These impacts are rounded down to zero.

5.8 Summary of Local Effects

A summary of local effects of the Project is provided in Table 5.4.

Table 5.4
Summary of Local Effects

	Project Direct	Project Direct: Local	Net Effect	Total Net Effect (with multiplier)
Scenario 1				
Employment	300	210	110	312
Net income (M)			$10.6	$18.2
Scenario 2				
Employment	300	150	79	224
Net income (M)			$7.6	$13.1
Scenario 3				
Employment	300	255	134	381
Net income (M)			$12.8	$22.2
Net non-labour expenditure (M)	$65 Mpa			
Second round and flow-on effects	Refer to Section 6			
Contraction in other sectors	No material impact			
Displaced activities	Not applicable			
Wage impacts	No material impact			
Housing impacts	No material impact			
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact ($M)**		
Contributions	Local Aboriginal people and community	$5		
Forestry impacts	NSW Forests but compensated	$0		
Agricultural impacts	Impacted farmers but compensated	$0		
Surface water and local water supply	Local surface water users but compensated via purchase of WALs	$1		
Subsidence impacts	Local landholders	Compensation via Mine Subsidence Levy		
Flooding	Local landholders	Mitigation measures included in capital and operating costs		
Groundwater	Local groundwater users	If WALs purchased off landholders then they are compensated. If from controlled allocation then no impact.		
Air quality impacts	Adjoining landholders	No properties impacted by exceedances		
Noise impacts	Adjoining landholders	Mitigation measures included in capital costs		
Ecology and biodiversity	Local and NSW households	Some loss of values but offset by provision of biodiversity offsets		
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts		
Historic heritage impacts	Local and NSW households	Accounted for through Mine Subsidence Levy		
Transport and traffic	Local residents	No material impacts. Costs of mitigation measures included in capital and operating costs		
Visual amenity	Adjoining landholders	Mitigation measures included in capital and operating costs		
Greenhouse gas impacts	Local and NSW households	$0		
Net public infrastructure costs	NSW Government and NSW households	No material impacts		
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts		

6 SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 Introduction

This section uses IO analysis to identify the gross economic activity footprint associated with the Project on the local economy. While Section 5 assumes full employment in the region (and nation) and no in-migration of labour, IO analysis assumes there is not full employment, allows for job chain effects and in-migration of labour to the region.

6.2 Structure of the Local Economy

For the purpose of the analysis, the local economy is defined as comprising the Gosford, Lake Macquarie and Wyong LGAs. This is the region where the Project is located and the majority of the Project operational workforce is expected to reside.

A 2011 IO table of the regional economy was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 8) using a 2011 IO table of the NSW economy (developed by the Centre for Agricultural and Regional Economics) as the parent table and a 2011 Census employment by industry data for the region. The 111 sector IO table of the regional economy was aggregated to 50 sectors and 8 sectors for the purpose of describing the economy.

A highly aggregated 2011 IO table for the regional economy is provided in Table 6.1. The rows of this table indicates 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). For example, the mining sector in the region sells $50,000 worth of output to the agriculture, forestry and fishing sector of the regional economy, $41,801,000 worth of output to the mining sector of the regional economy etc. It also sells $1,464,000 of output directly to households and exports $1,041,688,000 worth of output from the region.

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 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. For the mining sector to produce $1,390,936,000 worth of output, it purchases $418,000 of inputs from the agriculture, forestry and fishing sector of the regional economy, $41,808,000 of inputs from the mining sector of the regional economy etc. It also imports $195,671,000 of inputs from outside the region, generates $703,451,000 in other value added, employs 1,972 people and pays $235,331,000 in wages and salaries.

Output for the regional economy is estimated at $66,333M. Value-added for the regional economy is estimated at $18,683M, comprising $8,183M to households as wages and salaries and $10,501M in OVA.

The total employment in the regional economy was 142,153 jobs.

The economic structure of the regional economy can be compared with that for NSW through a comparison of results from the respective IO models (Figures 6.1 and 6.2). This reveals that the mining, manufacturing, utilities, trade/accommodation and public personal services sectors in the regional economy are of greater relative importance than they are to the NSW economy, while the agriculture/forest/fishing and business services sectors are of less relative importance than they are to the NSW economy.

Figures 6.3 to 6.5 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the regional economy. From these figures, it is evident that in terms of gross regional output, ownership of dwellings, retail trade and utilities are the most

significant sectors (Figure 6.3). In terms of value-added, retail trade, ownership of dwellings and retail trade are the most significant sectors (Figure 6.3). The retail trade sector is the most significant sector in terms of regional employment (Figure 6.4) while the education, retail trade, health and community care services sectors are the most significant sectors in terms of income (Figure 6.4). Major importing sectors include food manufacturing, metal manufacturing and retail trade, while major exporting sectors include coal mining, utilities, food manufacturing and metal manufacturing (Figure 6.5).

Table 6.1
Aggregated Transactions Table: Regional Economy 2011 ($'000)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Trade/ Accom	Bus. Srvcs	Public/ Pers. Srvcs	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	10,730	418	75,690	63	1,039	14,214	2,439	5,516	**110,110**	61,589	18,737	62,242	**252,678**
Mining	50	41,801	31,052	209,887	3,271	1,196	2,999	1,058	**291,312**	1,464	56,472	1,041,688	**1,390,936**
Manuf.	10,228	39,470	831,363	27,644	341,355	289,885	151,762	180,589	**1,872,297**	810,163	629,253	2,483,539	**5,795,252**
Utilities	1,567	8,617	62,431	260,798	33,312	57,548	53,987	41,782	**520,042**	234,617	358,118	801,788	**1,914,565**
Building	3,682	41,782	34,718	42,140	852,370	62,857	221,058	84,182	**1,342,788**	14,299	1,696,364	123,067	**3,176,519**
Trade/Accom	7,828	19,630	233,034	21,716	69,004	176,933	199,980	196,911	**925,036**	3,213,476	299,407	682,029	**5,119,947**
Bus.Srvcs	12,772	89,018	516,469	67,855	376,905	709,491	1,725,717	685,443	**4,183,670**	3,956,232	545,140	1,822,379	**10,507,421**
Public/Pers Srvcs	3,124	15,748	54,657	10,830	34,725	90,218	235,782	221,857	**666,941**	2,227,724	2,877,099	646,840	**6,418,604**
TOTAL	**49,982**	**256,483**	**1,839,415**	**640,933**	**1,711,981**	**1,402,341**	**2,593,724**	**1,417,338**	**9,912,196**	**10,519,564**	**6,480,590**	**7,663,571**	**34,575,922**
Household Income	36,571	235,331	870,258	187,917	576,919	1,421,324	2,005,301	2,848,924	**8,182,546**	0	0	0	**8,182,546**
OVA	87,615	703,451	831,495	622,614	364,175	1,068,173	3,999,904	1,141,529	**8,818,957**	1,283,693	202,038	196,306	**10,500,994**
Imports	78,509	195,671	2,254,084	463,101	523,445	1,228,109	1,908,492	1,010,813	**7,662,223**	4,411,007	1,000,449	0	**13,073,679**
TOTAL	**252,678**	**1,390,936**	**5,795,252**	**1,914,565**	**3,176,519**	**5,119,947**	**10,507,421**	**6,418,604**	**34,575,922**	**16,214,264**	**7,683,078**	**7,859,877**	**66,333,141**
Employment	**942**	**1,972**	**13,773**	**1,878**	**9,688**	**38,764**	**23,061**	**52,075**	**142,153**				

Figure 6.1
Summary of Aggregated Sectors: Regional Economy (2011)

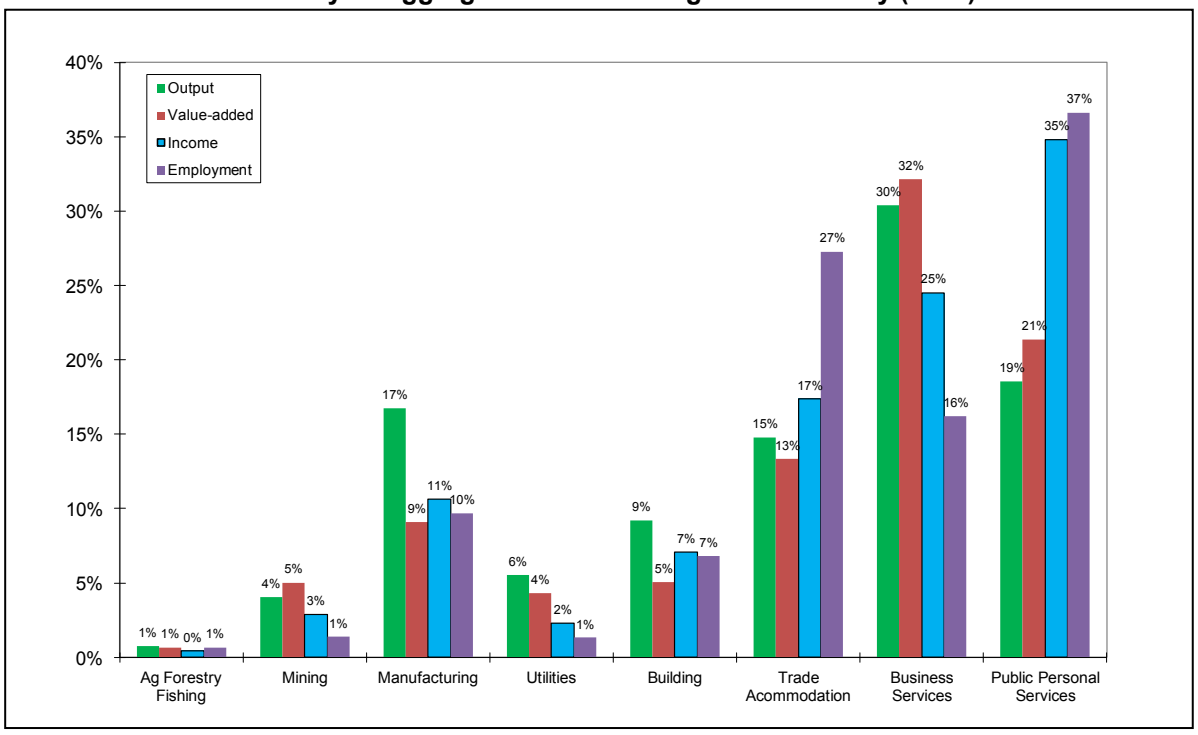


Figure 6.2
Summary of Aggregated Sectors: NSW Economy (2011)

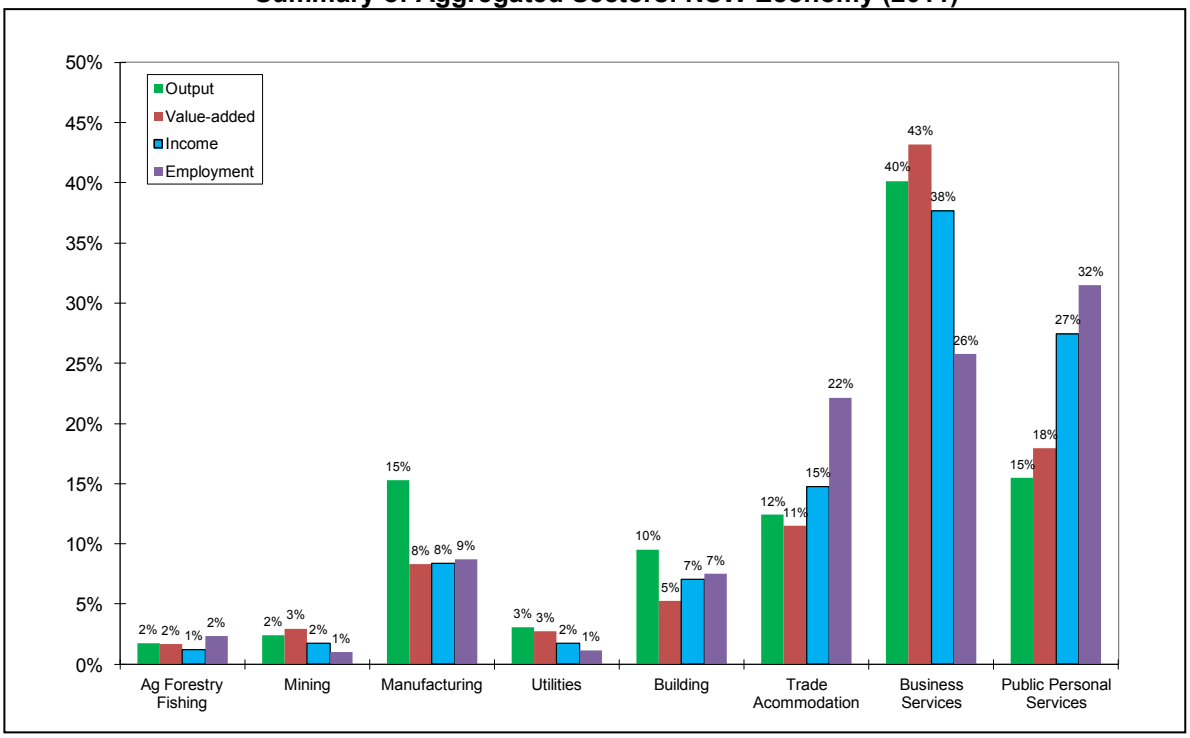
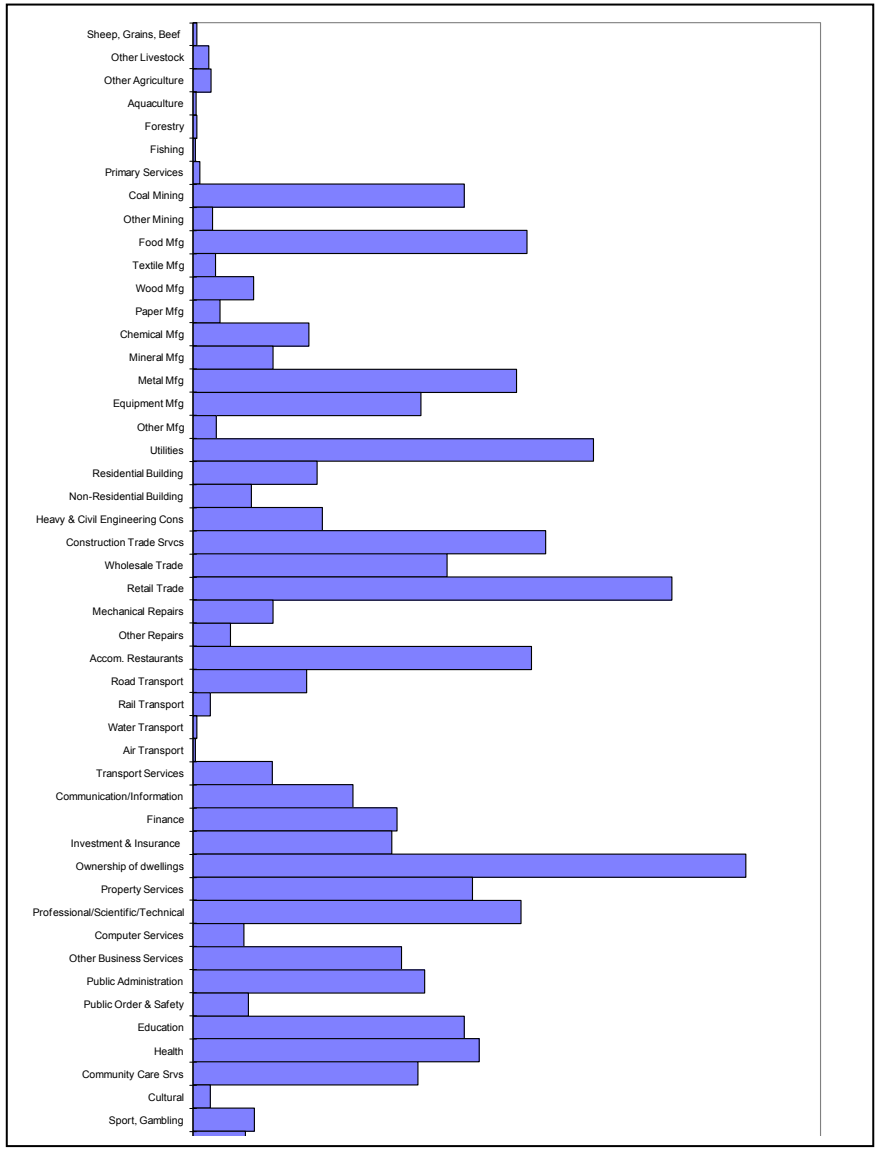


Figure 6.3 Sectoral Distribution of Gross Regional Output and Value Added ($'000)

Output



Value Added

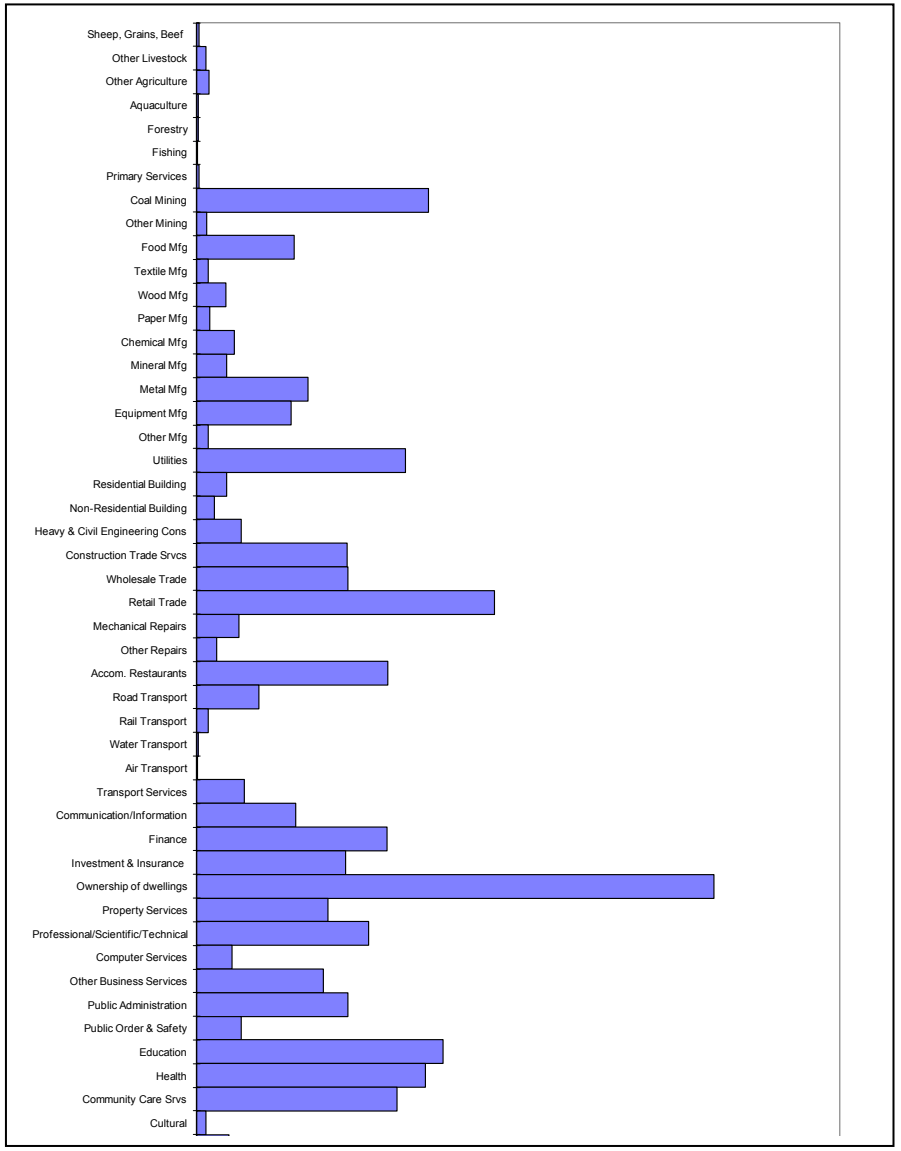


Figure 6.4 Sectoral Distribution of Income ($'000) and Employment (No.)

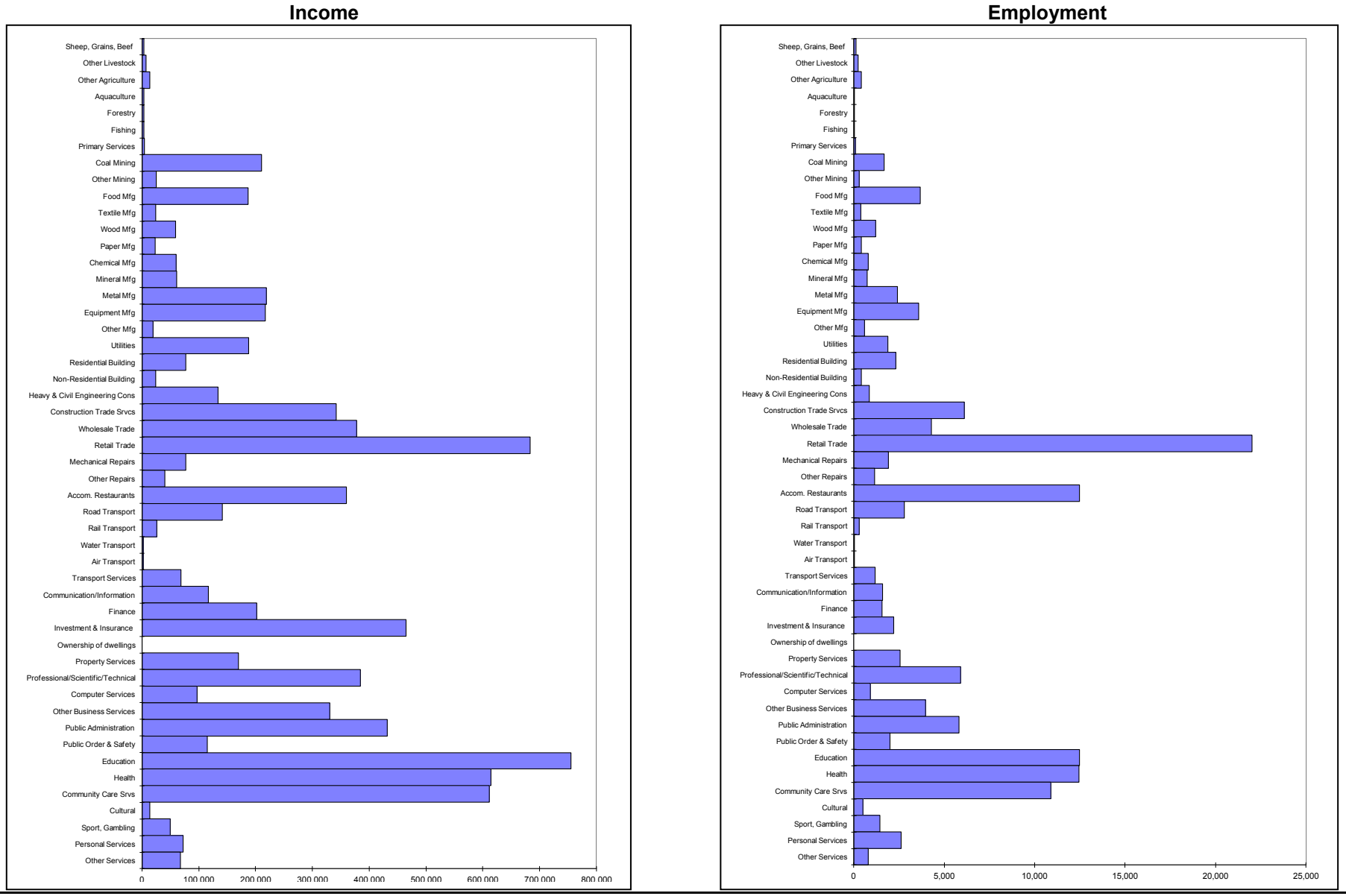
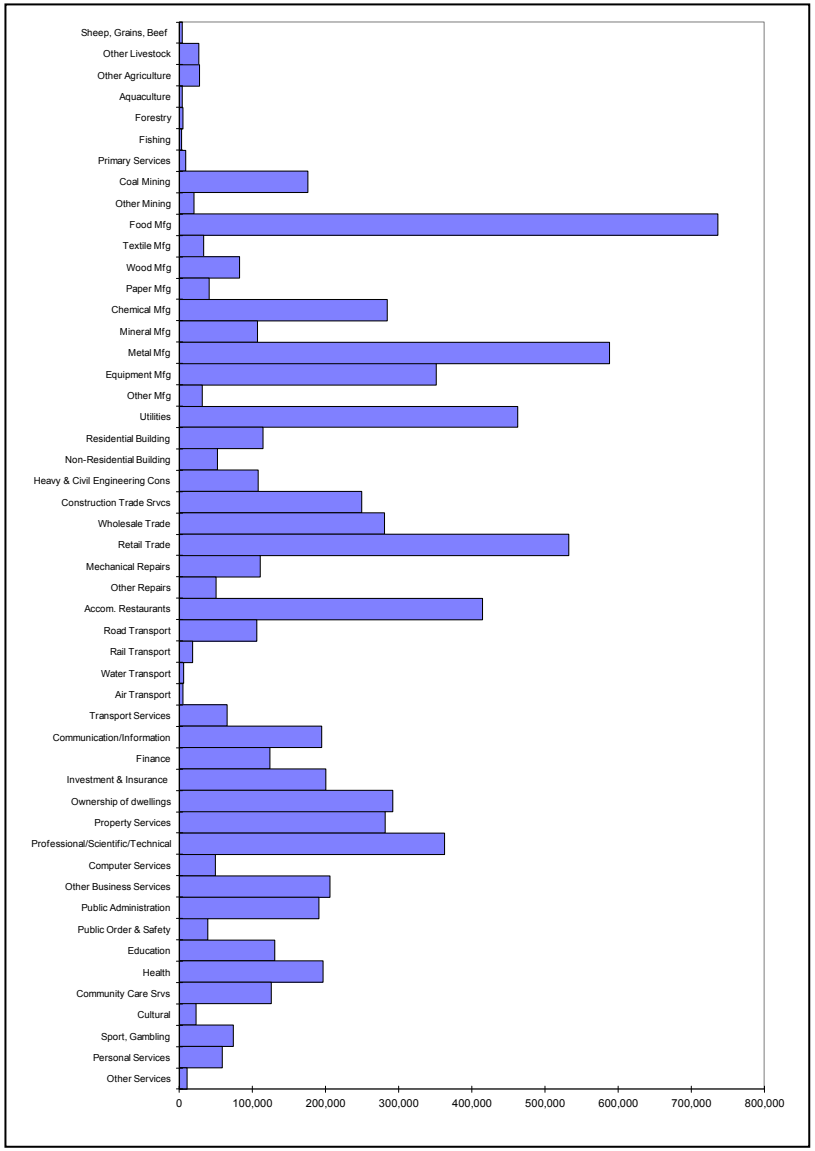


Figure 6.5 Sectoral Distribution of Imports and Exports ($'000)

Imports



Exports

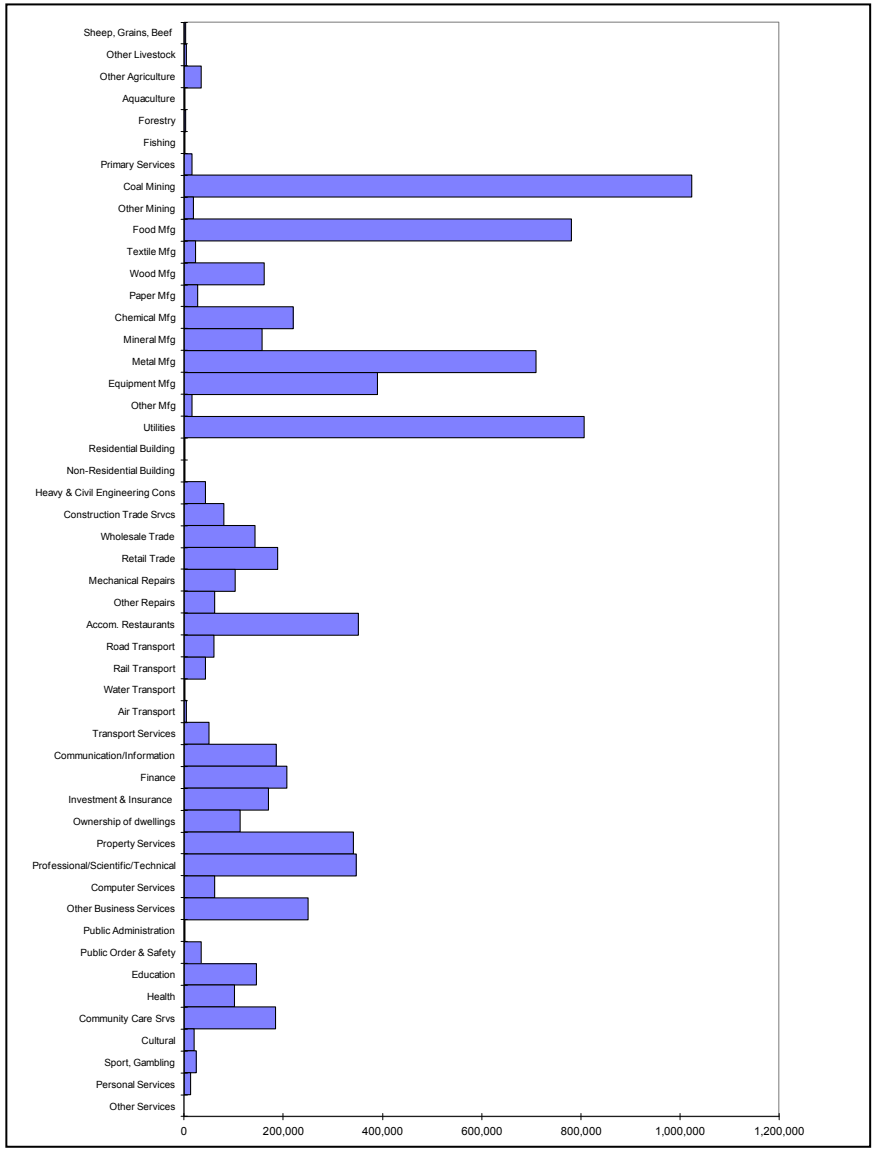
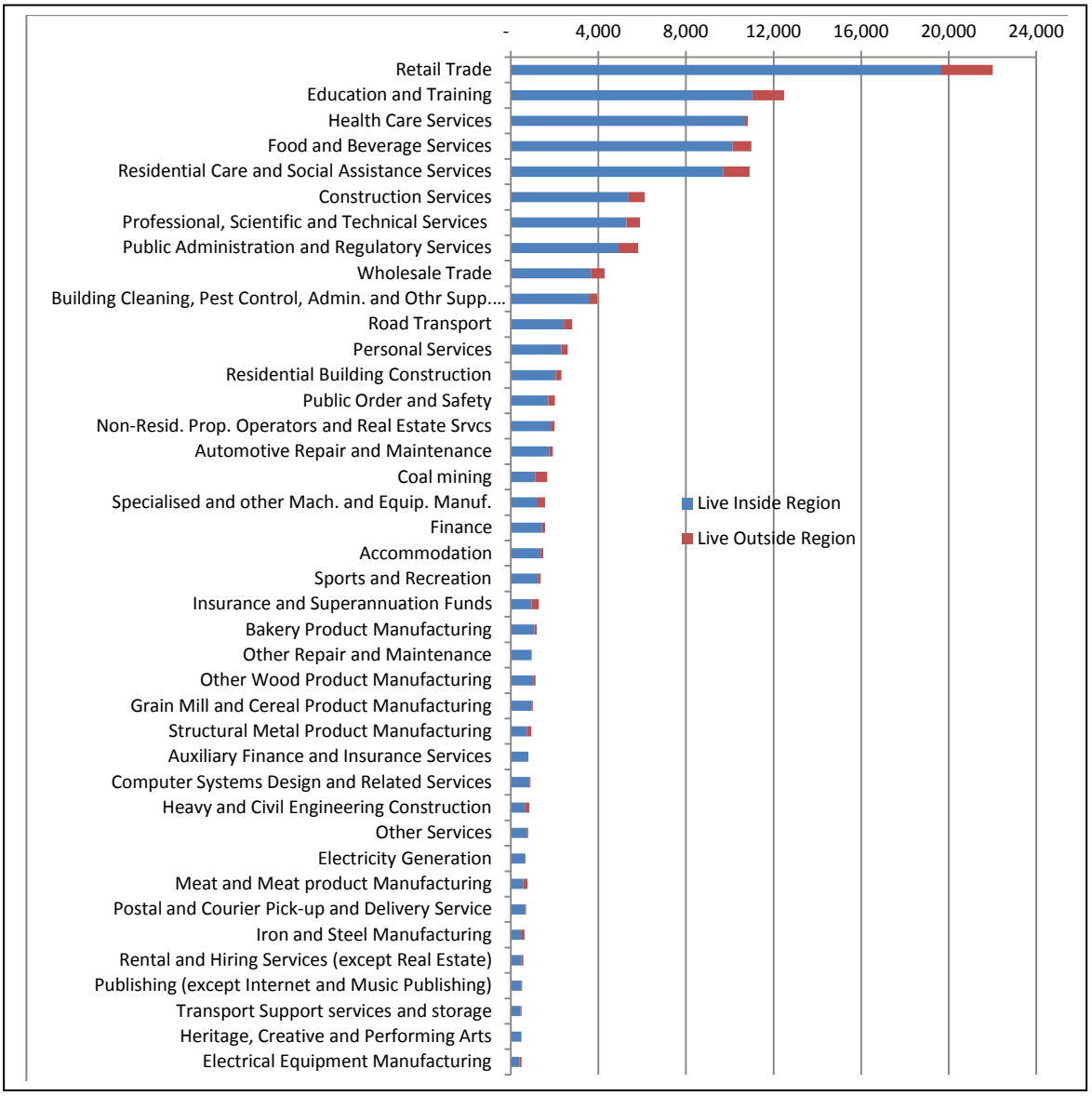


Figure 6.6 shows the top 40 individual industry sectors by employment number for the region. The five most significant employment providers in the region are the retail trade sector, education and training sector, health care services sector, food and beverage services sector and residential care and social assistance services sector. In the top 40 individual industry sectors by employment, 10% of the workforce resides outside the region.

Figure 6.6
Main Employment Sectors in the Region (Job Numbers)



Source: Generated from ABS 2011 census 4 digit employment by industry by place of usual residence data.

6.3 Expenditure During Mining Operation

6.3.1 Introduction

Mining projects provide direct economic activity to regional economies i.e. the output, value-added, income and employment associated with the quarrying operation. All other things being equal, the economic activity arising from a project will depend on:

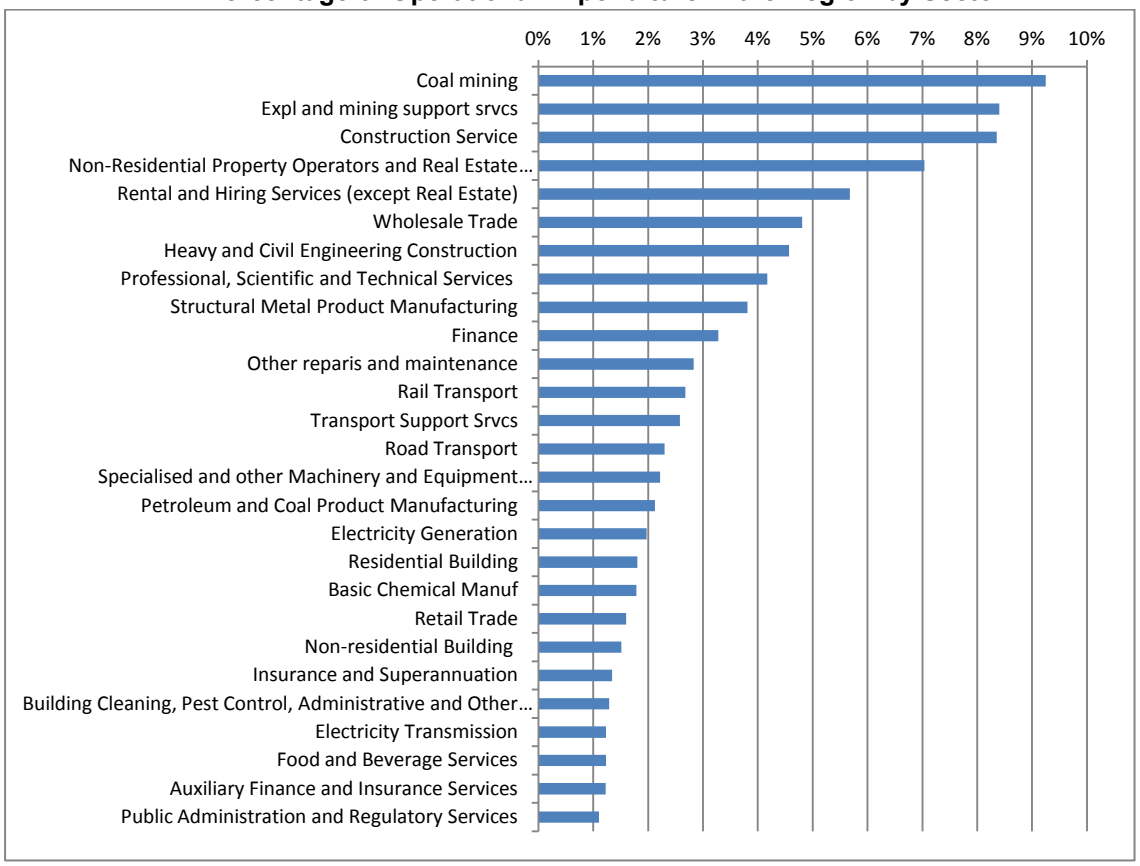
- the expenditure profile in the regional economy that is associated with the project;
- the expenditure profile and residential location of the workforce; and
- the size of the regional economy and the ability of local businesses to supply inputs to production demanded by mine proponents and the workforce.

6.3.2 Mining Operation Expenditure

The Project is a new development. Some indication of the main sectors of the regional economy that may directly benefit from the Project operation can be obtained by examining the regional expenditure pattern of the coal mining sector in regional IO table. This has been developed based on the expenditure pattern of the coal mining sector in a NSW IO table and the application of location quotients[24] to assess the ability of sectors in the regional economy to supply the goods and services demanded. Based on this approach, the main sectors in the regional economy to benefit from direct operational expenditure are shown in Figure 6.7.

[24] Location quotients are a way of quantifying how "concentrated" an industry is in a region compared to a larger geographic area, in this case NSW. They are calculated by comparing the industry's share of regional employment with its share of NSW employment. A LQ of one indicates that the concentration of an industry's employment in a region is the same as for the state. A LQ of greater than one indicates the region has a greater concentration of employment in an industry compared to NSW and hence the likelihood of this sector in a region being able to provide the goods and services demanded by a project are greater than where the concentration is less than one.

Figure 6.7
Percentage of Operational Expenditure in the Region by Sector

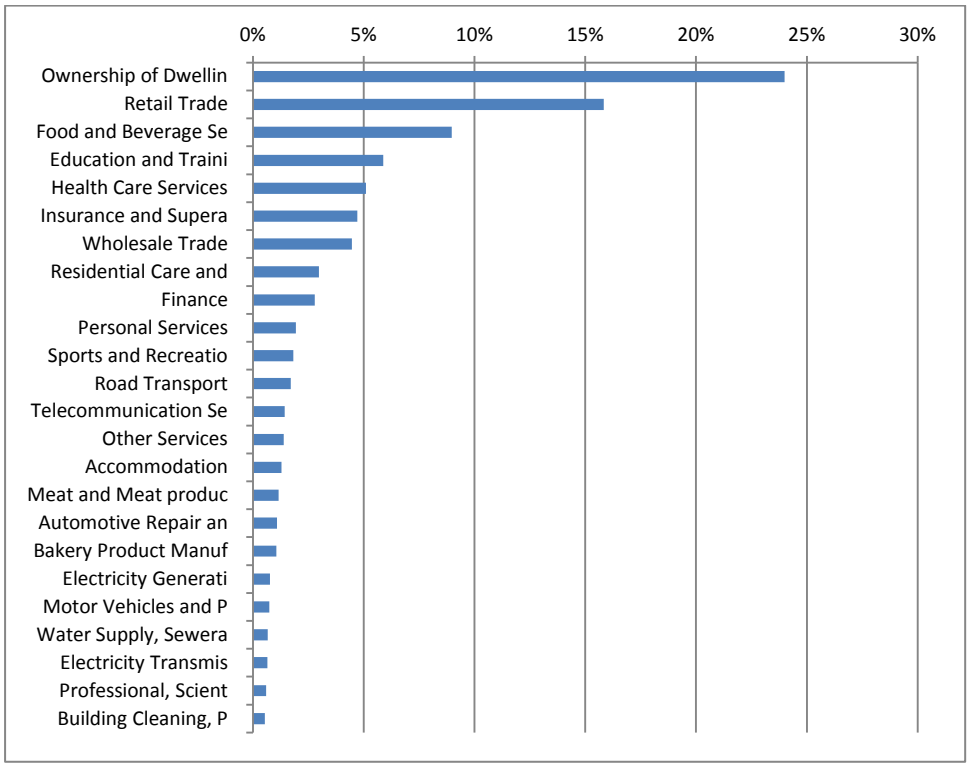


6.3.3 Mine Employee Expenditure

Economic activity in the region will also arise from the expenditure of the Project's workforce in the region. It is estimated that the Project will have 300 direct employees. Ninety percent are estimated to live in the region[25]. An indication of the main sectors of the regional economy that may benefit from employee expenditure can be obtained by examining the expenditure pattern of the household sector in the NSW IO table adjusted to the region using location quotients. Based on this approach the main sectors in the regional economy to benefit from direct expenditure of wages in the regional economy are shown in Figure 6.8. The main sectors benefitting from workforce expenditure are the ownership of dwellings sector, retail trade sector, food and beverage services sector and the education and training sector.

[25] This includes local hires plus those migrating into the region.

Figure 6.8 - Percentage of Employee Expenditure in the Region by Sector



6.4 Regional Impact of the Project

The revenue, expenditure and employment associated with the construction and operation phases of the Project would stimulate economic activity for the regional economy, as well as for the broader NSW economy, as described in this section.

6.4.1 Construction Phase

Introduction

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

- the *heavy and civil engineering construction sector* which includes businesses involved in the mine sites;
- the *construction services sector* which includes businesses involved in site preparation services, plumbing, electrical, and other trades; and
- the *specialised and other machinery and equipment manufacturing sector which includes the manufacturing of mining machinery and equipment*.

Impact on Regional Economy

The average annual Project construction workforce is estimated to reach a peak of approximately 450 in Year 2. For Year 1 and Year 3, the average annual construction workforce is estimated at 250 and 400, respectively.

To support 450 construction workers (Year 2), reference to the input-output coefficients for the region shows that approximately $163M of capital expenditure would be required in the *heavy and civil*

engineering construction sector and *construction services sector.* The direct and indirect regional economic impact of this level of expenditure in the regional economy is reported in Table 6.2.

Expenditure on machinery and equipment is estimated to reach a peak of $65M in Year 3. For Years 1, 2 and 4 the estimated expenditure on machinery and equipment is $15M, $50M and $40M, respectively. WACJV advise that in the order of 25% of these machinery and equipment purchases will occur within the region. The direct and indirect regional economic impact of $16.25M expenditure in the regional economy (Year 3) is reported in Table 6.3.

Impacts

Table 6.2
Economic Impacts of the Construction Workforce on the Regional Economy (Year 2)

	Direct	Production induced	Consumption induced	Total Flow on*	TOTAL EFFECT*
OUTPUT ($'000)	163,212	141,850	57,967	199,817	363,030
Type 11A Ratio	1.00	0.87	0.36	1.22	2.22
VALUE ADDED ($'000)	53,636	54,823	31,818	86,642	140,278
Type 11A Ratio	1.00	1.02	0.59	1.62	2.62
INCOME ($'000)	28,578	27,175	11,748	38,923	67,501
Type 11A Ratio	1.00	0.95	0.41	1.36	2.36
EMPL. (No.)	450	420	241	661	1,111
Type 11A Ratio	1.00	0.93	0.54	1.47	2.47

Note: Totals may have minor discrepancies due to rounding.

Table 6.3
Economic Impacts of Construction Equipment Purchases on the Regional Economy (Year 3)

	Direct	Production induced	Consumption induced	Total Flow on*	TOTAL EFFECT*
OUTPUT ($'000)	13,871[1]	7,223	3,563	10,786	24,657
Type 11A Ratio	1.00	0.52	0.26	0.78	1.78
VALUE ADDED ($'000)	4,865	2,793	1,956	4,749	9,614
Type 11A Ratio	1.00	0.57	0.40	0.98	1.98
INCOME ($'000)	2,200	1,226	722	1,948	4,149
Type 11A Ratio	1.00	0.56	0.33	0.89	1.89
EMPL. (No.)	41	20	15	35	77
Type 11A Ratio	1.00	0.49	0.36	0.85	1.85

Note: Totals may have minor discrepancies due to rounding.
[1] While $16,250,000 is estimated to be spent in the local economy an adjustment has been made for some leakage of construction of machinery outside the economy based on location quotients.

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

Production-induced effects occur in a near-proportional way within a region, whereas the consumption-induced flow-on effects only occur in a proportional way if workers and their families are located in the region or migrate into the region. Where workers commute from outside the region, some of the consumption-induced flow-on effects leak from the region.

In total, the construction workforce of the Project during the peak construction year (Year 2) would contribute in the order of up to:

- $363M in annual direct and indirect output;
- $140M in annual direct and indirect value added;
- $68M in annual direct and indirect household income; and
- 1,111 direct and indirect jobs.

Proportionally less impact would be felt in Year 1 and Year 3 of the construction phase of the Project as indicated in the summary table below.

Table 6.4
Summary of Economic Impacts of Construction on the Regional Economy

	Direct and Indirect Output ($000)	Annual Direct and Indirect Value Added ($000)	Annual Direct and Indirect Household Income ($000)	Direct and Indirect Jobs (No.)
Year 1	201,679	77,931	37,500	617
Year 2	363,030	140,278	67,501	1,111
Year 3	322,686	124,689	59,999	988

In total, the construction equipment purchases of the Project during the peak year of expenditure (Year 3) would contribute in the order of up to:

- $25M in annual direct and indirect output;
- $10M in annual direct and indirect value added;
- $4M in annual direct and indirect household income; and
- 77 direct and indirect jobs.

Proportionally less impact would be felt in Year 1, Year 2 and Year 4 from equipment purchases as indicated in the summary table below.

Table 6.5
Summary of Economic Impacts of Construction Equipment Purchases on the Regional Economy

	Direct and Indirect Output ($000)	Annual Direct and Indirect Value Added ($000)	Annual Direct and Indirect Household Income ($000)	Direct and Indirect Jobs (No.)
Year 1	5,690	2,219	957	18
Year 2	18,967	7,395	3,191	59
Year 3	24,657	9,614	4,149	77
Year 4	15,174	5,916	2,553	47

Multipliers

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

The Type 11A ratio multipliers for the construction workforce of the Project range from 2.22 for output up to 2.62 for value-added. The Type 11A ratio multipliers for the equipment expenditure in the region range from 1.78 for output up to 1.98 for value-added.

Main Sectors Affected

The input-output analysis indicates that construction is most likely to directly impact the heavy and civil engineering construction sector and construction services sector. 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 construction services, wholesale and retail trade, professional, scientific and technical services and building, cleaning, pest control, administrative and other support services, heavy and civil engineering constructions.

The input-output analysis indicates that impacts from the equipment purchases are most likely to directly impact the specialised and other machinery and equipment manufacturing sector. The sectors most impacted by output, value-added, income and employment flow-ons are likely to be iron and steel manufacturing, wholesale and retail trade, professional, scientific and technical services, non-residential property operators and real estate services, building, cleaning, pest control, administrative and other support services and food and beverage services.

Impact on the NSW Economy

When the impact of $163M of expenditure in the heavy and civil engineering construction sector and construction services sector is assessed for the NSW economy (Table 6.6), the impacts are greater because of the larger inter-sectoral linkages and hence multipliers of a larger economy.

The impact of machinery and equipment purchases on the NSW economy are also greater than for the regional economy (Table 6.7) as the NSW economy is able to capture more of the machinery and equipment purchases (75%) and the larger economy has greater inter-sectoral linkages and hence multipliers.

Impacts

Table 6.6
Economic Impacts of the Construction Workforce on the NSW Economy (Year 2)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	163,212	202,374	161,710	364,084	527,296
Type 11A Ratio	1.00	1.24	0.99	2.23	3.23
VALUE ADDED ($'000)	53,636	83,127	86,652	169,779	223,415
Type 11A Ratio	1.00	1.55	1.62	3.17	4.17
INCOME ($'000)	37,389	52,016	40,125	92,141	129,530
Type 11A Ratio	1.00	1.39	1.07	2.46	3.46
EMPL. (No.)	450	576	579	1,155	1,605
Type 11A Ratio	1.00	1.28	1.29	2.57	3.57

Note: Totals may have minor discrepancies due to rounding.

Table 6.7
Economic Impacts of Construction Equipment Purchases on the NSW Economy (Year 3)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	47,603	38,833	35,054	73,886	121,489
Type 11A Ratio	1.00	0.82	0.74	1.55	2.55
VALUE ADDED ($'000)	17,011	15,813	18,783	34,597	51,608
Type 11A Ratio	1.00	0.93	1.10	2.03	3.03
INCOME ($'000)	10,641	8,739	8,698	17,437	28,078
Type 11A Ratio	1.00	0.82	0.82	1.64	2.64
EMPL. (No.)	142	106	125	232	374
Type 11A Ratio	1.00	0.75	0.88	1.63	2.63

Note: Totals may have minor discrepancies due to rounding.
[1] While $48,750,000 is estimated to be spent in the NSW economy an adjustment has been made for some leakage of construction of machinery outside the economy based on location quotients.

Based on the above approach, expenditure in the *heavy and civil engineering construction sector* and *construction services sector* during the peak construction year of the Project (Year 2) would result in impacts on the NSW economy of up to:

- $527M in annual direct and indirect output;
- $223M in annual direct and indirect regional value added;
- $129M in annual direct and indirect household income; and
- 1,605 direct and indirect jobs.

Proportionally less impact would be felt in Year 1 and Year 3 of the construction phase of the Project as indicated in the summary table below.

Table 6.8
Summary of Economic Impacts of Construction on the NSW Economy

	Direct and Indirect Output ($000)	Annual Direct and Indirect Value Added ($000)	Annual Direct and Indirect Household Income ($000)	Direct and Indirect Jobs (No.)
Year 1	292,942	124,119	71,961	892
Year 2	527,296	223,415	129,530	1,605
Year 3	468,707	198,591	115,138	1,427

The impact of the peak year of equipment purchases (Year 3) on the NSW economy would be up to:

- $121M in annual direct and indirect output;
- $51M in annual direct and indirect value added;
- $28M in annual direct and indirect household income; and
- 374 direct and indirect jobs.

Proportionally less impact would be felt in Year 1, Year 2 and Year 4 from equipment purchases as indicated in the summary table below.

Table 6.9
Summary of Economic Impacts of Construction Equipment Purchases on the NSW Economy

	Direct and Indirect Output ($000)	Annual Direct and Indirect Value Added ($000)	Annual Direct and Indirect Household Income ($000)	Direct and Indirect Jobs (No.)
Year 1	28,036	11,909	6,480	86
Year 2	93,453	39,698	21,599	288
Year 3	121,489	51,608	28,078	374
Year 4	74,763	31,759	17,279	230

6.4.2 Operation Phase

Impact on the Regional Economy

Introduction

For the analysis of the Project, a Project sector was inserted into the regional input-output table[26] reflecting average annual production levels for the Project, once production has ramped up. The revenue, expenditure and employment data for this new sector was obtained from financial information provided by WACJV. For this new sector:

- the estimated gross annual revenue of the Project was allocated to the o*utput* row;
- the estimated wage bill of employees 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 WACJV;
- 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 were 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 2015 dollars) are shown in Table 6.10.

[26] Inflated to 2015

Table 6.10
Annual Regional Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	437,690	96,775	59,443	156,219	593,909
Type 11A Ratio	1.00	0.22	0.14	0.36	1.36
VALUE-ADDED ($'000)	271,797	37,764	32,629	70,392	342,189
Type 11A Ratio	1.00	0.14	0.12	0.26	1.26
INCOME ($'000)	40,153	17,019	12,047	29,067	69,220
Type 11A Ratio	1.00	0.42	0.30	0.72	1.72
EMPLOYMENT (No.)	300	306	247	553	853
Type 11A Ratio	1.00	1.02	0.82	1.84	2.84

Note: Totals may have minor discrepancies due to rounding.

Again regional economic impacts are separated out between production-induced effects and consumption-induced effects. Production-induced effects occur in a near-proportional way within a region. Where workers commute from outside the region some of the consumption-induced flow-on effects leak from the region. Where workers are already located in the region i.e. unemployed or employed, some of the consumption-induced flow-ons in the region may already be occurring through expenditure of their current wage or unemployment benefits.

The Project is estimated to make up to the following contribution to the regional economy (Table 6.10):

- $593M in annual direct and indirect regional output or business turnover;
- $342M in annual direct and indirect regional value-added;
- $69M in annual direct and indirect household income; and
- 853 direct and indirect jobs.

Multipliers

Type 11A ratio multipliers for the Project range from 1.26 for value-added up to 2.84 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:

- Specialised and other Machinery and Equipment Manufacturing Sector;
- Professional, Scientific and Technical Services Sector;

- Other Repair and Maintenance Sector;
- Exploration and Mining Support Services Sector;
- Retail Trade Sector;
- Wholesale Trade Sector;
- Food and Beverage Services Sector;
- Education and Training Sector;
- Food and Beverage Services Sector;
- Building Cleaning, Pest Control, Administrative and Other Support Services Sector; and
- Health Care Services 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 6.11).

Table 6.11
Sectoral Distribution of Total Regional Employment Impacts of the Project

Sector	Average Direct Effects	Production Induced	Consumption Induced	Total
Primary	0	0	2	2
Mining	300	28	0	329
Manufacturing	0	102	15	117
Utilities	0	6	2	7
Wholesale/Retail	0	26	75	102
Accommodation, cafes, restaurants	0	8	34	42
Building/Construction	0	5	4	9
Transport	0	13	8	21
Services	0	118	107	225
Total	**300**	**306**	**247**	**853**

Note: Totals may have minor discrepancies due to rounding.

Table 6.11 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 the *manufacturing, wholesale/retail, services* and *mining* sectors, while consumption induced flow-on employment would be mainly in the *services, wholesale/retail trade and accommodation/cafes/restaurants* sectors (Table 6.11).

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 NSW input-output table in the same manner described in Section 6.4.2. The primary difference from the Project sector identified for the regional economy was that a greater level of expenditure would 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 2015 dollars) are shown in Table 6.12.

Table 6.12
Annual State Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($'000)	437,690	139,291	130,975	270,267	707,957
Type 11A Ratio	1.00	0.32	0.30	0.62	1.62
VALUE-ADDED ($'000)	271,798	56,056	70,182	126,238	398,036
Type 11A Ratio	1.00	0.21	0.26	0.46	1.46
INCOME ($'000)	40,153	32,259	32,499	64,758	104,911
Type 11A Ratio	1.00	0.80	0.81	1.61	2.61
EMPLOYMENT (No.)	300	410	469	879	1,179
Type 11A Ratio	1.00	1.37	1.56	2.93	3.93

Note: Totals may have minor discrepancies due to rounding.

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

- $707M in annual direct and indirect output;
- $398M in annual direct and indirect regional value added;
- $104M in annual direct and indirect household income; and
- 1,179 direct and indirect jobs.

The estimated Project contributions to the NSW economy are 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.

6.5 Potential Contraction in Other Sectors

Economic impacts for regional economies modelled using IO analysis represent only the gross or positive economic activity associated with the Project. Where employed and unemployed labour resources in the region are limited and the mobility of in-migrating or commuting labour from outside the region is restricted, there may be competition for regional labour resources as a result of the individual project that drives up regional wages. In these situations, there may be some 'crowding out' of economic activity in other sectors of the regional economy.

'Crowding out' would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is not at full employment and is an open economy with access

to external labour resources. Consequently, 'crowding out' of economic activity in other sectors as a result of the Project would not be expected to be significant.

However, even where there is some 'crowding out' of other economic activities this does not indicate losses of jobs but the shifting of labour resources to higher valued economic activities. This reflects the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore considered a positive outcome for the economy not a negative.

6.6 Mine Cessation

As outlined in Section 6.4, the Project would provide direct and indirect economic activity in the regional economy for 28 years. Conversely, the cessation of the mining operations in the future 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 on the regional economy would depend on whether the workers and their families affected would leave the area. 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 number 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 6.10. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 6.10.

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

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 the 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 have little impact.

Nevertheless, given the uncertainty about the future prospects in the regional economy, it is not possible to predict the likely circumstances within which Project cessation would occur.

7 CONCLUSION

A CBA of the Project indicated that it would have net production benefits to NSW of $275M, present value at 7% discount rate. Provided the residual environmental, social and cultural impacts of the Project that accrue to NSW are considered to be valued at less than $275M, the Project can be considered to provide an improvement in economic efficiency and hence relative to the "without Project" scenario is justified on economic grounds.

Adverse uncompensated environmental, social and cultural impacts of the Project have been minimised through project design and mitigation, offset and compensation measures. The cost of implementing these measures have already been incorporated into the estimate of net production benefits, including the cost of using land and water resources, subsidence impacts, flooding impacts, noise mitigation and acquisition costs in accordance with the Voluntary Land Acquisition and Management Policy, provision of biodiversity offsets and the cost of intersection upgrades and maintenance. Expert technical investigations indicate no material impacts are envisaged in relation to air quality, Aboriginal heritage, public infrastructure or loss of surplus to other industries. Impacts that were quantified included forestry, agriculture, surface water and greenhouse gas generation, however these are minor compared to the estimated net production benefits of the Project.

There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $211M, present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of $274M to $485M, present value at 7% discount rate and hence relative to the "without Project" scenario is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $274M to $485M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The key driver of the net social benefits to NSW are the royalties generated. These are a function of Project revenue and are unaffected by assumptions about land opportunity costs, development costs, operating costs, mitigation, offset and compensation costs or effective company tax rates.

The relative magnitude of royalties and unmitigated environmental, cultural and social impacts indicates that even with large changes to the assumed coal price, the net production benefits of the Project to NSW would still far outweigh any residual impacts of the Project.

Local Effects Analysis

Under the strict LEA assumptions of full regional employment and no in-migration of labour, the Project is estimated to contribute between 79 and 134 direct full-time equivalent mining jobs and direct net regional income to existing residents of between $7.6M and $12.8M per annum.

Including multiplier effects the annual regional impact for 28 years is estimated at:

- $13M to $22M in direct and indirect household income; and
- 224 to 381 direct and indirect jobs.

Supplementary Local Effects Analysis using Input-Output Analysis

A supplementary LEA was undertaken using IO analysis. This method relaxes the restrictive assumptions of the LEA and allows for divergence from full employment, job chains effects and in-migration of labour to the region.

Using this approach it is estimated that the Project would make up to the following annual incremental contribution to the regional economy[27] for up to 28 years:

- $593M in annual direct and indirect regional output or business turnover;
- $342M in annual direct and indirect regional value-added;
- $69M in annual direct and indirect household income; and
- 853 direct and indirect jobs.

The actual regional impact of the Project operation is likely to lie between that assessed in the LEA and the Supplementary LEA.

Additional regional economic activity would be generated during the construction phase of the Project via expenditure of the construction workforce and purchase of equipment.

[27] The Local Government Areas of Wyong, Gosford and Lake Macquarie.

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ATTACHMENT 1 – LEGISLATIVE CONTEXT FOR ECONOMIC ANALYSIS IN EIA

Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation

- The basis for economic analysis under the *Environmental Planning and Assessment* (EP&A) *Act 1979* emanates from:
  - the definition of the term "environment" in the EP&A Act which is broad and includes the social and **economic** environment, as well as the biophysical environment;
  - the "objects" of the EP&A Act which includes *"promoting the social and **economic welfare** of the community"*; and
  - Clause 7(1)(f) of Schedule 2 of the EP&A Regulations which requires environmental assessment to provide "*the reasons **justifying** the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, **economic** and social considerations…"*
  - *Section 79C of the EP&A Act requires the following two matters to be taken into consideration by the consent authority in determining a development application:*
    - the public interest (taken as the collective public interest of households in NSW); and
    - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- Objects of promoting economic welfare and requirements to justify a project having regard to economic considerations are consistent with the use of CBA. A Note to Clause 7 (1) (f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- A cost benefit analysis is consistent with the consideration of the public interest, although the limitation of public interest to NSW households requires consideration of the costs and benefits to NSW households, whereas CBA would normally be undertaken at the National level.
- Elements of CBA can provide information on the economic impacts in the locality, although CBA should not be undertaken at the local level. This can be supplemented by other forms of analysis to examine economic impacts in the locality such as the consideration of:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.

Secretary's Environmental Assessment Requirements

- The Project SEARs include a requirement for:
  - 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;

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

- a detailed description of the measures that would be implemented to minimise the adverse social and economic impacts of the project including any infrastructure improvements, or contributions and/or voluntary planning agreement or similar mechanisms.

Other Economic Guidelines

- In 2015 the NSW Government prepared *Guidelines for the economic assessment of mining and coal seam gas proposals*. This provides an outline of how to undertake a CBA and local effects analysis of mining and coal seam gas proposals.

- NSW Treasury (2007) *NSW Government Guideline for Economic Appraisal*, provides guidance for Government agencies on how to undertake CBA of significant spending proposals, including proposed capital works, projects and new programs across all public sector agencies. However, many of the principles have broader application.

ATTACHMENT 2 – INTRODUCTION TO ECONOMIC METHODS

Cost Benefit Analysis

- Cost Benefit Analysis (CBA) is the primary way that economists evaluate projects and policies.

- CBA evaluates whether the well-being (**economic welfare**) of the community is in aggregate improved by a project. It does this by comparing the costs and benefits of a project to the community.

- The community whose welfare is included is broadly defined as anyone who bears significant costs and benefits of a project. However, in practice most CBA is undertaken at a national level. CBA at a sub-national level is not recommended however if undertaken at this level should provide decision-makers with estimates of all significant effects, including those to non-residents of the sub-national region.

- It is not possible to justify a project on economic grounds without doing a CBA.

Economic Activity Analysis

- Economists also often provide information to decision-makers on the **economic activity** that a project will provide to the regional, state or national economy. This is particularly relevant at the regional level since many regions and towns are experiencing long term decline as a result of structural change in the economy. Additional economic activity can help the prosperity of these regions.

- **Direct** economic activity provided by a project can be estimated from financial and labour estimates for a project. Methods that can be used to estimate **direct** and **indirect** economic activity include IO analysis and CGE modelling. Refer to Attachment 3 for a comparison of these methods and their assumptions.

- While economic activity measures from IO analysis and CGE modelling e.g. direct and indirect output, value-added and income, are generally not measures of benefits and costs relevant to a CBA this information can be of interest to decision-makers[28].

Economic Analysis and Decision-Making

- CBA and local effects analysis (including IO/CGE analysis) are not mechanised decision-making tools, but rather means of analysis that provide useful information to decision-makers.

- Decision-making is multi-dimensional. CBA is concerned with the single objective of **economic efficiency** (economic welfare) while IO analysis and CGE are concerned with the objective of **economic activity** (growth). They do not address equity and other objectives of government. Decision-makers therefore need to consider the economic efficiency and economic activity implications of a project, as indicated by CBA and IO/CGE analysis respectively, alongside the performance of a project in meeting other, often conflicting, government goals and objectives.

[28] It should be noted that it is possible to analyse industry benefits and costs within a general equilibrium framework where impacts are of a sufficient scale that they flow through into multiple sectors in the economy. However, for individual projects a partial equilibrium framework is the preferred approach for the estimation of costs and benefits (US EPA (2010) Guidelines for Preparing Economic Analyses, US EPA).

ATTACHMENT 3 – COMPARISON OF INPUT-OUTPUT ANALYSIS AND THE LEA METHOD

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the mine site then all these jobs are counted in IO analysis as a direct effect i.e. direct employment in the region, because the jobs are located in the region. However, in IO analysis only the income of employees living in the region are counted as direct income effects since it is only wages expenditure of those living in the region that flows through the regional economy. In IO analysis, if 40% of a projects jobs are filled by people who already reside in the region then the **total** wages of these people is counted as a direct regional income effect of the project. Similarly, if 40% of the new jobs are taken by people who migrate into the region this is also counted as direct income for the region, as it is income that will accrue to people living in the region even though they are new residents. In IO analysis, the income of those residing outside the region is excluded as most of their income will be taken home after shift and spent where they live or elsewhere.

These direct employment and income effects for the region are those **associated** with the project i.e. the gross footprint, rather than specifically an assessment of **incremental** effects. This is partly because assessment of incremental effects becomes highly contentious and difficult. However, as will be shown below, these gross direct effects associated with a project can also be a reasonable approximation of incremental effects when "trickle down" or "job chain" effects are considered.

However, first is a comparison between how IO analysis treats direct employment and income effects (as explained above) and that of LEA in the NSW (2015) guideline.

The guideline splits labour into those ordinarily resident in the region and those not ordinarily resident in the locality. For those ordinarily resident in the region the guideline suggests calculation of incremental income as the difference between a mining income and the average level of income in other industries in the region. Incremental direct employment is then calculated by dividing this incremental income by the average wage in mining.

The guideline ignores workers who migrate into the region to work. However, using the rationale of the guideline, workers who migrate into the region to take jobs in a project provide a greater level of incremental income and spending in the region than those that to take jobs in a project and who already reside in the region. The entire wage of those migrating into the region is additive to regional income in comparison to wage increments for those already residing in the region.

Table 1 provides an example of incremental wages using the guideline method and when income from those migrating into the region is counted. If only the incremental wages of those who already reside in the region are counted the incremental impact is $1.4M in annual wages. However, if the incremental wages to the region from those who migrate into the region are included, this increases to $5.4M.

Table 1 - Incremental Income when Immigrating Workforce is Included

Categories of Workers	Direct Empl	Current Wages @$65k	New Wages @$100k	Incremental New Wages for Workers	Incremental New Wages to the Region
Already Live in Region	40	2,600,000	4,000,000	1,400,000	1,400,000
Migrate into Region to Live	40	2,600,000	4,000,000	1,400,000	4,000,000
Commute from outside	20	1,300,000	2,000,000	700,000	0
Total Direct Empl	**100**	**6,500,000**	**10,000,000**	**3,500,000**	**5,400,000**

Even for those already living in the region who are already employed, the incremental income estimated using the guideline will substantially understate additional regional income effects. This is because new jobs in a region create a chain of job opportunities (referred to in the literature as the

"trickle down" effect or "job chain" - see Persky et al, 2004 What are jobs worth?, Employment Research Vol. 11 , p. 3).

An already employed person in the region moving into a mining job, creates a job vacancy, which can be filled by those in the region (already employed, unemployed or attracted into the labour force) or by in-migration. Where this job is filled by those already employed in the region this in turn creates another vacancy etc. Following the entire chain through, the cumulative increase in wages to a region would approach the wages of the total direct mining jobs. It would only be discounted if the chain ends with employment of those from local residents in the unemployment pool (who are receiving an allowance and hence already are spending income in the region) or if jobs remain unfilled. In periods of higher unemployment rates, jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new jobs.

Table 2 demonstrates the "trickle down" effect in relation to 40 new mining jobs filled by already employed local workers. It shows that the total annual wages of the new mining jobs is $4M. Under the trickle down approach where all jobs are backfilled including ultimately by 40 local residents from the unemployment pool the incremental wages to the region are $3.5M. If some of these jobs filled from the unemployment pool are ultimately filled by in-migration the difference between the incremental wages to the region and the total annual mining jobs wages will lessen.

The guideline does not take account of the "trickle down" effect and essentially assumes that the previous jobs of "job movers" in the region remain vacant for the life of the Project.

Incorporation of consideration of the "trickle down" effect means that the direct incremental income to a region approximates that assumed in IO analysis (i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect).

Table 2 - Demonstration of the Trickle Down Effect for 40 Jobs Filled by Locals Who are Already Employed in the Region

	Total wages	Increment Wages Gain to Region
1. New mining wage for 40 workers @$100k	$4,000,000	$1,400,000 (1-2)
2. Current Wages for 40 workers @$65k	$2,600,000	$1,000,000 (2-3)
3. Wage of people filling above 40 positions @$40k	$1,600,000	$800,000 (3-4)
4. Wage of people filling above 40 positions @$20k	$800,000	$ 255,664 (4-5)
5. Wages of the unemployed filling above 40 positions (Newstart - single no children)	$544,336	
Total		**$3,455,664**

ATTACHMENT 4 – INPUT-OUTPUT ANALYSIS AND COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[29] and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a CBA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.

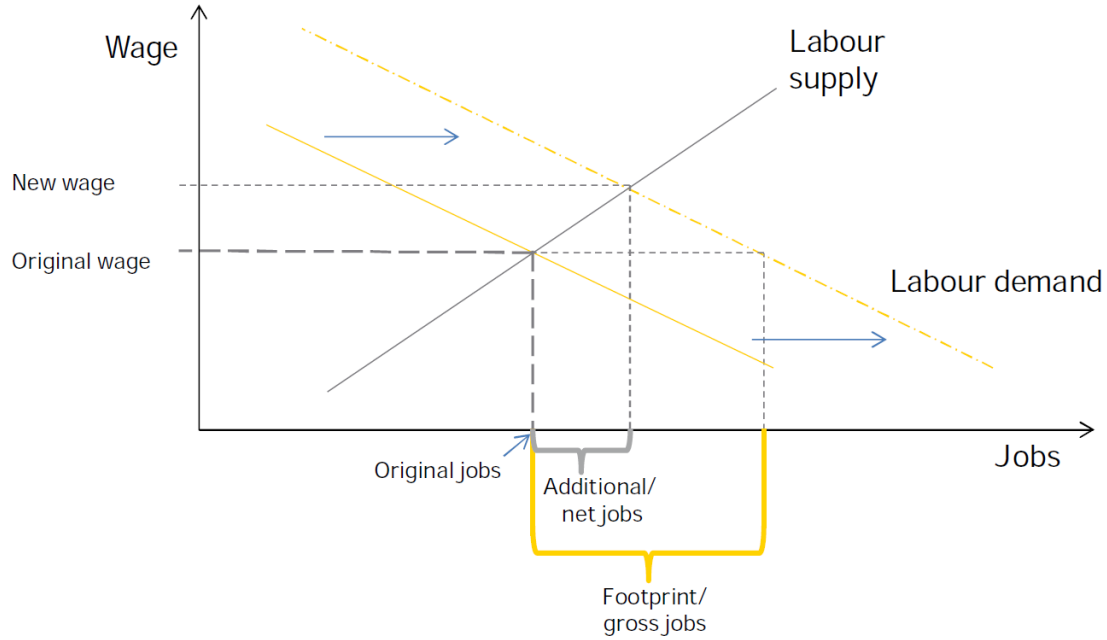
[29] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

- CGE modelling can be dynamic or comparative static[30] and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a CBA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a CBA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

[30] Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

Comparison of IO Analysis and CGE Modelling

Figure A4.1 – Comparison of Employment Estimates in IO Analysis and CGE Modelling



Source: Ernst Young (2014) Capital Metro Job Creation Analysis, p. 30.

- Figure A4.1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity[31]. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and "crowding out" across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I's *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.
- Other guidelines to recognise the role of IO analysis include:
  - US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*;

[31] This is akin to the marginal assumption in CBA.

- Australian Bureau of Rural Science (2005) *Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia*.

- NSW Treasury (2007) identify that IO analysis is commonly used to assess the regional impacts of a project. However, IO analysis is concerned with measuring economic activity, and is not a tool for the evaluation of projects (in the way that CBA is).
- NSW Treasury (2009) *Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government*, identifies IO analysis as an appropriate method for estimating the number of jobs that may be supported by the actions, programs and policies of the NSW Government.
- Mustafa Dinc an economist with the World Bank has recently release a publication titled *Introduction to Regional Economic Development: Major Theories and Basic Analytical Tools*. This publication recognises IO analysis as one of the most widely used models around the world to undertake regional economic analysis and a solid framework to analyse the interdependence of industries in an economy.

Government Applications of IO Analysis

- Applications of IO analysis commissioned by Government agencies include:
  - Department of Sustainability, Environment, Water, Population and Communities (2011) *Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale*
  - NSW Natural Resources Commission (2009) *River Red Gum Assessment: Socio-economic impact assessment*;
  - Victorian Environmental Assessment Council (2007) *River Red Gum Forests Investigation – Socio-Economic Assessment.*
  - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy.
  - Reserve Bank of Australia (2012) *Industry Dimensions of the Resource Boom: An Input-Output Analysis.*
  - DECCW (2009) Economic benefits of national parks and other reserves in New South Wales - Summary report, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.
  - DECCW (2006) *Socio Economic Assessment of the Batemans Bay Marine National Park*
  - DECCW (2006) *Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park*
  - National Parks Service, US Department of the Interior (2014) *2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation*.

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO is its use as a substitute for CBA, not its use for estimating direct and indirect regional economic activity impacts.

  - NSW Treasury (2009) "*Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (CBA)".*

- The main "abuse" reported by the Productivity Commission is using IO analysis to *"make the case for government intervention"* when CBA is the appropriate method for doing this.

- ABS's concerns with IO being "*biased*" refer to it being a "*biased estimator of the benefits or costs of a project"*. IO does not estimate benefits and costs but economic activity.

- Concerns of the Warkworth Judgement with IO analysis being "deficient" related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point)), but more fundamentally for not *"assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors".* This is an inappropriate criticism of the IO method, since it does not pretend to do this.

- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested in the Warkworth Judgement. It allows for labour to come from within or outside the region.

Latest Use of IO Analysis

- BAEconomics (2014) in its Economic Impact Assessment for Warkworth Continuation 2014 and Mt Thorley Operations 2014 justifies the use of IO analysis to estimate economic activity associated with the Project.

- Dr Brian Fisher, the Managing Director of BAEconomics is a highly respected resource economist who previously held the positions of Executive Director of the Australian Bureau of Agricultural and Resource Economics (ABARE) and Associate Commissioner of the Productivity Commission. He received an Order of Australia in the Queen's Birthday Honours List in 2007.

ATTACHMENT 5 – UNDERLYING ASSUMPTIONS AND INTERPRETATIONS OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS

1. "The *basic assumptions* in IO analysis include the following:

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

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

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

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

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

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

Multipliers 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.

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

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

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

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

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

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

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

ATTACHMENT 6 – CBA AND ASSESSMENT OF EXTERNALITIES

Consideration of Externalities in the Economic Assessment

Introduction

- The "perfect" CBA is an ideal. Different situations call for different styles and depths of analysis.
- Valuation of all environmental impacts is neither practical nor necessary.
- In attempting to value impacts, there is the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government 2012). The guideline gives an example of impacts of less than $1M being immaterial for a project with an estimated net present value of $20M.
- The CBA of the Project took three approaches to the consideration of environmental costs:
  - Threshold value analysis;
  - Qualitative consideration of impacts and valuation of the main impacts based on market data and benefit transfer; and
  - Additional threshold value analysis to recognise that some impacts may not have been fully valued and incorporated into the analysis.

Threshold Value Analysis

- The first approach used to consider the environmental impacts of the Project was the threshold value method.
- Threshold value analysis is a recognised approach to CBA where it is not possible or pragmatic to attempt to value potential external impacts.
- Threshold value analysis was developed by Krutilla and Fisher (1975)[32]. It is specifically referred to as an appropriate approach in the DP&I's (2002) *Draft Guideline for Economic Effects and Evaluation in EIA,* and is a widely recognised approach.
- Threshold value analysis avoids the sometimes contentious matter of physically quantifying environmental impacts and then placing dollar values on them.
- Threshold value analysis leaves the trade-off between quantified economic benefits and unquantified environmental costs for the decision-maker.
- In the Economic Assessment of the Project, the estimated net production benefits provides a threshold value or reference value against which the relative value of the residual environmental, social and cultural impacts of the Project, after mitigation, offset and compensation, may be assessed. The threshold value indicates the price that the community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the 'no development' option.

[32] Krutilla, J.V. and A.C. Fisher (1975) *The Economics of Natural Environments*, Johns Hopkins University Press, Baltimore.

Qualitative consideration of impacts and valuation of the main impacts based on market data and benefit transfer

- The second approach used was to qualitatively consider, and where possible value, the main environmental, cultural and social impacts of the Project for the well-being of people.

- Qualitative consideration of potential impacts and any subsequent valuation of impacts relied on the assessment of biophysical impacts provided in the Project EIS and Amendment Document by technical specialists.

- The approach to valuing environmental impacts in the Economic Assessment of the Project is summarised in Table A6.1.

Table A6.1 – Method for Valuing Environmental Impacts in the Economic Assessment of the Project

Impact	Potential Valuation Method	Comment
Greenhouse gas emissions	Damage cost method	Estimate of global social damage cost of carbon from literature and govt policy, adjusted to Australian and NSW damage cost.
Agricultural impacts	Property valuation method	Foregone agricultural production is reflected in land values. So opportunity costs of land reflect, among other things, foregone agriculture. Also foregone production from subsidence included based on gross margin analysis. Foregone forestry included based on foregone royalties.
Subsidence impacts	Damage cost approach	Accounted for through Mine Subsidence Levy
Noise impacts		
Significant	Property valuation method	Cost of acquiring properties encompasses property value impacts due to noise. No significant impacts identified.
Moderate	Defensive expenditure	Noise mitigation costs included in capital costs of project.
Significant air quality impacts	Property valuation method	Cost of acquiring properties encompasses property value impacts due to air quality impacts. However, no properties impacted by exceedances. Health impacts assessed as negligible.
Use of surface water	Market value of water	Cost of Water Access Licences reflects marginal value product of water. Included in CBA.
Use of groundwater	Market value of water	Cost of Water Access Licences reflects marginal value product of water. No potable water but licence cost of other groundwater licences included.
Groundwater drawdown	Defensive expenditure	No material impacts on private bores predicted.
Water discharges		Regulated under the Protection of Environment Operations Act 1997.
Flora and fauna	Replacement cost	Capital and operating costs of offsets included in capital and operating costs. Assumes that offsets levels are sufficient to compensate the community for values lost. This is a requirement of Govt. Policy.
Road transport impacts	Defensive expenditure	Cost of road investment required as a result of the Project included in capital costs of project and forms part of the VPA.
Aboriginal heritage	Defensive expenditure	No material impacts
Historic heritage	Defensive expenditure Damage cost	Accounted for through Mine Subsidence Levy
Visual	Defensive expenditure	Costs of mitigation measures included in the economic analysis.

Additional Threshold Value Analysis

- To the extent that there may be some disagreement about the estimated economic values of the environmental impacts of the Project, the estimated net benefits of the Project provides another threshold value that the residual environmental impacts of the Project after mitigation, compensation and offset would need to exceed to make the Project questionable form and economic efficiency perspective. This again allows the decision-maker to consider any material impacts that it identifies in the course of its consideration that were not valued in the Economic Assessment.

ATTACHMENT 7 – NON-MARKET BENEFITS OF EMPLOYMENT

- In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus).

- Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005[33]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project. The analysis included consideration of the magnitude of these additional benefits under a number of scenarios but conservatively excludes them from the core analysis. Ceteris paribus these estimates are conservative since they ignore any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

- These treatments of employment in CBA relate to the market value or opportunity cost of labour resources.

- The above treatment of employment in CBA relate to the impacts on the unemployed individuals themselves. However, there may also be spillover effects and externalities to third parties. These are public good values. Spill-over effects referred to in the literature relate to empathy based losses to family or friends (close associates) of impacted workers because of the workers being unemployed and increased crime and community dislocation (Haveman and Weimer 2015: Streeting and Hamilton 1991). Empathy based impacts may also spill over more broadly into the existence values of others in the community who feel sympathy for the unemployed.

- These are non-market values i.e. the values that individuals in a community hold for things even though they are not traded in markets. For example, people have been shown to value environmental resources even though they may never use the resource. These are referred to as existence values and are underpinned by the view in neoclassical welfare economics that individuals are the best judge of what has value to them.

- As identified by Portney (1994[34]), the concept of existence values should be interpreted more broadly than just relating to environmental resources.

  "If I derive some utility from the mere existence of certain natural environments I never intend to see (which I do), might I not also derive some satisfaction from knowing that refineries provide well-paying jobs for hard-working people, even though neither I nor anyone I know will ever have such a job?. I believe I do. Thus, any policy change that "destroys" those jobs imposes a cost on me – a cost that, in principle, could be estimated using the contingent valuation method.... Since regulatory programs will always impose costs on someone – taking the form of higher prices, job losses, or reduced shareholder earnings – lost existence values may figure every bit as prominently on the cost side of the ledger as the benefit side (Portney 1994, p. 13).

- The utility (welfare) of individuals may therefore be affected by changes in their own well-being as well as changes in the well-being of others (Rolfe and Bennett 2004[35]). This is consistent with the observed behaviour of altruism (Freeman III 2003[36]).

[33] Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-benefit analysis: concepts and practice*, Prentice Hall, New Jersey.
[34] Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.
[35] Rolfe and Bennett (2004) *Assessing Social Values for Water Allocation with the Contingent Valuation Method,* Valuing Floodplain Development in the Fitzroy Basin Research Reports, Research Report No. 11, Central Queensland University, Emerald.
[36] Freeman III, A. Myrick. (2003) *Economic Valuation: What and Why*. In A Primer on Non-market Valuation, Eds Champ, P., Boyle, K. and Brown, T. Kluwer Academic Publishers, London.

- Whether people have existence values for the employment of others, as hypothesised by Portney, is an empirical issue. A number of non-market valuation studies have found evidence that people hold existence values for the employment of others:

  - Johnson, F. and Desvouges, W. (1997) Estimating Stated Preferences with Rated-Pair Data: Environmental, Health and Employment Effects of Energy Programs. Journal of Environmental Economics and Management, 34, 75-99, estimated the non-market value of employment effects of energy programs.
  - Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. (1998) Stated Preference Approaches to Measuring Passive Use Values: Choice Experiments Versus Contingent Valuation, American Journal of Agricultural and Economics, 80, 64-75, in a study on the protection of old growth forests included an attribute for forest industry employment losses.
  - Morrison, M., Bennett, J. and Blamey, R. (1999) Valuing improved wetland quality using choice modelling, Water Resources Research (Vol. 35, No. 9, pp. 2805-2814) valued irrigation related employment losses as a result of wetland protection.
  - Blamey, R., Rolfe, J., Bennett, J., and Morrison, M., (2000) Valuing remnant vegetation in Central Queensland using choice modelling, The Australian Journal of Agricultural and Resource Economics(44(3): 439-56) in a study of broadscale tree clearing in the Desert Uplands of Queensland, Australia included an attribute for jobs lost to the region.
  - Do, T.N. and Bennett, J. (2007) Estimating Wetland Biodiversity Values: A Choice Modeling Application in Vietnam's Mekong River Delta, Australian National University, Economics and Environmental Network Working Paper estimated values for the number of farmers affected by a change in wetland management of Tram Chim.
  - Othman, J., Bennett, J., Blamey, R. (2004) Environmental values and resource management options: a choice modelling experience in Malaysia, Environ. Dev. Econ. 9, 803–824, valued local employment losses from different conservation management strategies for the Matang Mangrove Wetlands in Perak State, Malaysia.
  - Marsh, D. (2010) Water Resource Management in New Zealand: Jobs or Algal Blooms? Presented at the Conference of the New Zealand Association of Economists Auckland 2 July 2010, valued employment losses as a result of improvements in water quality in a dairy catchment in Waikato region of New Zealand the catchment.
  - Longo A, Markandya A, Petrucci M (2008) The Internalization of Externalities in the Production of Electricity: Willingness to Pay for the Attributes of a Policy for Renewable Energy, Ecological Economics 67:140-152, in the context of renewable energy projects valued additional electricity sector jobs.
  - Colombo, S., Hanley, N., and Requena, J.C. (2005) Designing Policy for Reducing the Off-farm Effects of Soil Erosion Using Choice Experiments, Journal of Agricultural Economics, 56(1), 81-96, valued local employment generated from watershed policies to reduce soil erosion.
  - Caparrós A, Oviedo JL, Campos P (2008) Would you choose your preferred option? Comparing choice and recoded ranking experiments. Am J Agricult Econ 90(3):843–855, valued increases in local employment from a NP reforestation program.
  - Windle, J. and Rolfe, J. (2014) Assessing the trade-offs of increased mining activity in the Surat Basin, Queensland: preferences of Brisbane residents using non-market valuation techniques, Australian Journal of Agricultural and Resource Economics, 58, pp. 111-129, valued jobs generated by mining developments in the Surat Basin, as well as social impacts of mining developments such as increased housing prices and increase wages in non-mining sectors.

- Three non-market valuation studies have found evidence that people in NSW hold existence values for the employment of others in coal mining projects:

  - Gillespie, R. (2009) Bulli Seam Operations Socio-Economic Assessment, prepared for Illawarra Coal Holdings Pty Ltd.
  - Gillespie, R. and Kragt, M. (2012) Accounting for non-market impacts in a benefit-cost analysis of underground coal mining in New South Wales, Australia, Journal of Benefit Cost Analysis, 3(2): article 4.
  - Gillespie, R. and Bennett, J. (2012) Valuing the Environmental, Cultural and Social Impacts of Open Cut Coal Mining in the Hunter Valley of NSW, Australia, Journal of Environmental Economics and Policy, Volume 1, Issue 3, 1-13.

- The values from these studies are summarised in Table A7.1.

Table A7.1 – Existence Values for Mine Employment

	Mean Implicit Price ($) (95% CI)	Aggregate WTP per Job Year ($) (95% CI)	Coal Mine	Reference
WTP per household per year for 20 years for each year the mine provides 320 jobs	$5.94 $4.96 to $7.22	$8,157 $3,659 to $5,326	Metropolitan Colliery	Gillespie (2009)
WTP per household (once-off) for each year the mine provides 1,170 jobs	$36.21 $29.89 to $43.97	$1,299 $1,037 to $1,578	Bulli Seam Operations	Gillespie and Kragt (2012)
WTP per household (once-off) for each year the mine provides 975 jobs	$27.45 $17.52 to $36.95	$3,546 $2,263 to $4,773	Warkworth	Gillespie and Bennett (2012)

*Implicit prices are aggregated to 50% of NSW households.

- These values are public good values i.e. they are the sum of values held by individual households in NSW. Comparison of public good values to private good values such as wages are meaningless.

- The motivation behind people's willingness to pay for the employment of others is unknown. Split sample analysis undertaken by Gillespie (2009) providing different information to survey respondents on the re-employment prospects of impacted workers did not impact household willingness to pay for the employment provided by the mine. It is possible that respondents were not concerned so much with the prospects of re-employment elsewhere in the economy or net employment impacts but with the 'forced' change to other people's employment. However, further investigation is required to unpack respondent motivations in relation to attributes representing employment.

- Notwithstanding the above justification for the inclusion of non-market employment values in CBA, it is recognised that some people view this as contentious and so the results of the CBA for the Project are reported "with" and "without" the non-use values for employment being included.

ATTACHMENT 8 – 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 other mining sector. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study.

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). This means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A8.1 (Powell and Chalmers, 1995).

Table A8.1
The GRIT Method

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

Source: Bayne and West (1988).

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ATTACHMENT 9 – STUDIES ON THE FLOW-EMPLOYMENT OF THE MINING NDUSTRY

Mining projects provide direct employment opportunities in regional economies. In addition, expenditure on inputs to production and by employees can provide flow-on employment in other sectors of the economy.

All other things being equal, the flow-on employment arising from a project will depend on:

- the expenditure profile associated with a project;
- the size of the regional economy and the ability of local businesses to supply inputs to production demanded by mine proponents;
- the residential location of employees and whether they migrate into the region or already live there and were previously employed or unemployed.

Estimated flow-on employment will also vary based on the modelling approach used i.e. whether primary IO analysis has been undertaken or whether multipliers have been obtained from other studies, and which type of multiplier has been used e.g. Type 1A, Type 1B, Type 11A or Type 11B.

A number of studies have examined the flow-on impacts of mining projects on regional economies and the NSW economy. The results are summarised in Table A9.1.

These studies indicate that:

- for every direct job in mine construction total regional employment impacts range from 1.5 to 1.89; and
- for every operational job total regional impacts range from 1.70 to 4.79.

Table A9.1 – Flow-on Employment of Mining Projects

Construction or operation	Full-time equivalents or Full-time/part time	IIA Multiplier	Method	Region	Project	Reference
Construction	Unspecified	2.73	Borrowed	NSW	Angus Place	Aegis Group (2014)
Construction	Unspecified	4.71	Borrowed	NSW	Bulga Optimisation	Economic Consulting Services (2012)
Construction	Unspecified	1.59	Borrowed	Broke/Bulga	Bulga Optimisation	Economic Consulting Services (2012)
Construction	Unspecified	1.89	Borrowed	Newcastle, Maitland, Cessnock, Singleton, Muswellbrook	Bulga Optimisation	Economic Consulting Services (2012)
Construction	FTE	1.50	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Construction	FTE	1.62	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	6.05	IO	NSW	Warkworth and Mount Thorley	BAE (2014)
Operation	Unspecified	3.50	Borrowed	NSW	Bulga Optimisation	Economic Consulting Services (2012)
Operation	Unspecified	3.98	Borrowed	NSW	Angus Place	Aegis Group (2014)
Operation	FTE	4.79	IO	Upper and Mid Hunter	Warkworth and Mount Thorley	BAE (2014)
Operation	FTE	2.37	IO	Singleton LGA	Warkworth and Mount Thorley	BAE (2014)
Operation	Unspecified	1.49	Borrowed	Broke/Bulga	Bulga Optimisation	Economic Consulting Services (2012)
Operation	Unspecified	1.70	Borrowed	Newcastle, Maitland, Cessnock, Singleton, Muswellbrook	Bulga Optimisation	Economic Consulting Services (2012)
Operation	FTE	4.27	Borrowed	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	3.94	IO	Hunter Region	Warkworth Extension Project	Hunter Valley Research Foundation (2009)
Operation	FTE	2.94	IO	Hunter Region	Bloomfield Collieries	Hunter Valley Research Foundation (2008)

References:

Aegis Group (2014) Angus Place Colliery Extension Project, Economic Impact Assessment
Economic Consulting Services (2012) BCM Optimisation Project: Economic Impacts.
Hunter Valley Research Foundation (2009) An Economic Assessment of the Warkworth Coal Resource.
BAE (2014) Economic Impact of Warkworth Continuation 2014 and Mount Thorley Operations 2014,
Hunter Valley Research Foundation (2008) Client briefing: An economic assessment of Bloomfield Collieries, Hunter Region, NSW

ATTACHMENT 10 – GUIDELINE TO ROYALTY CALCULATIONS

- Royalty for coal is charged as a percentage of the **value of production**.

- The **value of production** is equal to the total revenue from the sale of the coal less allowable deductions.

- Deductions will differ from mine to mine.

- Allowable deductions include:

  - Beneficiation costs at a rate of:

    - $3.50 per tonne for coal which has been subject to a full cycle of washing;
    - $2.00 per tonne for coal which has been subject to a simple washing process such as wet jigging;
    - $0.50 per tonne for coal which has been crushed and screened but not subject to a washing process.

  - Levies

    - Coal research levy at $0.04545455/tonne of product coal.
    - Mine Subsidence Levy – the levy rate payable to the Mine Subsidence Compensation Fund for individual underground mines is prescribed in the Mine Subsidence Compensation Regulation 2012. Rates are in relation to each dollar of the land value of a colliery holding. Rates vary from $0.00132 to $0.39006 per dollar of land value.
    - Mines Rescue Levy prescribed under the *Coal Industry Act 2001*.
    - Commonwealth Levy for Long Service Leave is required under the *Coal Mining Industry (Long Service Leave) Payroll Levy Act 1992* (Commonwealth). The levy is a prescribed under the *Coal Mining Industry (Long Service Leave) Payroll Levy Regulations 1993* as 2.7% of eligible wages paid.

  - Bad debts

- The coal ad valorem royalty rates are 6.2% for deep underground mines (coal extracted below 400 metres), 7.2% for underground mines and 8.2% for open cut mines[37]. These rates are applied to the **value of production,** which is the sale value of coal less deductions.

- A sample spreadsheet for the estimation of coal royalties in NSW is provided by the NSW Industry and Investment at the following web address www.resourcesandenergy.nsw.gov.au/__data/assets/excel_doc/0004/434416/Monthly-Ad-Valorem-Coal-31122008-.xls

- Deductions have very little impact on the total estimate of royalties at any given assumed coal price as they reduce the **value of production** that royalty rates are applied to. They are not deducted from the royalty estimates themselves as has been claimed in submissions to previous mining projects.

[37] Royalty is also payable if the coal reject is used or disposed of for the purpose of producing energy. Coal reject is defined as a by-product of the mining or processing of coal that has energy value of less than 16 gigajoules per dry tonne or contains more than 35% ash by dry weight. The rate of royalty on coal in coal reject is no more than half the rate applicable to coal.

- The main influence of deductions on the **value of production**, to which the royalty rate is applied, is the level of Beneficiation. The impact of different levels of Beneficiation on the effective royalty rate for a 5 Mtpa coal mine is provided in Table A10.1[38].

Table A10.1 – Effective Royalty Rate for a 5Mtpa Coal Mine Under Different Levels of Beneficiation

SCENARIO	OPEN CUT	UNDERGROUND MINE
BASE ROYALTY RATE	8.2%	7.2%
100% CRUSHED AND SCREENED ONLY	8.1%	7.1%
100% SIMPLE WASH	8.0%	7.0%
100% FULL WASH	7.9%	6.9%

- The PAC review of the Economic Assessment of the previous Wallarah 2 Project considered royalties to be considerably overstated because:
  - there are multiple deductions available from royalties that can significantly reduce the amount payable (by as much as $3.50 per tonne, i.e. nearly 50%);
  - royalties are calculated on full production and NSW mines characteristically produce less per year than their authorised extraction limits.

- However, the claim that allowance for deductions can reduce the estimate of royalties from a project by nearly 50% is incorrect. As illustrated in Table A10.1 including an allowance for deductions reduces estimated royalties by between 1% and 5%. Few deductions apply to the Wallarah 2 Project as coal is to be crushed and screened only and so any impact on royalties is in the order of 1% not 50%. The source of the spurious claim regarding the impact of deductions on royalties has publicly retracted its claim (Newcastle Herald, Sept 15, 2014).

- Royalty estimates in this and the previous Economic Assessment are in relation to a production profile that is less per year than the maximum production rate i.e.4 Mtpa rather than 5 Mtpa.

[38] Assuming 5 Mtpa of thermal product coal, a coal price of AUD$100/t, employment of 450 with an average wage of $120,000 per annum, land value of $20M and a mine subsidence levy for underground mining of $0.19.

ATTACHMENT 11 – COMPANY TAX RATES AND DISTRIBUTION AMONG STATES

Effective Tax Rates for Mining Companies in Australia

- Company taxes represent part of the producer surplus benefit of mining projects that accrue to Australia.

- The current Australian Tax Office (ATO) corporate tax rate is 30% of taxable income.

- NSW Treasury (2007) *Commercial Policy Framework: Guidelines for Financial Appraisal* requires the use of the prevailing corporate tax rate for government agencies and businesses.

- Financial Appraisal text books such as Mott (1997) *Investment Appraisal*, recommend the use of the full corporate tax rate.

- An analysis of ATO data by Dr Sinclair Davidson[39], Professor of Institutional Economics at RMIT University and a Senior Fellow at the Institute of Public Affairs found that the Australian mining industry pays corporate tax at a rate close to 30% of its **taxable income**.

- Taxable income is revenues - operating costs - royalties - depreciation. There are generally two components to the depreciation associated with a mining project:

  - depreciation of assets - capital equipment - over the asset life; and
  - depreciation of the project pool (non-asset capital expenditure) over the project life.

  Because assessments are normally undertaken on a standalone project basis - losses in any particular year are carried forward and hence tax does not apply until taxable income in a particular year (with losses in previous years carried forward) is positive.

- The procedure in the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposal*, for estimating company tax is the application of a 30% of company tax rate to earnings before interest and tax (year i.e. revenue - capital costs - operating costs - royalties) in each year.

  This is a simplified approach to the estimation of company tax which treats capital costs as and when they occur and results in negative company tax in early years where capital investment occurs and positive company tax in later years. It understates company tax generated from a Project.

- Submissions to previous mining projects have questioned the use of the company tax rate when estimating the company tax generated from mining projects. One of the studies referred to in these submissions that purports to show an effective tax rate of less than 30% e.g. Richardson and Denniss (2011)[40] calculates the effective tax rate for the mining sector in relation to Gross Operating Surplus (GOS) NOT taxable income. GOS does not consider the costs of production such as consumption of fixed capital, interest, royalties, land rent payments and direct taxes payable on inputs.

- The Australian Treasury[41] has rejected GOS as an appropriate denominator for estimating effective tax rates.

[39] Davidson, S. (2014) *Mining Taxes and Subsidies: Official evidence*, A Minerals Council of Australia Background Paper.
[40] Richardson, D. and Denniss, R. (2011) *Mining the truth: The rhetoric and reality of the commodities boom*, prepared for The Australia Institute.
[41] Clark, J., B. Pridmore and N. Stoney. 2007. 'Trends in aggregate measures of Australia's corporate tax level', *Economic Roundup*, Winter, pp 1 – 28)

- The other study referred to in submissions to previous mining projects to support the claim for effective tax rates of less than 30% is Markle and Shackelford (2009[42]). In response to the inappropriate quoting of this working paper the authors have issued a press release that states, among other things, that:

  - The purpose of the study was not to precisely calculate rates of tax paid but to provide a broad comparison of effective tax rates across countries. All numbers are appropriately interpreted on a relative – rather than absolute basis.
  - The version of the paper cited is a draft that has not been through a peer review process;
  - It is possible that the data for Australia represents average data for as few as four companies over a five year period. As such we reach no conclusion nor make any comments about individual industries in individual countries. Our purpose in producing the table was to make relative comparisons only;
  - The most recent draft of the report uses a different data source which did not have enough observations to include a number for the mining industry in Australia;
  - We have read the analysis of Professor Sinclair Davison and do not disagree with his conclusions.

Distribution of Company Tax to NSW

- In Australia the Commonwealth Government collects over 80% of tax revenue but it is responsible for only half of government direct expenditure (Abelson 2012, p. 598[43]).

- State and territory governments raise about 15% of tax revenue but account for some 45% of government direct expenditure (Abelson 2012, p. 598).

- This Vertical Fiscal Imbalance is addressed via intergovernmental grants.

- In 2014/15 Taxation revenue estimate was $368,814M. The source of revenue is provided in Table A11.1.

Table A11.1 - Commonwealth Taxation Revenue by Source ($M)

Taxation Revenue Source	2014/15	%
Income and capital gains levied on individuals	188,050	51.0%
Income and capital gains levied on enterprises (including company tax)	83,140	22.5%
Taxes on employers payroll and labour	738	0.2%
Sales/goods and services tax	58,120	15.8%
Excises and levies	26,939	7.3%
Taxes on international trade	9,270	2.5%
Other sale of goods and services	2,557	0.7%
Total	**368,814**	**100.0%**

Source: Australian Government (2014) Budget 2014-15, http://www.budget.gov.au/2014-15/index.htm.

- The category of Income and capital gains tax levied on enterprises (in Table A7.1) includes company tax, FBT, superannuation taxes, MRRT and the Petroleum resource rent tax. In 2012/13, when these items were reported separately in the Commonwealth Budget Papers, 84% of this category of revenue was from company tax. These proportions are relatively stable over time (refer to Figure 10 in 2012/13 Budget Papers).

[42] Markle, K. and Shackelford, D. (2009) Do Multinationals or Domestic Firms Face Higher Effective Tax Rates? National Bureau Of Economic Research, Working Paper Series.
[43] Abelson, P. (2012) Public Economics: Principles and Practice, McGraw Hill, Australia.

- The Commonwealth provides funding to the States and Territories, in key sectors such as health, education, community services and affordable housing, and deliver productivity-enhancing projects and reforms in sectors including infrastructure, and skills and workforce development (Budget papers). In 2014-15, the Commonwealth proposed to provide the States and Territories with payments totalling $101.1B comprising:

  - $46.3B in payments for specific purposes; and
  - $54.9 in general revenue assistance, comprising GST payments of $53.7B and other general revenue assistance of $1.2B.

Table A11.2 – Commonwealth Payments to the States (2014-15)

$million	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	Total
2014-15									
Payments for specific purposes(a)	13,654	11,166	9,792	5,313	3,171	1,039	755	1,041	46,285
General revenue assistance(b)	16,808	11,853	11,736	2,310	4,956	1,911	1,137	3,166	54,861
Total payments to the States	30,462	23,019	21,527	7,623	8,128	2,950	1,892	4,207	101,147

(a) As State allocations for a small number of programmes have yet to be determined, these payments are not reflected in State totals. As such, total payments for specific purposes will not equal the sum of State totals.

(b) As State allocations for royalties are not published due to commercial sensitivities, these payments are not reflected in State totals. As such, total general revenue assistance will not equal the sum of the State totals.

Source: Australian Government (2014) Budget 2014-15, http://www.budget.gov.au/2014-15/index.htm.

- Payments for specific purposes are funded from revenue sources other than GST. Company tax makes up 22% of this remaining revenue. NSW share of total Commonwealth payments for specific purposes is 13,654/46285 = 29%, so an estimate of company tax redistributed to NSW is 22%*29% i.e. 7%.

- This is a conservative estimate. A higher proportion occurs if it is assumed that all payments for special purposes arise from company tax revenue alone rather than the pool of revenue after adjustment for GST.

- The NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*, suggests that the proportion of company tax attributable to NSW should be estimated by applying the proportion of Australia's population based in NSW, equivalent to 32 per cent as of June 2014.