Appendix Q

Economic Impact Assessment Report

Appendix Q

Economic Impact Assessment of the Hume Coal project

Prepared for Hume Coal Pty Ltd

Date: 20 February 2017

35 Endeavour Street
Red Hill, ACT 2603
Phone: +61 437 394 309
Fax: +61 2 6239 5864
www.baeconomics.com.au

Table of contents

Abbreviations

2015 Guidelines	Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals
ABS	Australian Bureau of Statistics
AIP	Aquifer Interference Policy
ASNA	Australian System of National Accounts
BRP	Berrima Rail Project
CAV	Construction accommodation village
CBA	Cost benefit analysis
CPP	Coal preparation plant
DSE	Dry sheep equivalent
EEC	Endangered ecological communities
EIS	Environmental impact statement
EVAO	Estimated value of agricultural operations
FTE	Full-time equivalent
GDE	Groundwater dependent ecosystem
GDP	Gross domestic product
GE	General equilibrium
GL	Gigalitre
GOS	Gross operating surplus
GMI	Gross mixed income
GSP	Gross state product
GVA	Gross value of agricultural production
ha	Hectare
HCC	Hard coking coal
LEA	Local effects analysis
LGA	Local government area
LQ	Location quotient
MIA	Mine Infrastructure Area
ML	Megalitre
Mt	Million tonnes
Mtpa	Million tonnes per annum
ROM	Run of mine
SEARs	Secretary's Environmental Assessment Requirements
SIA	Social Impact Assessment
WTA	Willingness-to-accept
WTP	Willingness-to-pay

Summary

BAEconomics was commissioned by Hume Coal Pty Ltd (Hume Coal) to prepare an economic impact assessment of the proposed Hume Coal project (the project). The project involves developing and operating and rehabilitating an underground coal mine and associated infrastructure over an estimated 23-year timeframe, including the construction of a rail spur that is the subject of a separate environmental impact statement (EIS), the Berrima Rail Project (BRP).

The approach to preparing the assessment is consistent with various guidelines published by the NSW Government, including the 'Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals' published in 2015 (the 2015 Guidelines). The 2015 Guidelines require a public interest test in the form of a cost-benefit analysis (CBA) to be undertaken to assess the net benefit of the project to the NSW community. The 2015 Guidelines also require a 'local effects analysis' (LEA) to be undertaken to assess the likely impacts of the project on the local economy.

While the BRP component of the project is subject to a separate EIS process, from an economic perspective, the benefits that would accrue to NSW and to the local community as a result of the project and the BRP arise jointly. That is, the project would not be developed in the absence of the BRP; conversely, the BRP would not be commissioned in the absence of the project. The CBA and LEA presented in this report therefore incorporate the combined costs of the project and the BRP component of the project, including the costs of any external effects. The net benefits to NSW and the local community identified in this report therefore arise as a result of the project, including the BRP component of the project.

Table E-1 summarises the net direct and flow-on benefits of the Hume Coal project for the State of NSW and the local economy, respectively, in terms of the contribution to value added or gross state product, disposable income, and full-time equivalent (FTE) employment. The components of these net benefits are discussed in the following sections.

Table E-1. Summary of net direct and flow-on benefits of the Hume Coal project

	Direct benefits	Flow-on benefits	Total
NSW			
Net value added / gross state product	$295 millions	$73 millions	$368 millions
Net employment	56 FTEs	62 FTEs	118 FTEs
Southern Highlands region			
Net disposable income	$85 millions	$44 millions	$129 millions
Net employment	33 FTEs	34 FTEs	67 FTEs

Net benefits of the Project for NSW

Direct impacts

The direct benefits of the project to NSW relative to the 'do nothing' (reference) case would amount to $316 million in net present value (NPV) terms, consisting of:

- incremental royalty payments that would accrue to the NSW Government of $114 million in NPV terms;
- incremental personal and company income tax payments attributable to NSW of $48 million in NPV terms;
- incremental disposable income payments accruing to NSW residents of $134 million in NPV terms, and
- other incremental benefits accruing to NSW, comprising Medicare payments, payroll taxes, land taxes, levies and local government rate payments, that amount to $20 million in NPV terms.

Disposable income benefits have been estimated conservatively by assuming that a share of the workforce would be employed elsewhere in NSW if the project does not proceed.

The (gross) direct benefits of the project to NSW would be offset by externalities from greenhouse gas emissions and a small loss in agricultural value added. These costs have been estimated at around $21 million in NPV terms. The net direct benefits of the project to NSW are therefore estimated at $295 million in NPV terms.

Flow-on impacts

In addition to the direct impacts described above, the project is expected to generate 'flow-on' benefits for NSW. Flow-on effects reflect the projected additional expenditures that arise as a result of the project. The additional demand for goods and services sets the economy in motion as businesses buy and sell goods and services from one another, and households earn and spend additional income. These linkages between businesses and households cause the total effects on the economy to exceed the initial change in demand as a result of the project.

The project would give rise to:

- incremental disposable income flow-on benefits of at least $73 million in NPV terms ($6 million per annum); and
- incremental annual average employment flow-on benefits of 62 full-time equivalent (FTE) jobs.

Net benefits of the project for the local economy

For the purpose of assessing the impacts of a development on the local region, the 2015 Guidelines require proponents of a development to adopt a study area defined according to a Statistical Area Level 3 (SA3) geographical definition. In the case of the project, the relevant SA3 area is the Southern Highlands SA3 Region. The Southern Highlands SA3 Region is largely aligned with the Wingecarribee Shire local government area (LGA).

Direct impacts

The direct benefits of the project for the local economy predominantly consist of the additional disposable income that accrues to the project workforce. The project would give rise to:

- incremental disposable income benefits of $85 million in NPV terms accruing to the project workforce in the Southern Highlands SA3 Region; and
- incremental payments in shire rates accruing to local government of $1 million in NPV terms.

Accounting for a loss of agricultural value added of $2 million in NPV terms, the net benefits accruing to the local economy are estimated at $84 million.

As is the case for the CBA, disposable income benefits have been estimated conservatively by assuming that a share of the workforce would be employed elsewhere in the local economy if the project does not proceed.

Flow-on impacts

The calculation of value added multipliers and flow-on effects for a small local region is not meaningful. The assessment of local flow-on impacts of the project has therefore been limited to income and employment.

The project would generate the following flow-on impacts in the Southern Highlands SA3 Region:

- incremental disposable income flow-on benefits of $44 million in NPV terms or $4 million per annum; and
- incremental employment flow-on benefits, accounting for agricultural impacts, of 34 FTE jobs.

The estimated flow-on effects have been calculated accounting for a small reduction in economic activity that would occur because of the displacement of agriculture as a result of the project.

Summary LEA analysis

The following summary table presents the results from the LEA for the project, as required by the 2015 Guidelines. As discussed in this report, non-labour related expenditures have not been attributed to the local economy because there are no regional statistics on the local and imported content of goods and services, and the local ownership of capital. Hence any increase or loss of surplus in other industries cannot be attributed to a small geographical (local) area. However, given that Hume Coal would incur overall operating expenditures of $643 millions in NPV terms over the life of the project, the local economy can be expected to benefit from these expenditures.

A portion of the land that would be disturbed by the project is currently used for livestock production. The net benefits arising from the project would therefore be offset by a small reduction in agricultural value added in the local region. The externalities arising from greenhouse gas (GHG) emissions associated with the project are global in nature and have therefore not been attributed to the local economy. This approach is consistent with the 2015 Guidelines, which recommend a focus on externalities that create material, un-mitigated effects within the locality.

Table E-2. Project – Summary LEA analysis

	Project direct: Total	Project direct: Local	Net direct effect: Local	Total local direct effect (SA3 Region)
Employment related				
Operational workforce jobs, average (FY 2020 to FY 2041)	275 FTEs	163 FTEs	33 FTEs	33 FTEs
Disposable income (NPV $2016)	$236 millions	$138 millions	$85 millions	$85 millions
Other, non-labour operating expenditure (NPV $2016)	$643 millions	N/a	N/a	N/a
Externality benefit/cost				
Scope 1 and 2 greenhouse gas emissions (NPV $2016)	$19 millions	N/a	N/a	N/a
Loss of agricultural value added (NPV $2016)	$2 millions	$2 millions	$2 millions	$2 millions

1 Introduction

BAEconomics was commissioned by Hume Coal Pty Ltd (Hume Coal) to prepare an economic impact assessment of the proposed Hume Coal project (the project). The economic assessment described in this report forms part of an Environmental Impact Statement (EIS), which has been prepared to accompany a Development Application made for the project in accordance with Division 4.1 of Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act).

1.1 Purpose and scope of the economic assessment

This economic assessment has been prepared to address the economic components of the Secretary's Environmental Assessment Requirements (SEARs), and with reference to various guidelines published by the NSW Government, in particular the 'Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals' (2015, 'the 2015 Guidelines'). The 2015 Guidelines require a cost-benefit analysis (CBA) to be undertaken to assess the net benefit of the project to the NSW community. The 2015 Guidelines also require a 'local effects analysis' (LEA) to be undertaken to assess the likely impacts of the project on the local economy.

The project involves developing, operating and rehabilitating an underground coal mine and associated infrastructure over an estimated 23-year timeframe, including the construction of a rail spur that is the subject of a separate EIS, the Berrima Rail Project (BRP). While the BRP component of the project is subject to a separate EIS process, from an economic perspective, the benefits that would accrue to NSW and to the local community as a result of the project and the BRP arise jointly. That is, the project would not be developed in the absence of the BRP; conversely, the BRP would not be commissioned in the absence of the project.

Given that their benefits and costs are inextricably linked, the CBA and LEA presented in this report therefore incorporate the combined costs of the project and the BRP component of the project, including the costs of any external effects. The net benefits to NSW and the local community identified in this report therefore arise as a result of the project, including the BRP component of the project. This approach is consistent with the approach specified in the 'NSW Government Guidelines for Economic Appraisal' (NSW Treasury 2007,. p.33), which state that:

> *Project interdependencies may arise in which the costs or benefits of one project are dependent on whether or not a second project of group of projects, goes ahead. The appropriate response is to evaluate projects as a single project…*

The approach that has been applied is also fully consistent with that recommended by the European Commission (1997, pp.16-17), which similarly requires an integrated analysis for projects that are mutually dependent.

1.2 Structure of this report

This report is structured as follows:

- Section 2 describes the project;
- Section 3 describes the approach to undertaking the CBA and the results of the CBA;
- Section 4 describes the approach to undertaking the LEA and the results of the LEA; and
- Section 5 describes the analysis conducted to identify the 'flow-on' impacts of the project for NSW and for the local region.

Supporting documentation is presented in two appendices:

- Appendix A provides additional detail on the methodology and assumptions used in preparing the CBA and the LEA; and
- Appendix B describes the derivation of the input-output multipliers used to determine flow-on effects.

2 Project and regional context

This section provides an overview of the project and its regional context:

- Section 2.1 sets out the range of activities comprising the project;
- Section 2.2 describes the local region where the project would be located; and
- Section 2.3 sets out where the issues raised in the SEARs are addressed in this report.

2.1 Project description

This economic assessment considers all aspects of the combined Hume Coal and Berrima Rail projects. The former is outlined below while the latter is described in Appendix D to the Hume Coal EIS.

The Hume Coal project involves developing and operating an underground coal mine and associated infrastructure over a total estimated project life of 23 years. Indicative mine and surface infrastructure plans are provided in Figure 2-1 and Figure 2-2. A full description of the project, as assessed in this report, is provided in Chapter 2 of the main EIS report (EMM 2016). In summary, the project involves:

- ongoing resource definition activities, along with geotechnical and engineering testing, and other low impact fieldwork to facilitate detailed design;
- establishment of a temporary construction accommodation village;
- development and operation of an underground coal mine, comprising of approximately two years of construction and 19 years of mining, followed by a closure and rehabilitation phase of up to two years, leading to a total project life of 23 years. Some coal extraction will commence during the second year of construction during installation of the drifts, and hence there will be some overlap between the construction and operational phases;
- extraction of approximately 50 million tonnes (Mt) of run-of-mine (ROM) coal from the Wongawilli Seam, at a rate of up to 3.5 million tonnes per annum (Mtpa). Low impact mining methods will be used, which will have negligible subsidence impacts;
- following processing of ROM coal in the Coal Preparation Plant (CPP), production of up to 3 Mtpa of metallurgical and thermal coal for sale to international and domestic markets;
- construction and operation of associated mine infrastructure, mostly on cleared land, including:

- one personnel and materials drift access and one conveyor drift access from the surface to the coal seam;
- ventilation shafts, comprising one upcast ventilation shaft and fans, and up to two downcast shafts installed over the life of the mine, depending on ventilation requirements as the mine progresses;
- a surface infrastructure area, including administration, bathhouse, washdown and workshop facilities, fuel and lubrication storage, warehouses, laydown areas, and other facilities. The surface infrastructure area will also comprise the CPP and ROM coal, product coal and emergency reject stockpiles;
- surface and groundwater management and treatment facilities, including storages, pipelines, pumps and associated infrastructure;
- overland conveyors;
- rail load-out facilities;
- an explosives magazine;
- ancillary facilities, including fences, access roads, car parking areas, helipad and communications infrastructure; and
- environmental management and monitoring equipment.

- establishment of site access from Mereworth Road, and minor internal road modifications and relocation of some existing utilities;
- coal reject emplacement underground, in the mined-out voids;
- peak workforces of approximately 414 full-time equivalent employees during construction and approximately 300 full-time equivalent employees during operations; and
- decommissioning of mine infrastructure and rehabilitating the area once mining is complete, so that it can support land uses similar to current land uses.

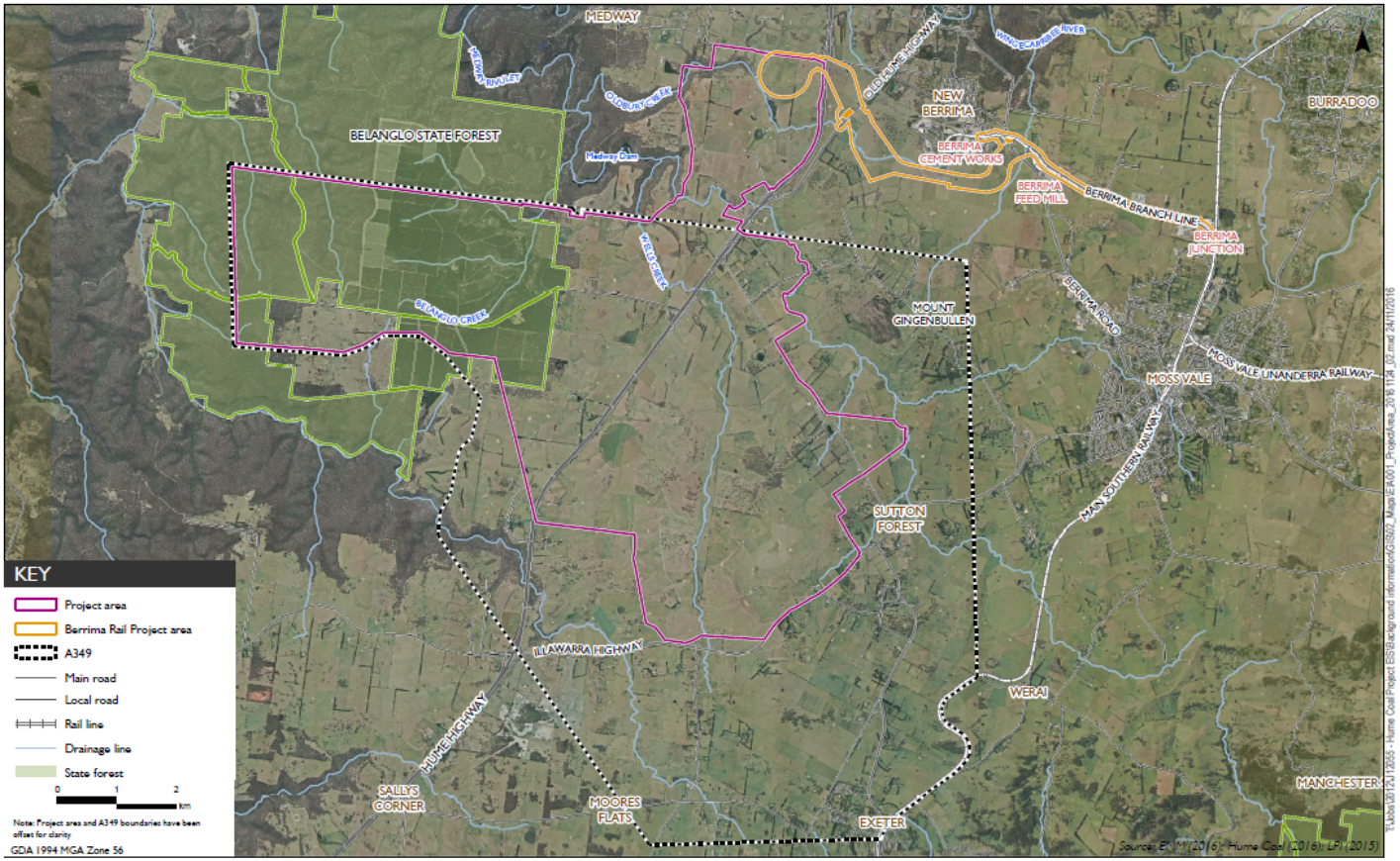
2.1.1 Project and surface area

The project area, shown in Figure 2-1, is approximately 5,051 hectares (ha). Surface disturbance will mainly be restricted to the surface infrastructure areas shown indicatively in Figure 2-2, although this will include some other areas above the underground mine, such as drill pads and access tracks. The project area generally comprises direct surface disturbance areas of up to approximately 117 ha, and an underground mining area of approximately 3,472 ha, where negligible subsidence impacts are anticipated.

There will be a construction buffer zone around the direct disturbance areas. The buffer zone will provide an area for construction vehicle and equipment movements, minor stockpiling and equipment laydown, as well as allowing for minor realignments of surface infrastructure. Ground disturbance will generally be minor and associated with temporary vehicle tracks and sediment controls as well as minor works such as backfilled trenches associated with realignment of existing services. Notwithstanding, environmental features identified in the relevant technical assessments will be marked as avoidance zones so that activities in this area do not have an environmental impact.

Product coal will be transported by rail, primarily to Port Kembla terminal for the international market, and possibly to the domestic market depending on market demand. As noted, the rail works and use are the subject of a separate EIS and State significant development application for the BRP.

Figure 2-1. Project area



Source: EMM / Hume Coal.

Figure 2-2. Surface infrastructure areas

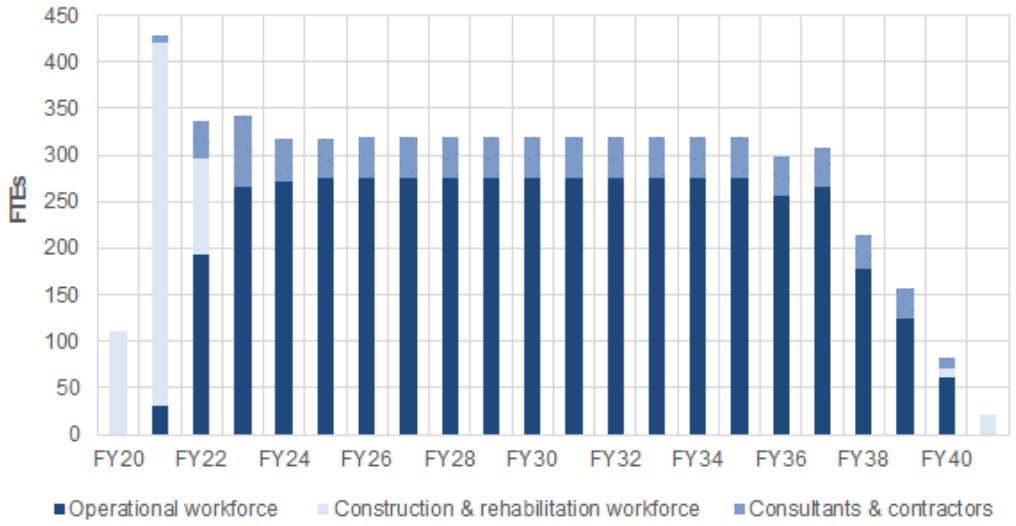
Source: EMM / Hume Coal.

2.1.2 Employment

Figure 2-3 shows projected employment for the project from the beginning of construction activities until mine closure and rehabilitation. Over that timeframe:

- construction would begin in FY 2020 and would be completed by FY 2022, with rehabilitation activities commencing in FY 2040. At its peak in FY 2021, the annualised average construction workforce would amount to 405 FTEs; and
- the operational workforce would begin ramping up in FY 2021. The annualised average operational workforce would peak in FY 2023 at 343 FTEs. Between FY 2021 and FY 2040, the operational workforce would average 275.

Figure 2-3. Hume project – Projected employment schedule



Source: Hume Coal.

2.2 Local region

The project would be located in the Southern Highlands region of NSW and the Sydney Basin Biogeographic Region. The project area is approximately 100 km south-west of Sydney and 4.5 km west of Moss Vale town centre in the Wingecarribee LGA (Figure 2-1). The nearest area of surface disturbance will be associated with the surface infrastructure area, which will be 7.2 km north-west of Moss Vale town centre.

2.2.1 Local setting

The project area is in a semi-rural setting, with the wider region characterised by grazing properties, small-scale farm businesses, natural areas, forestry, scattered rural residences, villages and towns, industrial activities such as the Berrima Cement work and Berrima Feed Mill, and some extractive industry and major transport infrastructure such as the Hume Highway.

Hume Coal propose to develop surface infrastructure on predominately cleared land owned by Hume Coal or affiliated entities, or for which there are appropriate access agreements in place with the landowner. Over half of the remainder of the project area (principally land above the underground mining area) comprises cleared land that is, and will continue to be, used for livestock grazing and small-scale farm businesses. Belanglo State Forest covers the north-western portion of the project area and contains introduced pine forest plantations, areas of native vegetation and several creeks that flow through deep sandstone gorges. Native vegetation within the project area is largely restricted to parts of Belanglo State Forest and riparian corridors along some watercourses.

The project area is traversed by several drainage lines including Oldbury Creek, Medway Rivulet, Wells Creek, Wells Creek Tributary, Belanglo Creek and Longacre Creek, all of which ultimately discharge to the Wingecarribee River, at least 5 km downstream of the project area (Figure 2-1). The Wingecarribee River's catchment forms part of the broader Warragamba Dam and Hawkesbury-Nepean catchments. Medway Dam is also adjacent to the northern portion of the project area.

Most of the central and eastern parts of the project area are characterised by very low rolling hills with occasional elevated ridge lines. However, there are steeper slopes and deep gorges in the west in Belanglo State Forest.

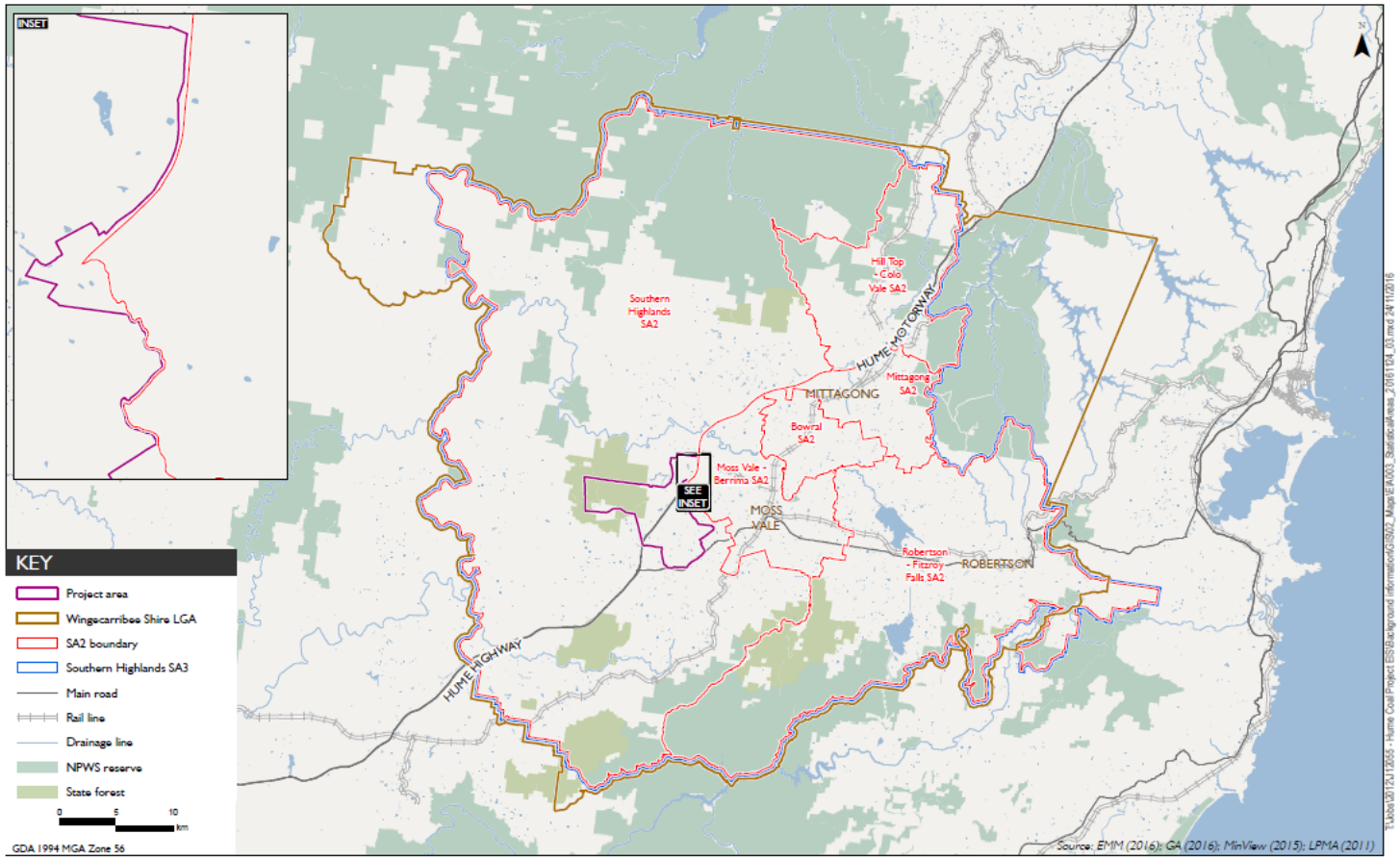
Existing built features across the project area include scattered rural residences and farm improvements such as outbuildings, dams, access tracks, fences, yards and gardens, as well as infrastructure and utilities including roads, electricity lines, communications cables and water and gas pipelines. Key roads that traverse the project area are the Hume Highway and the Golden Vale Road. The Illawarra Highway borders the south-east section of the project area.

Industrial and manufacturing facilities adjacent to the project area include the Berrima Cement Works and Berrima Feed Mill on the fringe of New Berrima. Berrima Colliery's mining lease (CCL 748) also adjoins the project area's northern boundary. Berrima Colliery is currently not operating, with production having ceased in 2013 after almost 100 years of operation. The mine is currently undergoing closure.

2.2.2 Study area

For the purpose of undertaking the LEA, the 2015 Guidelines require proponents to adopt a study area that should match a SA3 geographical definition. In the case of the project, the relevant SA3 area is the Southern Highlands SA3 Region (Figure 2-4). Figure 2-4 shows the Southern Highlands SA3 Region, which comprises the five Statistical Area Level 2 (SA2) areas of Southern Highlands, Hill Top, Mittagong, Bowral, Moss Vale, and Robertson Fitzroy Falls. Figure 2-4 also shows that the Southern Highlands SA3 Region largely aligns with the Wingecarribee Shire LGA.

Figure 2-4. Project area within the context of statistical area bondaries



Source: Hume Coal / EMM.

2.3 Secretary's Environmental Assessment requirements

The SEARs state that the EIS for the project must address the following socio-economic components (P.3):

- *an assessment of the likely social impacts of the development; and*
- *an assessment of the likely economic impacts of the development, paying particular attention to:*
  - *the significance of the resource;*
  - *economic benefits of the project for the State and region; and*
  - *the demand for the provision of local infrastructure and services, having regard to Wingecarribee Shire Council's requirements (see Attachment 2).*

This report addresses the economic SEARs; the social impacts SEARs are addressed separately in Chapter 20 and Appendix R of the EIS.

2.3.1 Significance of the resource

The repealed clause 12AA of the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 (the Mining SEPP) indicates the matters that may be relevant in assessing the 'significance of the resource'. Clause 12AA of the Mining SEPP required the significance of the resource to be assessed, having regard to the economic benefits, both to the State and the region, of developing the resource. The matters taken to be relevant were:

- employment generation;
- expenditure, including capital investment; and
- the payment of royalties to the State.

The broader economic benefits to the State of NSW and the region are considered in the CBA for NSW and the LEA for the local region, presented in Sections 3 and 4. The net economic benefits of the project for NSW are estimated at $295 million in NPV terms. For the local region, net economic benefits are estimated at $84 million in NPV terms.

Estimates of project employment are provided in Section 2.1. From FY 2020 to FY 2041, the project would generate an average of 275 operational jobs, as well on average 202 construction jobs from FY2020 to FY2022. In terms of project expenditure, the project is expected to require around $860 million (undiscounted) in total capital expenditures, including for sustaining capital expenditures and rehabilitation, and around $1.4 billion (undiscounted) in operating expenditures, including for materials and services. Estimates of royalties accruing to the State of NSW are derived as part of the results for the CBA (Section 3). The project is expected to generate around $266 million in royalty payments, or $114 million in NPV terms.

2.3.2 Local government requirements

We understand that Wingecarribee Shire Council has not communicated any requirements with respect to the SEARs, and does not intend to do so.

3 Cost benefit analysis of the project

This section describes the CBA that has been undertaken to derive the net benefits of the project for the State of NSW:

- Section 3.1 describes the economic framework that has been applied to prepare the CBA;
- Section 3.2 describes the approach to valuing market transactions;
- Section 3.3 sets out the approach to valuing the predicted (non-market) external effects;
- Section 3.4 describes the approach to determining the foregone value of agricultural production;
- Section 3.5 comments on other matters raised in the 2015 Guidelines;
- Section 3.6 describes the results of the CBA, in terms of the net benefits of the project for NSW; and
- Section 0 describes the sensitivities of the results of the CBA to changes in various assumptions.

The flow-on effects of the project are described in Section 5. Appendix A describes the accounting framework and assumptions used for the CBA.

3.1 Economic framework

CBA is a technique for assessing the economic merits of an initiative or course of action (such as undertaking a mining investment) from the perspective of society as a whole. A CBA compares all costs and benefits attributable to the initiative, discounted to a common point in time, to arrive at an overall assessment of whether the initiative is 'net beneficial'; that is, whether society will benefit from its implementation. A project is net beneficial if the NPV of the sum of benefits minus the sum of costs is greater than zero.

3.1.1 Reference case and project scenario

A CBA requires that the economic merits of a project are compared to a meaningful counterfactual. The CBA prepared for the project therefore considers the incremental (net) benefits that would arise if the project is approved, referred to as the 'project scenario', relative to the counterfactual, referred to as the 'reference case'. For the Hume Coal project, the reference case is to 'do nothing', whereby the land owned by Hume Coal and required for the project would continue to be used for agricultural purposes.

3.1.2 Net benefits of the project for the State of NSW

The 2015 Guidelines set out that the purpose of the CBA is to estimate the net benefits of a proposed development for the State of NSW. From an economic perspective, the extent to which a project contributes to the welfare of a country or state differs from a private benefit calculation, which focuses on the consumer and producer surplus. The public benefit of a project is measured with reference to 'value added'. Value added is the additional value of goods and services that are newly created in an economy, and that are available for domestic consumption or for export.

Value added is a central concept in the Australian System of National Accounts (ASNA), where it is referred to as 'gross value added' to emphasise that this measure is gross of the consumption of fixed capital (that is, depreciation). Gross value added is the difference between output and intermediate inputs (the value created by production), and equals the contribution of labour and capital to the production process (ABS 2013). Subject to adjustments that need to be made to ensure that valuations are internally consistent by accounting for various taxes and subsidies, the sum of gross value added across all industries in a country or state equals gross domestic product (GDP) or gross state product (GSP), respectively.

Given the objective of the CBA to identify the net benefits accruing to the State of NSW, the economic impacts of the project have been evaluated with reference to its contribution to NSW GSP. The focus on value added as a means of measuring the contribution of the project to NSW GSP is based on an internally consistent economic framework that reflects standard public accounting rules (United Nations 2003, Lequiller and Blades 2007). In particular, this framework avoids double-counting and enables a clear line to be drawn as to the factors that constitute a public cost or a benefit, and those that do not.

As discussed in the following sections, within a value added framework, the project's contributions to GSP fall into the following broad categories:

- the additional salaries and wages paid to the NSW workforce, which comprise the additional disposable income accruing to the NSW workforce and the NSW share of personal income taxes and Medicare contributions;
- the share of the project's 'gross operating surplus' (GOS) that can be attributed to NSW, including coal royalties, the NSW share of company income taxes, and the share of the project surplus that would accrue to residents of NSW; and
- the additional payroll taxes, land taxes, shire rates and levies paid to the State of NSW and local government.

3.2 Valuation of market transactions

A CBA requires a full accounting calculation whereby the direct costs and benefits of a project are compared in monetary terms, and therefore requires that costs and benefits should, as far as possible, be valued. As a general matter, a CBA relies on the 'opportunity cost' principle to value goods or services (Commonwealth 2006). In practice, the opportunity cost concept is made operational with reference to the 'willingness-to-pay' (WTP) criterion. For 'conventional', market based transactions, such as the sale of coal outputs or the purchase of labour and other inputs, the relevant valuation is determined with reference to the market price.

3.2.1 Incremental income benefits attributable to NSW

The compensation of employees and long-term contractors is a key component of value added, and the incremental change in wage and salary payments associated with the project represents a contribution to NSW GSP. However, only a share of incremental wage and salary payments can be attributed to NSW, namely:

- the incremental disposable incomes (gross wages and salaries, net of superannuation, taxes, and Medicare contributions) paid to the NSW workforce; and
- of the total imposts paid by the workforce, the incremental share of income taxes and Medicare contributions that would accrue to NSW.

3.2.1.1 Incremental gross income

If approved, the project would represent a source of additional employment and additional gross income paid to the workforce. However, only a share of the added income accruing to the NSW workforce is strictly 'additional'. In the absence of the project, a share of the workforce would likely be employed elsewhere in NSW at an 'alternative wage'.

The income benefits accruing to NSW have therefore been reduced by the proportion of the workforce that would have found alternative employment in NSW at an alternative wage. The proportion of the workforce assumed to find alternative employment in NSW in the absence of the project is assumed to be 80 per cent in the central case modelled for the CBA. The remaining 20 per cent may remain unemployed or leave the NSW workforce, for instance, by retiring, or by moving interstate.

The 2015 Guidelines do not offer clear guidance on the approach to be adopted in relation to the wages paid to the workforce of a given project, and how the alternative wage should be determined. The Guidelines state that the economic benefit to workers (or 'wage premium') is the difference between the wage paid by a mining project and the minimum (reservation) wage that the workers would accept for working elsewhere in the mining sector. According to the 2015 Guidelines, an appropriate starting assumption should be that workers on a given mining project do not receive a wage premium; i.e., that workers are paid wages that are generally reflective of remuneration in the mining sector.

The following approach has been applied to estimating gross wages paid to the construction and operational workforce of the project:

- Annual average gross wages paid to the operational workforce were provided by Hume Coal, on the basis of a detailed, bottom-up calculation reflecting the mix of skills and qualifications required for the project workforce over the life of the project. It is understood that the corresponding mix of wages and salaries reflects Hume Coal's estimates of the 'market rates' for the workforce composition that will be required. For the construction workforce, which would consist of external contractors, average adult full-time ordinary time earnings for Australian construction workers were used to estimate gross wages.

- The alternative wage has been determined with reference to the median employee income applicable to the relevant geographical area. For the CBA, the alternative wage is the median employee income for the State of NSW; for the LEA, the alternative wage is the median employee income for the Southern Highlands SA3 Region. A consistent alternative wage definition has therefore been applied for both geographical areas. The alternative wage is assumed to increase by 1 per cent per annum in real terms over the timeframe of the analysis.

In summary, the estimated wages that would be paid to the project workforce have been derived on the basis of market outcomes for similar types of skills, and do not incorporate any type of wage premium. The approach adopted here is therefore considered to be consistent with the 2015 Guidelines. The sensitivity of the CBA results to the alternative wage assumption is tested in Section 0.

3.2.1.2 *Incremental disposable income*

The gross wages that would be paid to the project workforce and the alternative wage have been further adjusted to derive incremental disposable income. The per person disposable income was derived by taking average gross wages and deducting superannuation payments, income taxes, and Medicare payments. Aggregated across workforce numbers in the project scenario, this gives an estimate of the incremental disposable income accruing to the Hume Coal workforce.

3.2.1.3 *Personal income tax and Medicare payments*

In the project scenario, the project workforce would make personal income tax and Medicare payments to the Commonwealth, a share of which can be attributed to NSW. In order to avoid overstating personal income tax and Medicare benefits, the same approach has been applied as for deriving disposable income benefits. That is, incremental tax and Medicare benefits were derived by subtracting the taxation and Medicare payments that would be made by the share of the workforce that would be employed elsewhere in the absence of the project.

3.2.2 Gross operating surplus attributable to NSW

One of the key components of the increase in NSW GSP attributable to the project is the share of its GOS that can be attributed to NSW. The GOS is the portion of the income derived from production that is earned by the capital factor of production (i.e. the capital invested in the mine). GOS is calculated as output valued at producer prices (gross mining revenues), net of intermediate consumption (operating expenditures), net of employee compensation, and net of taxes on production (ABS 2013). Only a portion of the incremental GOS associated with the project accrues to NSW, namely:

- the coal royalties paid by Hume Coal to the State of NSW;
- the share of company taxes paid by Hume Coal to the Commonwealth Government that accrues to NSW; and
- the share of any surplus generated by Hume Coal that accrues to NSW residents.

3.2.2.1 *Royalties*

Incremental royalty payments accruing to NSW were derived by multiplying gross mining revenues, net of allowable deductions for coal beneficiation, and net of estimated levies with the relevant underground ad valorem royalty rate of 7.2 per cent applied to the net disposal value.

Gross mining revenues were estimated by multiplying the product coal production schedules provided by Hume Coal with projected coal prices. The projected coal prices reflect the Wood Mackenzie forecast for thermal export coal and hard coking coal (HCC) as of the first half of 2016. In real US$ terms, Wood Mackenzie project thermal export coal prices to increase from around US$ 55 per tonne in 2020 to around US$ 73 by 2040, and HCC prices to increase from around US$ 93 per tonne in 2020 to around US$ 119 by 2040. These benchmark prices were adjusted by a price premium (discount) to reflect coal quality variations from the benchmark, and converted into Australian dollars using a US$/AU$ exchange rate of 0.77.

The sensitivity of the results of the CBA to variations in coal price and exchange rate assumptions is considered in Section 3.7.

3.2.2.2 *Company income tax payments*

Aggregate Commonwealth company income tax payments were derived by deducting operating expenditures, royalty and tax payments, and nominal depreciation from the respective gross mining revenues to derive taxable income. The inflation adjustment was made to account for the fact that depreciation is determined on the basis of nominal asset values. The company tax rate of 30 per cent was then applied to derive nominal company tax payments. Real ($2016) company tax payments were derived by adjusting for inflation, assumed to be 2.5 per cent per annum over the forecasting timeframe in line with the Reserve Bank of Australia's 2 to 3 per cent inflation target, on average, for its monetary policy. As required in the 2015 Guidelines, the share of incremental company income taxes paid as a result of the project that accrues to NSW was determined on the basis of the NSW share of the Australian population (32 per cent).

3.2.2.3 *Share of GOS accruing to NSW residents*

Hume Coal's ultimate parent company, POSCO, is listed on Korean and US stock exchanges. Whilst it is possible that NSW residents own shares in POSCO (both directly and via superannuation funds and index funds), this information is not available, and the profits attributable to residents of NSW arising from the project are not likely to be material in the scope of this CBA. For the purpose of this analysis, it has therefore been assumed that no share of project profits would accrue to NSW residents.

3.2.3 Other taxation benefits attributable to NSW

3.2.3.1 *Payroll taxes*

Payroll taxes constitute a tax on production and a contribution to NSW GSP. The 2015 Guidelines note that payroll taxes may be recognised as a benefit, provided that these taxes are shown to be additional and would not be offset by lower taxation payments elsewhere in the economy. The approach in relation to estimating incremental payroll taxes in this report therefore parallels that adopted to derive disposable income benefits accruing to NSW (Section 3.2.1). That is, the additional payroll taxes accruing to NSW have been derived by:

- estimating the payroll taxes that would be paid in the project scenario; and
- adjusting for the payroll taxes that would be paid for the share of the workforce assumed to find alternative employment in NSW at an alternative wage, to arrive at a full opportunity cost calculation.

3.2.3.2 *Local government rates*

Local government rates constitute a tax on production and a contribution to NSW GSP. Hume Coal is assumed to pay local government rates of around $150,000 per annum in the project scenario over the operating life of the mine. These rate payments accrue to local authorities.

In the absence of the project, the site of the proposed development would continue to be used for agricultural purposes, and corresponding rate payments would accrue to local authorities. Estimated local government rate payments of around $90,000 per annum have therefore been deducted from Hume Coal's estimated rate payments to arrive at a full opportunity cost calculation.

3.2.3.3 *Land taxes*

Land taxes also constitute a tax on production and a contribution to NSW GSP. It has been assumed that Hume Coal would pay land taxes of around $114,000 per annum in the project scenario over the operating life of the mine. Land tax payments accrue to the State of NSW.

In the absence of the project, the site of the proposed development would continue to be used for agricultural purposes. Section 10AA of the NSW Land Tax Management Act, 1956 exempts land that is used for the dominant purpose of primary production, including for the purposes of cultivation and the maintenance of animals. No offsetting land tax payments have, therefore, been incorporated.

3.3 Valuation of non-market (external) effects

The direct impacts of a project that are relevant for society, but for which a market value is not available need to be accounted for as part of the economic benefits and costs considered in a CBA. Such 'externalities' or 'external effects' are spillovers (positive or negative) from the production of a good or service, for example, in the form of air pollution or noise (negative spillovers). In addition, the 2015 Guidelines specify that external effects should be assessed on a cumulative basis; that is, taking into account the effects of existing and already approved (but not yet operational) projects. Where relevant, these have been considered in the specialist studies undertaken for the project.

3.3.1 Overview of predicted impacts

The predicted environmental impacts of the project, including those from the associated BRP, are summarised in Table 3-1. Chapter 24 of the EIS provides a summary of the mitigation, management and monitoring measures proposed by Hume Coal. The approach to valuing the external effects is described in more detail below. The approach to estimating the value of foregone agricultural production is described in Section 3.4 below.

As set out in Table 3-1, the external effects associated with the project are limited. In particular, no air quality impacts (6) are expected, and traffic impacts (8) are expected to be negligible. These outcomes reflect a range of mitigation strategies incorporated in the design of the project, including:

- the design of the mining system such that there would be no damage to the water bearing zones in the sandstone, meaning inflows into the active mining area would be minimised;
- the use of 'non-caving' coal extraction methods such that surface subsidence impacts would be negligible;
- relatedly, the underground emplacement of reject material, which significantly reduces the potential for visual, dust and noise impacts, reduces the surface disturbance footprint, and eliminates the need for tailings ponds or cells on the surface;
- the use of covered rail wagons to transport product coal, reducing dust emissions from trains travelling to and from the project; and
- the use of advanced high performance locomotives that use less fuel and generate less emissions than older locomotives commonly used in Australia, as well as giving rise to less vibration and noise emissions.

Table 3-1. Hume project – Predicted external effects (including external effects attributable to BRP)

	Aspect	Issue	Predicted impacts
1	Surface water	Residual of licenses (water demand minus existing licenses)	5.5 ML is required as residual.
		Reduction in catchment area	Minimal reduction of approximately 94.2 ha in catchment areas: ▪ 0.8% of the total catchment for Medway Rivulet to its confluence with Wingecarribee River (totaling approximately 12,264ha); or ▪ 0.01% of the total catchment for Lake Burragorang (905,100ha).
2	Groundwater	Residual licensable groundwater take	Peak of approx. 1GL/annum from the Sydney Basin Nepean groundwater source.
		Private bores within zone of greater than 2m AIP minimal impact criteria	AIP 2012 minimal impact criteria exceeded at 93 landholder bores.
3	Visual amenity	Viewpoints in close proximity to the surface infrastructure area	Two viewpoints are predicted to experience a moderate visual impact (private residence along Medway Road and the Hume Highway at its intersection with Medway road). No further mitigation is recommended.
4	Noise	Properties predicted to exceed project-specific noise levels (voluntary acquisition zone)	Number of properties is 2.
		Properties predicted to exceed project specific noise levels (voluntary mitigation zone)	Number of properties is 9.
5	Ecology	Native vegetation to be removed	Clearing of 64 paddock trees (Brittle Gums and Scribble Gums) underlain by exotic pasture, resulting in an 'effective clearing area' requiring offset of 8.3ha for the mine infrastructure. Clearing of 2ha of native vegetation (Broad-leaved Peppermint Narrow-leaved Peppermint grassy woodland and Snow Gum Woodland) for the BRP, requiring 0.2ha to be offset.
		GDE to be impacted	No GDE to be removed. No impacts are expected to ecosystems on Belanglo Creek and south of Wells Creek if periods of prolonged drought are not experienced during mining.
		EEC vegetation to be removed	None
		Threatened species directly impacted	None
		Habitat of threatened species to be removed	Loss of 17 hollow bearing trees.

	Aspect	Issue	Predicted impacts
6	Air quality	Number of properties predicted to exceed dust criteria (acquisition zone)	Nil
		Number of properties predicted to exceed dust criteria (management zone)	Nil
7	Greenhouse gas	Scope 1 and 2 emissions over the life of the project	1.7 Mt CO2-e
8	Traffic	Level of service at assessed intersections (construction)	No or only marginal increases in wait times with no change to levels of service.
		Level of service at assessed intersections (operations)	No or only marginal increases in wait times with no change to levels of service.
		Predicted safety implications	No perceptible change predicted.
9	Aboriginal heritage	Aboriginal sites identified in the project area	No sites of high significance will be disturbed. 11 sites will be avoided and fenced. 20 sites will be impacted to some degree by the surface infrastructure area: ▪ 4 sites partially collected/fenced and avoided; ▪ 10 sites will be collected; ▪ 4 sites will be partially excavated with the remainder avoided; ▪ 2 sites will be subject to unmitigated impacts (subsurface sites of low significance which do not warrant further investigation or salvage). An additional 8 sites will be directly impacted by the Berrima Rail Project: ▪ no sites of high significance; ▪ 2 sites of moderate significance; ▪ 6 sites of low significance.

Notes: EECs refers to 'endangered ecological communities'. GDEs refers to 'groundwater dependent ecosystems. AIP refers to 'Aquifer Interference Policy'.

Source: EMM.

External effects give rise to non-market impacts that are difficult to value. A variety of techniques have been developed to quantify these effects, including surrogate market (revealed preference) valuation techniques and hypothetical market (stated preference) techniques. These techniques aim to elicit estimates of either the WTP for, or the 'willingness-to-accept' (WTA) a particular outcome. They differ in a number of ways, including in terms of the amount and detail of data that are required (which may or may not be available) and how reliable the results are (the extent to which they are subject to biases).

Market-based valuations (direct revealed preference methods) infer an implicit price that is revealed by examining consumer behaviour and/or prices in a similar or related market (Department of Treasury and Finance 2013). Market-based valuation techniques include the use of:

- defensive expenditures: the costs incurred by individuals to mitigate the impact of changes and/or to recreate a situation that existed before a change, for instance by investing in noise insulation;
- replacement costs: the cost of replacing or repairing a damage, for instance, to restore the environment to its previous condition; and
- the productivity method: this method is used where an impact leads to a change in production levels, costs or prices.

Indirect revealed preference methods derive values of environmental goods and services from market prices. They include hedonic pricing whereby the WTP for specific environmental or other characteristics is inferred from market prices, and travel cost analysis, where the opportunity cost of time and travel costs is interpreted as a proxy of the value of ecosystem sites, such as parks.

Stated preference methods rely on specifically constructed questionnaires and interviews that are put to survey participants in order to discover the WTP for a particular outcome, or the WTA a particular outcome. Stated preference techniques include:

- contingent valuation methods: these ask individuals the amount they would be willing to pay to get a particular benefit or to avoid a negative impact, for instance, to maintain an ecosystem, a common good, or a heritage building; and
- choice modelling methods: individuals reveal the value of a non-market impact indirectly by choosing between goods with different characteristics and various monetary contributions.

Stated preference methods suffer from biases that often limit their validity and reliability (Pearce et al. 2006, Commonwealth 2006).[1] In contrast, and while such approaches cannot be applied in all circumstances and may not precisely capture the effect in question, the strength of revealed preference methods is that they are based on actual decisions made by individuals/households or other decision-makers. This report has therefore relied on market-based and revealed preference techniques for valuing the external effects associated with the project. The unifying characteristic of both techniques is that they aim to value non-market impacts by observing actual behaviour, and are therefore considered to be more reliable indicators of peoples' preferences.

3.3.2 External effects that can be internalised by Hume Coal

External effects that can be internalised by Hume Coal are non-market costs that can be accounted for through either financial instruments, or the creation of direct offsets.

3.3.2.1 Financial instruments (market-based valuation)

Financial instruments generally involve the compensation of affected individuals or payments for measures designed to mitigate or remove the impact of the external effect. This is a 'defensive expenditure' valuation method, which relies on the observed behaviour of households or individuals of incurring financial outlays to insulate themselves against a non-market 'bad', for instance, by moving house or by installing double-glazing in noise-affected homes (Pearce et al. 2006).

[1] These limitations include the presence of hypothetical bias, since the situations described to respondents are not real-world decisions (and therefore difficult to assess for respondents); strategic behaviour, whereby the respondent may, for one reason or another, give an exaggerated response; scope problems, whereby responses are insensitive to the size or coverage of the good being valued; anchoring bias, if the valuation given depends on prior options being presented; and information bias, whereby how the question is framed unduly influences the answer. Overcoming these types of difficulties requires a rigorous survey design and testing the survey responses for their robustness, including by testing whether responses can be reproduced and are stable over time. In practice, this is rarely done.

External effects that have been valued in this manner (that is, on the basis of expenditures that would be incurred by Hume Coal if the application is successful) are:

- Noise impacts (4): Noise impacts arise in 11 locations owned by third parties, of which 2 are located in the voluntary acquisition zone and 9 in the voluntary mitigation zone. Hume Coal propose a range of mitigation measures to minimise noise impacts, including:
  - the construction of a noise wall;
  - the use of low noise conveyor idlers, and of underground conveyor transfers;
  - the cladding of the CPP and application of 'tuneable' soft-start equipment in the CPP;
  - the cladding of conveyors;
  - the placement of silencers on main vent fans; and
  - the selection of alternative stockpile equipment that does not require the use of dozers to minimise noise and dust.

The costs of the above noise mitigation measures have been included in the project costings.

- Visual amenity impacts (3): Visual amenity is expected to be affected at two viewpoints. Hume Coal has planted vegetation screening consisting of native vegetation species that are common to the area. Planting has already been undertaken to maximise the time available for establishment of the trees and plants, thereby ensuring the effectiveness of the screening as early as possible. The cost of the associated fencing, trees, labour and ongoing maintenance has been spent and is a sunk cost.
- Aboriginal heritage impacts (9): As noted in Table 3-1, unmitigated impacts will arise at two sites. These are sub-surface sites of low significance, which do not warrant further investigation or salvage. A range of Aboriginal heritage management measures will apply to the remaining identified sites for the duration of the project, including:
  - active protection of Aboriginal sites that are located close to the surface infrastructure area through fencing;
  - passive management by avoidance of Aboriginal sites that are located within the project area, but more than 25 meters from surface infrastructure;
  - the collection of all surface stone artefacts in the surface infrastructure area disturbance footprint, and archaeological excavation of four sites of moderate significance;

- the monitoring of sites that may be susceptible to subsidence for the most significant sites above the underground mining area;
- procedures that specify actions to be taken in the event that human remains or Aboriginal sites are discovered; and
- procedures for the ongoing care of salvaged Aboriginal objects within a keeping place.

Defensive expenditures may represent an under- or an overestimate of the value of the non-market impact on wellbeing. For instance, households predicted to be significantly affected (that is, above government-prescribed criteria) by noise outcomes will be offered acquisition of their properties. To the extent that property purchase prices are above market values, it could be argued that the valuation of the corresponding external effects on that basis overestimates the impacts, although the affected landowners may have a (subjective) perspective of these impacts that may be lower or higher.

More generally, there will inevitably be instances of more or less arbitrary cut-off points, for instance, because noise criteria are exceeded at one location, but not at a different but nearby location. These types of boundary issues are difficult to address in practice, but essentially reflect rigid environmental criteria that may deem one level of disturbance to be acceptable, but no longer tolerate a slightly higher level of disturbance. Irrespective of the criteria that may be set down in statutes or regulations, peoples' personal preferences may also vary, so that what may be an acceptable disturbance to some, may be considered distressing by others. While these variations in perceived impacts should be acknowledged, they could not be measured or assessed in a reliable manner, and we have not attempted to do so here.

3.3.2.2 *Offsets (market-based valuation)*

Direct offsets refer to initiatives that deliver an outcome that is equivalent or preferable to the case in which the project does not proceed. The cost of establishing direct offsets and related initiatives is pertinent to the valuation of ecological impacts (5).

The primary ecological impact from the project, including the BRP component, would be the clearing of vegetation, including native vegetation and paddock trees. To compensate for the clearing impacts, the project would require 103 ecosystem credits for the removal of vegetation and 'ecosystem credit species' habitat, and a total of 640 species credits for the removal of habitat and 'potential habitat'. An assessment of an offset area which would potentially satisfy this credit requirement was undertaken as part of the biodiversity assessment, and suitable credits were found in an area of 32 ha of native vegetation. No endangered ecological communities (EECs) would be removed and no groundwater dependent ecosystems (GDEs) are predicted to be impacted.

The ecological impacts resulting from the project would be mitigated by establishing an offset that would be approved under the NSW Biodiversity Certification Assessment Methodology. The biodiversity certification scheme was established under the Threatened Species Conservation Act 1995. The Minister may confer biodiversity certification on land if the Minister is satisfied that biodiversity certification will improve or maintain biodiversity values (NSW Office of Environment and Heritage 2016). The Total Fund Deposit, the estimated cost of managing the biobank site, has been estimated with reference to the Biodiversity Credits Pricing Spreadsheet, administered by the NSW Office of Environment and Heritage. The Total Fund Deposit estimate incorporates the costs of a range of management actions, including for bush regeneration, fencing maintenance, and signage installation, as well as other recurring costs, such as monitoring and reporting costs, council rates and targeted surveys.

Given therefore, that the identified ecological impacts (5) will be offset to achieve an outcome that is deemed to be as good or better than the status quo by the relevant NSW authorities and under legislation, the ecological impacts associated with the project have been valued at the cost of implementing the offsets and associated initiatives.

3.3.3 Public values

Some external effects cannot be addressed through direct compensation or offsets, but can be given an appropriate public value.

3.3.3.1 Publicly determined values

Revealed preference studies consider the public expenditure or taxes that are used to achieve, for example, an environmental outcome. From this perspective, the consequences or outcomes of government decisions reflect implicit choices and value judgements. The incremental effects on surface water (1) and groundwater (2) can therefore be valued using the cost of licences that Hume Coal would need to acquire or other measures that Hume Coal would need to adopt in order to compensate for any external effects:

- Where surface water requirements are concerned, 5.5 ML of additional surface license volume would be required over the life of the mine. The cost of acquiring this license volume has been internalised by Hume Coal.
- Where groundwater requirements are concerned, Hume Coal would need to acquire about 1 gigalitre (GL) of water licence allocations from Year 7 of operations onwards. The typical price for a groundwater licence in the Hume area ranges between $2,500 and $2,800 per megalitre (ML), and confers the right to extract a corresponding quantity of groundwater in each year, in perpetuity. The cost of groundwater licence would therefore represent a one-off cost for Hume Coal. For the project costings, it has been assumed that the necessary licenses are acquired in equal parts in 2019 and 2020, at average price of $2,650 per ML.

- Where groundwater impacts are concerned, the modelling indicates that Aquifer Interference Policy (AIP) 2012 minimal impact criteria would be exceeded at 93 privately owned bores. Hume Coal propose to apply a range of 'make-good' measures so that landholders have access to a reasonable quantity and quality of water that aligns to the bores' authorised use. These options include:
  - compensation for additional electricity costs for pumping;
  - adding a rising main to lower the pump intake in the bore;
  - installing new headworks and piping to create a more efficient system;
  - changing the pump so that it is better suited/more efficient to a decreased water level in the bore;
  - deepening the bore to allow it to tap a deeper part of the aquifer;
  - reconditioning the water bore to improve its hydraulic efficiency;
  - drilling a new bore to a different depth or wider diameter;
  - providing an alternate water supply;
  - constructing of a farm dam (within existing licensing constraints);
  - installing tank/s and providing water (pipeline/carting/dams); or
  - installing additional infrastructure to better capture and store rainfall.

The cost of estimated make-good measures has been accounted for in the costings for the project.

3.3.3.2 Greenhouse gas emissions

The project will give rise to GHG emissions. The additional Scope 1 and 2 GHG emissions have been valued in accordance with the NSW Government's 'Greenhouse Gas Emissions Valuation Workbook' (NSW Government 2015a) using the social cost of carbon determined by the US EPA. Alternative valuations using the forecast European Union Emission Allowance Units price and the carbon price applied in the Australian Treasury Clean Energy Future Policy Scenario were applied as part of the sensitivity testing in Section 3.7.

3.4 Foregone value of agricultural production

This section describes the direct agricultural impacts that are expected as a result of the project. The flow-on effects that are expected to arise from a reduction in agricultural activity are described in Section 5.

3.4.1 Context

The Southern Highlands SA3 Region, comprising the SA2 regions of Southern Highlands, Hill Top – Colo Vale, Mittagong, Moss Vale – Berrima, Robertson - Fitzroy Falls and Bowral, has a diverse range of agriculture dictated by rainfall, soils and amenity values. The distribution of the gross value of agricultural production (GVA, a measure of the market value of the agricultural products produced) across the Southern Highlands SA3 Region is shown in Table 3-2.

Table 3-2 highlights the relative importance of the Roberson – Fitzroy Fall region, as well as the limited level of agricultural production in the other regions making up the Southern Highlands SA3 Region, particularly in the Bowral and Hill Top – Colo Vale regions. The project area is located to the northwest of Moss Vale, with most of the mine infrastructure located northwest of the Hume highway, on land predominantly used for grazing but in proximity to relatively highly populated areas. In this area, potential stocking rates are at the lower end of the NSW range for a high rainfall zone (defined by average annual rainfall in excess of 550mm), due to its having lower levels of rainfall and relatively poor soils.

Table 3-2. Southern Highlands SA3 Region – Gross value of agricultural production, by SA4 region (2010-11)

	Crops ($ millions)	Livestock ($ millions)	Total agriculture ($ millions)	Population density (Persons/ km^2, 2014)
Southern Highlands SA3 Region	$20.6	$17.6	$44.8	20.4
Comprising:				
Southern Highlands SA2 Region	$3.9	$2.6	$9.3	4.6
Hill Top-Colo Vale SA2 Region	$1.3	$1.2	$1.5	35.0
Mittagong SA2 Region	$8.6	$8.6	$9.0	118.0
Bowral SA2 Region	$0.8	$0.8	$1.3	237.2
Moss Vale-Berrima SA2 Region	$1.4	$0.3	$8.6	80.2
Robertson-Fitzroy Falls SA2 Region	$4.6	$4.1	$15.1	7.1
New South Wales	$7,079	$1,551	$11,714	9.4

Source: ABS, 7503.0 - Value of Agricultural Commodities Produced, Australia, 2010-11; 3218.0 Regional Population Growth, Australia.

3.4.2 Direct agricultural impacts

The agricultural impacts of the project, including those associated with the BRP, relate to the displacement of agriculture during construction of the mine and the associated rail infrastructure, the displacement of agriculture as a result of the life-of-mine infrastructure, as well as any permanent impacts on soil productivity. Subsidence is not expected to disturb agricultural activities. Some drawdowns of the water table are predicted (Table 3-1); however, under the NSW Aquifer Interference policy, 'make good' provisions will apply, and have been included in the project costings.

The displacement of agriculture during the construction and operation of the project, including as a result of the rail infrastructure, as well as any permanent productivity losses due to the disturbance of land are internal costs to Hume Coal. These foregone values are also costs from a NSW perspective, and are counted as an offset against the direct and flow-on benefits of the project on NSW GSP and the local economy. As noted, the land that would be disturbed by the project is currently used for livestock production. Cropping in the project area is for fodder production. Current stocking rates (shown in Table 3-3) are considerably higher than when the land was initially purchased by Hume Coal owing to various pasture activities that have been undertaken.

Table 3-3. Current livestock enterprises on the properties in the project area

Property	Land (ha)	Cattle[1]	Sheep[1]	DSE[2]	DSE/ha
Mereworth	500	1,500	N/a	11,250	22.5
Evandale	580	1,000	8,000	15,500	26.7
Stonnington	120	400	N/a	3,000	25.0
Eastern properties	80	250	N/a	1,875	23.4
Other freehold[3]	26	26	N/a	195	7.5

Notes: 1) Estimates as per Princess Pastoral Farm Management Plan (2015). 2) Calculated using the assumption that cattle correspond to 7.5 Dry Sheep Equivalents (DSE). 3) Land that will be disturbed by the project on other properties.

Source: Hume Coal.

3.4.3 Foregone value added of agricultural production

To estimate the foregone value of agricultural production from these properties (the net value added to the state economy), gross margins per hectare for typical livestock enterprises were taken from budgets compiled by the NSW Department of Primary Industry (2016). Gross margins are calculated as sales revenues less operating costs for representative livestock production systems. The systems selected are conservative, being amongst the highest returning per Dry Sheep Equivalent (DSE):

- the fattening of weaner calves at $48 per DSE; and
- Merinos ewes 20 micron at $36 per DSE.

The gross margins (or value per hectare, per annum) for the relevant properties and for farm properties applying 'typical' farm management practices are shown in Table 3-4. Gross margins on Hume Coal managed properties are significantly higher than would be the case for typical properties in the region. As a result, the foregone agricultural value added is also higher.

The NPV of gross margins is an approximate indicator of the foregone value of agricultural production that is analogous to the concept of value added in national and state accounts. Agricultural gross margins refer to revenues less variable costs, but exclude capital costs and a return to owner-operator labour, and hence overstate the opportunity cost of the project. The degree to which opportunity costs are overestimated increases with the length of time considered, hence the estimates of foregone production values are conservative. This overestimation may be offset to some degree because the restoration of full agricultural productivity may not occur within the two-year rehabilitation period. However, these costs are not expected to be material, as the majority of the rehabilitation takes place at the end of the mine life. At an annual discount rate of 7 per cent, these costs are heavily discounted.

Table 3-4. Agricultural gross margins, $ per hectare (A$ 2016)

	Hume farm management			Typical farm management		
Property	**DSE/ha**	**$/DSE**	**$/ha/year**	**DSE/ha**	**$/DSE[1]**	**$/ha/year**
Mereworth	19.6	46	900	9	46	414
Evandale	17.8	43	774	9	43	391
Stonington	16.9	48	810	9	48	432
Eastern properties	14.8	48	711	9	48	432
Other freehold[2]	9	48	432	9	48	432

Notes: 1) $/DSE is influenced by the percentage of sheep and cattle on the property. 2) Land that will be disturbed by the project on other properties.

Source: Hume Coal / BAEconomics analysis.

The estimated foregone value added of agriculture production – the land removed from production multiplied by the corresponding gross margins – is shown in Table 3-5. The foregone value added of agriculture is estimated at $2million in NPV terms (rounded to the nearest million).

Table 3-5. Foregone agricultural value added (NPV A$ 2016, '000s)

Project phase	**Hectares**	**Foregone value added**
Construction phase	279	$529,000
Operational phase	135	$1,178,000
In perpetuity (post operational phase)	3	$15,000
Total		$1,722,000

Notes: NPVs calculated using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

3.4.4 Foregone income and employment

Income in the form of wages and salaries derived from agriculture is a component of agricultural value added; it can therefore be expected that there may be some limited local impacts on income and employment due to agricultural land being removed from production. According to the ABS 2013-14 input output requirements table (ABS 2016a), employee compensation makes up about 15 per cent of the value added by agriculture. The foregone income for NSW and for the Southern Highlands SA3 Region, assuming that farm labour is sourced locally, would then be approximately $260,000 in NPV terms.[2] Converting this estimate of foregone agricultural income to an annual amortised value over the life of the project corresponds to approximately $22,000 per annum. At an average regional wage of about $46,000, this represents a loss of FTE jobs of less than 0.5 per annum.

3.5 Other matters raised in the 2015 guidelines

This section addresses other requirements discussed in the 2015 Guidelines.

3.5.1 Change in economic surplus in other NSW industries

The 2015 Guidelines specify that the CBA should incorporate changes in economic surplus arising in other NSW industries. For example, local suppliers may achieve higher surpluses as a result of a mining project, while there may be a loss of economic surplus in other industries.

This requirement poses practical difficulties, given that, at the local and state level, there are limited statistics on:

- the imported content of goods and services; or
- the stock of capital and the ownership of that capital.

Expenditures (for instance, as a result of purchasing equipment, materials and services) are relevant for determining the net benefits of a project for the State of NSW only so far as they can be apportioned to the value added by other NSW industries. For example, a business supplying local materials and labour, but using equipment constructed interstate or overseas, only adds local value from wages and the surplus or profits made from the supply of the materials in question. The balance of the expenditure flows to wages and to profits to those who manufactured the equipment. In addition, a change in surplus (or profits) in an industry is relevant for determining the net benefits of a project for NSW only so far as it accrues to residents of NSW that own or have a share in the capital invested. If a local business supplying

[2] As shown in Figure 2-4, Wingecarribee LGA largely aligns with the Southern Highlands SA3 Region.

materials to a development is owned by an interstate or overseas corporation, then no profits would flow locally or to the State of NSW, and the only component of expenditure that benefited the State of NSW would be the wages paid to NSW residents and any taxes paid in NSW.

The limitations described above imply that the change in economic surplus in particular NSW industries arising from the project cannot be measured with any precision, and we have not attempted to do so in this report. However, overall, the impacts of the project on other NSW industries are likely to be positive:

- Hume Coal would incur overall operating expenditures (net of labour costs) of $643 million in NPV terms. If it is assumed, for illustrative purposes, that 10 per cent of these expenditures represents additional margins to NSW suppliers, the additional surplus accruing to suppliers would be $64 million in NPV terms; and
- the analysis of flow-on impacts for the State of NSW in Section 5 indicates that the project would generate additional value added in other industries of $73 million in NPV terms.

3.5.2 Economic benefit to existing landholders

The 2015 Guidelines note that a mining proponent may purchase or lease land from an existing landholder(s) at a price which may exceed the opportunity cost of the land. This is more likely to occur when a mining proponent pays a premium above market prices for land acquisitions or leases. The corresponding surplus is an economic benefit that accrues to existing landholders and should be attributed to NSW.

Any future acquisitions, such as properties provided with voluntary acquisition rights as a result of the planning approval process, may include a slight premium to market value. However, the resulting net benefit accruing to landholders is insignificant relative to the overall net benefit to NSW generated by the project, and these premia often include a component of compensation to account for the costs of relocation. Therefore, the economic benefits accruing to local landholders have not been estimated. The approach adopted in this report is therefore conservative.

3.5.3 Net public infrastructure costs

Any net public infrastructure costs (the difference between the cost of the infrastructure to the public and any contributions made by the proponent) need to be included in the CBA. No public infrastructure costs are expected to be incurred for the project.

3.6 Net benefits of the project for NSW

The net economic benefit of the project for NSW is estimated at $295 million in NPV terms (Table 3-6). Key components include:

- royalty payments, which are estimated at $114 million in NPV terms (39 per cent of net benefits);
- net employment benefits in terms of the additional disposable income accruing to NSW residents and the NSW shares of personal and company income taxes, corresponding to:
  - $134 million in terms of net disposable income benefits;
  - $21 million in terms of the NSW share of personal income taxes; and
  - $27 million in terms of the NSW share of company income taxes; and
- incremental payroll taxes, shire rates and various levies, as well as the NSW share of Medicare payments amounting to around $20 million in NPV terms.

As discussed in Section 3.2, a number of adjustments have been made so that employment related benefits are estimated conservatively by accounting for re-employed workers, by including only incremental disposable income and incremental tax receipts, and attributing the share of income taxes and Medicare contributions that would accrue to NSW. Net disposable income benefits have also been adjusted to account for the foregone income from reduced agricultural activities.

The net costs arising from external effects relate to the social cost of GHG emissions ($19 million in NPV terms) and the foregone value of agricultural production ($2 million in NPV terms). The social cost of the Scope 1 and 2 GHG emissions associated with the project has been calculated in accordance with the NSW Government's 'GHG Emissions Valuation Workbook' (NSW Government 2015a), and has been fully attributed to NSW in the CBA.[3]

[3] Alternatively, if the social cost of GHG emissions were attributed to NSW commensurate with NSW GDP as a share of world GDP (0.36 per cent), the cost of GHG emissions attributable to NSW is around $70,000.

The remaining external effects would be internalised by Hume Coal and are accounted for in the cost-benefit calculation. These are the costs of measures to mitigate against environmental impacts, including groundwater, visual amenity, noise, and Aboriginal heritage impacts, as well as a range of operating and capital costs to mitigate against potential external effects.

Table 3-6. Incremental (economic) benefits of the project for NSW (NPV A$ 2016)

Costs	NPV (A$ m real 2016)	Benefits	NPV (A$ m real 2016)
Production related		**Production related**	
		Employment benefits:	
		Disposable income	$134
		NSW share of personal income taxes	$21
		NSW share of Medicare payments	$1
		Share of Hume Coal gross operating surplus accruing to NSW:	
		Royalties	$114
		NSW share of company income taxes	$27
		Taxes on production and imports:	
		Payroll taxes	$12
		Shire rates	$1
		Land taxes	$1
		Levies	$5
Total production related		**Total production related**	$316
Externalities (costs)		Externalities (offsets)	
Loss of agricultural value added	$2	Loss of agricultural value added	$0
GHG emissions	$19	GHG emissions	$0
Total externalities	$21	**Total externalities**	$0
Net economic benefits			$295

Notes: NPVs have been derived using an annual discount rate of 7 per cent. Totals may not sum precisely due to rounding. Detailed calculations to derive production-related benefits that can be attributed to NSW are set out in Appendix A.

Source: BAEconomics analysis.

3.7 Sensitivity analysis

The 2015 Guidelines require a proponent to undertake sensitivity analyses of a range of variables as part of the CBA. The following sections consider variations in key parameters to assess the sensitivity of the net benefits generated by the project.

3.7.1 Variations in the discount rate

In accordance with the 2015 Guidelines, a discount rate of 7 per cent per annum has been assumed for the analysis, and the sensitivity of the results of the CBA has been tested by applying a discount rate of 4 per cent and 10 per cent, respectively (Table 3-7). Reducing the discount rate to 4 per cent implies net benefits to NSW of around $410 million, while increasing the discount rate to 10 per cent implies net benefits to NSW of around $220 million.

Table 3-7. Net benefit to NSW – Discount rate sensitivity (NPV A$ 2016)

Discount rate assumption	Incremental benefits of the project for NSW (NPV A$ m 2016)
7 per cent	$295
4 per cent	$409
10 per cent	$220

Source: BAEconomics analysis.

3.7.2 Variations in coal prices and exchange rates

Most of the project's coal production would be exported and is priced in US dollars. The results of the CBA incorporate coal price forecasts from Wood Mackenzie corresponding to an average price of US$66.5 per tonne for export thermal coal and an average price of US$110.9 per tonne for HCC over the life of the mine. The US$/AU$ exchange rate is assumed to remain at 0.77 over the life of the mine.

Different combinations of coal prices and US$/A$ exchange rates will affect corporate income tax payments and royalty payments to NSW.

Table 3-8 shows the net benefits accruing to NSW as a function of various combinations of coal prices and exchange rates:

- for the coal price sensitivity, product (thermal and HCC) coal prices have been varied by +25 per cent and –25 per cent over the life of the mine, respectively; and
- for the exchange rate sensitivity, the US$/AU$ exchange rate has also been varied by +25 per cent and –25 per cent, respectively, over the life of the mine.

Table 3-8 shows that in the 'worst case' scenario modelled of a combination of a low coal price and a high exchange rate, the net benefits to NSW of the project would be $186 million in NPV terms. We note that such a low coal price and high exchange rate combination is unlikely, given that the Australian dollar is a 'commodity currency' that tends to appreciate and depreciate in line with the price of Australia's key exports – iron ore and coal (Cayen et al. 2010). It follows that even under extreme assumptions the project is likely to be of net benefit to NSW.

Table 3-8. Net benefit to NSW – Coal price and exchange rate sensitivity (NPV A$ m 2016)

Coal price assumptions / Exchange rates (US$/A$)	Average benchmark thermal coal price (US$ per tonne)		
	$50	**$66**	**$83**
$0.58	$295	$387	$479
$0.77	$227	$295	$364
$0.96	$186	$241	$295

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

The 2015 Guidelines require proponents, where practicable, to undertake a sensitivity analysis of how much output prices would need to fall for a project to have a zero NPV, and to report on whether such a scenario is either likely or unlikely.

Hume Coal considers that such analysis is commercial-in-confidence and as such it has not been undertaken by BAEconomics.

3.7.3 Variations in employment assumptions (NSW)

As discussed in Section 3.2, only a share of employment benefits can be considered to be additional for the purposes of the net benefit calculation. Two key assumptions were adopted to estimate the additional employment benefits attributable to the project, namely:

- the proportion of the project workforce that would move to the project from alternative employment in NSW was assumed to be 80 per cent; and
- the alternative wage that the project workforce would earn in alternative employment was assumed to be the NSW median employee income.

Table 3-9 explores the implications of varying these assumptions. It can be seen that:

- the net disposable income benefits generated by the project increase, the smaller the share of the workforce that is assumed to move from alternative employment in NSW; and

- the net disposable income benefits generated by the project increase, the lower the alternative wage earned by the workforce.

Table 3-9. Net benefits to NSW and net employment benefits – Variations in employment assumptions (NPV A$ 2016)

	Net benefits to NSW (NPV A$2016 m)	Net employment benefits (disposable income) (NPV A$2016 m)
Variations in the share of the Hume Coal workforce re-employed from elsewhere in NSW		
70 per cent	$310	$146
80 per cent (central case assumption)	$295	$134
90 per cent	$281	$121
Variations in the NSW alternative wage		
$40,776 (20 per cent decrease)	$316	$150
$50,970 (central case assumption)	$295	$134
$61,164 (20 per cent increase)	$275	$117

Notes: Average alternative wage and salary income is assumed to be $50,970 (A$2016). NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

3.7.4 Variations in royalty payments

The 2015 Guidelines require an assessment of the royalties derived from the project if mining revenues are 25 per cent lower or higher than in the central case. Table 3-10 shows that an increase (decrease) in mining revenues by 25 per cent would result in project royalties of around $144 million and $85 million, respectively.

Table 3-10. Net benefits to NSW and net royalty receipts – Variations in mining revenues (NPV A$ 2016)

	Net benefits to NSW (NPV A$2016 m)	Net royalty receipts (NPV A$2016 m)
25 per cent increase in mining revenues	$364	$144
Central case mining revenues	$295	$114
25 per cent decrease in mining revenues	$227	$85

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

3.7.5 Variations in company income tax payments

The 2015 Guidelines require an assessment of a variation in company income tax by +/- 50 per cent. Table 3-11 summarises the results of the analysis.

Table 3-11. NSW share of company income tax payments – Sensitivity (NPV A$ 2016)

	Net company income tax payments (NPV A$2016 m)
50 per cent increase in company income tax	$41
Central case company income tax	$27
50 per cent decrease in company income tax	$14

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

3.7.6 Variations in the social cost of carbon

The key environmental externalities that would not be internalised by Hume Coal relate to the costs of GHG emissions. Table 3-12 shows the sensitivity of the cost of GHG emissions for different carbon price assumptions derived from the NSW Government's 'GHG Emissions Valuation Workbook' (NSW Government 2015a):

- the US EPA's Social Cost of Carbon with a starting value in 2018 of AU$17.8 per tonne of CO2-e (2015 $), rising to AU$38.4 per tonne of CO2-e in 2048;
- the forecast European Union Emission Allowance Units price, starting at AU$9.1 per tonne of CO2-e (2015 $) in 2018 and rising to AU$26.1 per tonne of CO2-e in 2048; and
- the Australian Treasury Clean Energy Future Policy Scenario carbon price, starting at AU$30.1 per tonne of CO2-e (2015 $) in 2018 and rising to AU$136.1 per tonne of CO2-e in 2048.

In Table 3-12, the social cost of GHG emissions associated with the project ranges from $10 million in NPV terms to $46 million in NPV terms.

Table 3-12. NSW share of GHG emissions costs – Carbon price sensitivity (NPV A$ 2016)

Alternative carbon price assumptions (AU$ 2016)	Cost of GHG emissions (NPV A$2016 m)
Forecast European Union Emission Allowance Units price	$10
Australian Treasury Clean Energy Future Policy Scenario	$46
US EPA Social Cost of Carbon	$19

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

3.7.7 Major risks, unquantified and distributional impacts

The 2015 Guidelines require a discussion of major risks, as well as unquantified and distributional impacts relevant to the CBA. All resources projects are exposed to the risk of a major and sustained downturn in the price of the underlying commodity, in this case, coal prices. Beyond generic risks of this nature, we are not aware of major risks or potential impacts that have not been quantified in the CBA described in the preceding sections.

4 Local effects analysis

This section describes the economic impacts of the project on the local region, consistent with the requirements of the 2015 Guidelines:

- Section 4.1 describes the economic framework that has been applied to estimate the net benefits of the project that can be attributed to the local region; and
- Section 4.2 sets out the results of the LEA, in terms of the net benefits that would accrue to the local region.

The flow-on effects of the project on the local region are discussed in Section 5.

4.1 Economic framework

The same framework adopted for the CBA (Section 3.1) has been adopted for the LEA.

4.1.1 Incremental income benefits attributable to the local region

As is the case for the CBA, a number of adjustments have been made to ensure that employment and income benefits derived in the LEA are estimated conservatively. For the purpose of estimating the local income benefits only the incremental disposable income (gross wages and salaries net of taxes, superannuation and Medicare contributions) accruing to the local workforce has been included in the LEA.

Attributing income benefits to the local region furthermore requires assumptions to be made about the share of the workforce expected to reside in the Southern Highlands SA3 Region. The assumptions made in this report are consistent with those developed in the Social Impact Assessment (SIA) for the project (Appendix R, EIS).

Where the construction workforce is concerned, the SIA assumes conservatively that 90 per cent of construction personnel will temporarily relocate to the local region, so that only 10 per cent of the workforce would be recruited locally. The local income benefits attributable to the construction workforce have therefore been derived on the assumption that 10 per cent of the construction workforce would reside in the SA3 Region.

Where the operational workforce is concerned, for health and safety reasons, Hume Coal will require all workers, including those involved in the mine closure, to live within a 45-minute travel time from the project. The 45-minute travel catchment (the 'workforce catchment area') includes most of the Wingecarribee LGA, as well as the following localities in adjoining LGAs:

- Douglas Park, Picton, Thirlmere, Tahmoor and Wilton (Wollondilly LGA);
- Carrington Falls (Kiama LGA);
- Kangaroo Valley (Shoalhaven LGA); and

- Goulburn and Marulan (Goulburn Mulwaree LGA).

To estimate the local income benefits attributable to the operational workforce the results of the SIA have been applied as follows:

- The SIA considers two local recruitment scenarios, whereby 70 per cent and 50 per cent, respectively, of the project workforce would be recruited from within the workforce catchment area. Conversely, 30 per cent and 50 per cent, respectively, of the project workforce would relocate from elsewhere to the workforce catchment area. Taking the average of these two scenarios implies that 60 per cent of the project workforce would be recruited from the (45-minute drive) workforce catchment area, and 40 per cent would relocate to the workforce catchment area.

- Looking first at the 60 per cent of the operational workforce that would be recruited from the workforce catchment area, an assessment of the respective populations suggests that the population in the Southern Highlands SA3 Region accounts for at least 51 per cent of the population in the workforce catchment area. 31 per cent (60 per cent × 51 per cent) of the operational workforce that is assumed to be already based in the Southern Highlands SA3 Region.

- Looking next at the 40 per cent of the operational workforce that is expected to relocate to the workforce catchment area, the population distribution derived in the SIA predicts that 86 per cent of those relocating to the workforce catchment area would move to the Wingecarribee LGA, or equivalently, to the Southern Highlands SA3 Region.[4] 34 per cent (40 per cent × 86 per cent) of this share of the operational workforce would therefore be based in the Southern Highlands SA3 Region.

Overall, therefore, and considering both the share of the operational workforce that already resides in the local region and the share that is expected to relocate there, 65 per cent of the operational workforce has been attributed to the Southern Highlands SA3 Region. The local income benefits have been derived on that basis.

[4] As shown in Figure 2-4, Wingecarribee LGA largely aligns with the Southern Highlands SA3 Region.

We note that Hume Coal consider the estimates of the share of workers that would reside in the local region to be conservative, given that:

- there is an existing skills base in heavy manufacturing that would be directly transferrable in the Southern Highlands SA3 Region, and that may be attracted to the project workforce; and
- training programs provided by Hume Coal are expected to increase the potential to recruit local workers.

Overall, Hume Coal estimate that, given the reasonably large pool of suitable local workers, about 70 per cent of all workers may be sourced locally over the life of the project.

As is the case for the CBA, we have furthermore assumed that, in the absence of the project, a share of the workforce would be employed elsewhere in the local region. The disposable income benefits attributable to the local region have therefore been reduced by the proportion of the workforce assumed to find alternative employment in the local region at an alternative wage. As noted in Section 3.2, for the purposes of the CBA, 80 per cent of the workforce is assumed to find alternative employment in NSW in the absence of the project. This percentage has also been applied to the respective shares of the workforce assumed to reside in the local region; that is, 52 per cent (65 per cent × 80 per cent) of the project workforce is assumed to find alternative employment in the local region in the reference case.

The 2015 Guidelines set out that, for the LEA, the alterative wage should be determined as the average level of income in the local area. The alternative wage has therefore been assumed to be the median employee income in the Southern Highlands SA3 Region, determined to be $46,296 in 2016 dollars.

4.1.2 Other net benefits attributable to the local region

In addition to the incremental income benefits discussed above, net rate payments accruing to Wingecarribee Shire LGA also represent direct benefit to the local region. As discussed in Section 3.2, it has been assumed that Hume Coal would pay local government rates of around $150,000 per annum in the project scenario over the operating life of the mine. These rate payments have been reduced by the rates that Hume Coal or another land owner would pay in the reference case (i.e., if agricultural production were to continue).

4.1.3 Other matters raised in the 2015 guidelines

Various other requirements of the 2015 Guidelines are discussed in the following sections.

4.1.3.1 Non-labour project expenditure

The 2015 Guidelines require a proponent to quantify (non-labour) construction and operating expenditures and to attribute that expenditure to the relevant local region. As set out in Section 3.5, meeting this requirement is not possible in practice. A key difficulty is that there are no data about the local content of any goods and services that Hume Coal may purchase, or about the ownership of the corresponding suppliers. For instance, and while it would, in principle, be possible to match mining expenditures to certain local postcodes (corresponding to a supplier's address), such an attribution would not be meaningful since a local postcode only indicates that a supplier has a local presence, not that the supplier is locally owned or what share of value added would accrue to the local region.

It is therefore not possible to provide a reliable estimate about the extent to which the projected operating expenditures would benefit the Southern Highlands SA3 Region, and these benefits have not been quantified in this report. However, as noted in Section 3.5, Hume Coal would incur operating expenditures of approximately $643 million in NPV terms for the project. A share of these expenditures, for instance, for transport, repair and maintenance services, various consumables, and food and accommodation services would be expected to benefit the local region.

4.1.3.2 Effects on other local sectors

The 2015 Guidelines require a qualitative discussion of the effects of a project on other local industries, including whether a project would displace specific land uses, affect tourism, or whether short run market adjustments, for instance in housing markets, might be expected.

Local housing market

The potential impacts of the project on the local housing market are discussed in the SIA (Appendix R, EIS). Overall, no significant adverse impacts are predicted:

- the construction workforce for the project (including for the BRP) would be housed in a purpose-built construction accommodation village (CAV), and would therefore not add to the demand for local housing; and
- given current availability and the forecast supply of new housing in the region, the operational workforce would also not significantly impact the local housing market. It is probable that there will be adequate capacity to cater for relocated workers and their families, so that mitigation measures would likely not be needed.

Local tourism

In the year ending September 2014, Wingecarribee LGA recorded 1,407,000 visitors (including overnight and day-trip visitors), or 1.8 per cent of the NSW total (Destination NSW 2015). According to the ABS 2011 Census, employment in accommodation and food services in the Southern Highlands SA3 Region amounted to 1,263 in 2011, or 8 per cent of total employment.

Table 4-1 below provides an overview of the number of tourism establishments and rooms, as well as associated accommodation revenues in Wingecarribee LGA, including the Bowral, Mittagong, Moss Vale – Berrima and Southern Highlands SA2 regions.[5] It is apparent that as of June 2015, there were three tourist accommodation establishments in the Southern Highlands SA2 region (where the mine would be located), or 15 per cent of all establishments in Wingecarribee LGA. As of 2014-15, revenues from tourist accommodation in the Southern Highlands SA2 region accounted for 2 per cent of total for the Wingecarribee LGA.

Table 4-1. Tourism establishments, rooms and accommodation revenues

	No. of establishments (June 2015)	Percentage WCB LGA	No. of rooms (June 2015)	Percentage WCB LGA	Revenues from accommodation (2014-15)	Percentage WCB LGA
Bowral SA2 Region	8	40%	292	45%	$9,739,680	55%
Mittagong SA2 Region	5	25%	151	23%	$4,071,598	23%
Moss Vale – Berrima SA2 Region	4	20%	114	18%	$3,592,436	20%
Southern Highlands SA2 Region	3	15%	92	14%	$411,802	2%
Total Wingecarribee	20	100%	649	100%	$17,815,516	100%
Capital Country total	63		2,135		$51,979,886	
New South Wales	1,435		75,184		$3,243,668,892	

Notes: WCB refers to Wingecarribee LGA.

Source: ABS, 86350DO002_201415 Tourist Accommodation, New South Wales, 2014-15.

[5] As shown in Figure 2-4, Wingecarribee LGA largely aligns with the Southern Highlands SA3 Region.

Table 4-1 suggests that the Southern Highlands SA2 region where the mine would be located accounts for a relatively small share of tourism establishments, and, in particular, a very small share of revenues from tourism accommodation in the Wingecarribee LGA. These high-level indicators suggest that negative impacts on tourism of the project would be limited. Other aspects of the project that would support this conclusion are that:

- while the temporary construction workforce would be housed in the CAV, there would be some demand for short-term accommodation during the construction phase of the CAV and subsequently by visitors to the mine site. As set out in the SIA, the additional demand for short-term accommodation could be managed relatively easily, and would benefit local accommodation providers; and
- the project is an underground mine, so that any visual impacts would be limited. While some surface infrastructure would be required to support the project, the visual impact assessment of the project found that there are unlikely to be significant impacts on the character and amenity of the area.

4.1.4 Critical mass analysis of agricultural impacts

The NSW Guidelines for Agricultural Impact Statements (NSW Government 2012) require that if a project reduces the proportion of agricultural enterprises within a locality or region by more than 5 per cent, a 'critical mass threshold' analysis is required. The potential reduction in livestock production as a result of the project would be less than 5 per cent of total cattle production in the Southern Highlands region, and hence falls below the threshold for conducting a critical mass analysis.

4.2 Net benefits of the project for the local region

The 2015 Guidelines specify that the LEA should translate the effects estimated at the State level to the local level. For the local region, the net benefits of the project are expected to amount to $84 million in NPV terms, corresponding to (Table 4-2):

- additional disposable income of $85 million that would accrue to residents of the SA3 Region;
- $1 million in NPV terms in additional shire rate payments; and
- total externalities and loss of agricultural value added of $2 million.

The estimated net benefits of $84 million account for the expected forgone value of agricultural production, the estimated foregone income from reduced agricultural activities, as well as reduced local government rate payments from agricultural activities. The externalities arising from GHG emissions associated with the project are global in nature and have therefore not been attributed to the local economy. This approach is consistent with the 2015 Guidelines, which recommend a focus on externalities that create material, un-mitigated effects within the locality.

Table 4-2. Net benefits of the project, Southern Highlands SA3 Region (NPV A$ 2016)

Costs	NPV (A$ m real 2016)	Benefits	NPV (A$ m real 2016)
Production related		Production related	
		Employment benefits:	
		Disposable income	$85
		Taxes on production and imports:	
		Shire rates	$1
Total production related		Total production related	$86
Externalities (costs)		Externalities (offsets)	
Loss of agricultural value added	$2	Loss of agricultural value added	$0
Total externalities	$2	Total externalities	$0
Net economic benefits			$84

Notes: NPVs have been calculated using an annual discount rate of 7 per cent. Totals may not sum precisely due to rounding.

Source: BAEconomics analysis.

5 Flow-on benefits of the project

This section describes the analysis that has been undertaken to derive the secondary or flow-on benefits of the project for the State of NSW and for the local region. Section 5 is structured as follows:

- Section 5.1 sets out the approach taken to determine flow-on benefits;
- Sections 5.2 and 5.3 comment on the interpretation of input-output multipliers, and the limitations of input-output analysis, respectively;
- Section 5.4 describes the estimated flow-on benefits for NSW, accounting for agricultural impacts; and
- Section 5.5 describes the estimated flow-on benefits for the Southern Highlands SA3 Region, including in terms of agricultural employment impacts.

The detailed methodology used for deriving the input-output multipliers is described in Appendix B.

5.1 Economic framework

Flow-on effects refer to the adjustments in the economy that follow from initial changes in the level of demand for goods, services and labour arising from a significant development (such as the project). The economic framework described in the following has been applied to estimate these flow-on effects for the NSW and the local economy.

5.1.1 Choice of input-output analysis

There are a number of methods that can be used for calculating the flow-on effects for resources projects. They all face a singular issue in that the relative importance of a project increases when moving from a national to a state, and then to a regional perspective. At the same time, the degree of difficulty in estimating flow-on effects increases when moving from the national to the state and the regional level. For the most part, this reflects a general lack of information about the specific composition and source of intermediate inputs used by an industry, as well as about trade at a state and regional level. In addition, there may also be local rigidities in employment, capital assets and other fixed resources that are not consistent with the assumptions that underpin methodologies for measuring flow-on effects.

The methodology used here relies on input-output analysis to derive various multipliers. The primary reasons for selecting this methodology are the simplicity and clarity with which the underlying assumptions can be set out and appropriate caveats made. Further, when compared to more complex methods such a general equilibrium (GE) analysis:

- The gross value of the project is small in relation to the Australian and NSW economies. Unlike an input-output analysis, a GE analysis takes into account the price impacts of a project on inputs and outputs. However, given the relatively small size of the project (relative to the NSW economy), material price impacts would not be expected and the difference between the results of a GE and an input-output analysis should also be small.

- Given the lack of information about industry structure and trade at a regional and state level, there is no reason to think that one method would be materially more accurate than another. Both GE and input-output analysis depend critically on accurately modelling flows of production and expenditure.

5.1.2 Adjusting regional/state industry composition and trade

Regional impact analysis depends, in large part, on adjusting the flows of production and expenditure, as represented by national input-output tables, to represent a state or local economy.[6] However, industries at a local or state level have differing compositions of inputs and outputs than is the case for the national average; the same difficulty arises for specific projects within a local region. Hence, a consistent set of ancillary information that is specific to national, state and regional economies is required to apportion national aggregates. The most commonly used information for this purpose (which is also recommended by the ABS) is industry employment.

As of 2011, the ABS has conducted a census of employment by industry and at the LGA level. This employment information can be used to calculate location quotients (LQs) to adjust national industry structure and trade flow data to derive the corresponding state and regional aggregates. Employment based LQs are ratios that indicate the percentage of people employed in a particular industry at a state or regional level, relative to the percentage of people employed in that industry in the national economy. Employment based LQs are then used to proportionally adjust the contribution of an industry to the use of intermediate inputs in a state or region. The consequent shortfall in intermediate inputs is made up by increasing 'imports' from outside the state or region across all industries.

[6] Input-output tables capture the flows of intermediate inputs between producers and form the basis for deriving multipliers. These tables are generally prepared at a national level; national input-output multipliers are essentially derived from a weighted average of enterprises at the national level. Thus the Australian input-output tables reflect a snapshot in time of the entire Australian economy and the inter-relationships between producers, households, governments, and the outside world. However, while the ABS publishes national input-output tables, similar information about the relationships between economic agents within a region and flows into and out of a region ('imports' and 'exports') is not available.

The use of employment LQs has a critical limitation. Input-output tables do not explicitly account for fixed capital, human or physical, although the returns to these assets are implicitly reflected in wages and operating surpluses (profits). As the impact analysis becomes more granular, the geographic location of these assets becomes increasingly important. A local region may simply not have the fixed capital needed to cost-effectively produce the input required by a local industry. The input will be then be 'imported' from other regions, states, or from overseas.

5.2 Interpretation of input-output multipliers

A change in demand sets the economy in motion as the productive sectors buy and sell goods and services from one another and households earn additional incomes, which gives rise to further flow-on effects (Coughlin et al. 1991). These relationships cause the total effects on the regional and state economy to exceed the initial change in demand.

Economic flow-on impacts can be measured in terms of income, value added and employment, which in turn gives rise to income, value added and employment multipliers.[7] In the case of the project:

- the income multiplier refers to the percentage change in total income arising per dollar change in the wages and salaries paid by Hume Coal;
- the employment multiplier corresponds to the change in total employment (in numbers of FTEs) arising per additional person employed by Hume Coal; and
- the value added multiplier refers to the percentage change in total value added arising per dollar change in the value added created by Hume Coal.

[7] It is also possible to calculate output multipliers, as representing the amount of additional output induced by the need for other industries to produce the output to meet the demand for an extra dollar of output from a project. However, the value of total business activity implied by output multipliers is larger than the market value of the goods and services that are produced, because some of the re-spending is used for the purchase of intermediate goods and services. Because of the implied double-counting, some commentators consider output multipliers to be misleading, and we do not report them here.

Multipliers are classified into 'types'. Type I multipliers refer only to flow-on effects in the production sectors, while Type II multipliers incorporate subsequent impacts on households. In the case of the project:

- Type IA multipliers refer to the 'initial' and 'first-round' effects arising from an increase in demand from the project. The initial effect refers to the additional output from the project. The first-round effect captures the immediate subsequent impacts on income, employment or value added from all industries whose output is required to produce the additional output from the project.
- Type IB multipliers refer to the initial and 'production induced' effects, which encompass first-round effects and additionally 'industrial support' effects. Industrial support effects capture subsequently induced effects that occur after the first-round effects (since the initial output effect from project will induce additional output in other industries, which will in turn lead to further rounds of effects and so on).
- Type IIA multipliers incorporate the effects of the initial increase in output from the project on households, and refer to the sum of production induced and consumption induced effects. Consumption induced effects capture the fact that, as a result of the additional output from the project and subsequent production induced effects in other industries, wage and salary earners will earn extra income which they spend on goods and services produced by all industries in the state or region.

5.3 Limitations of input-output analysis

The principal advantage of the impact multiplier method is the simplicity with which levels of mining investment, employment and output can be translated into measures of changes in regional income and employment. However, the accounting conventions that form the basis of input-output models and hence how multipliers are derived impose a number of restrictive assumptions. Some of these assumptions pertain to input-output analysis generally while others relate to the use and interpretation of input-output analysis at a regional or state, as opposed to a national level. The key assumptions are set out below.

5.3.1 Key assumptions

Fixed capital stocks

The National Accounts, on which input-output analysis is based, do not explicitly account for fixed capital stocks. This is an issue with input-output analysis generally, as fixed capital has a significant impact on how an industry adjusts over time. A corollary to this is that input-output analysis is static in the sense that it takes no account of the time required for the composition of inputs and outputs of production to shift to a changed level in output. Industries that require large amounts of fixed capital and labour adjust slowly, particularly when they are near full employment or when the supply of skilled labour is tight. These dynamics are hard to predict, but the implication over the short- to medium-term is that input-output effects will be overstated to varying degrees across industries.

The fixed nature of the capital stock is a critical issue in local impact assessments. In moving from the national to a state or local level, the location of fixed assets becomes increasingly important in establishing the goods and services that are supplied locally and those which are imported. Moreover, there is no information as to whether fixed assets are owned locally or whether the owners are located outside the region or state. As a consequence, determining the valued added by local industry becomes increasingly problematic.

Supply constraints

Relatedly, when the initial impact considered is an increase in production, the assumption of fixed production patterns requires that there is a sufficient endowment of resources that is either available in (or able to migrate to) a local region to meet the increase in demand for inputs whose supply is fixed. These inputs include resources such as land and water, as well as labour with adequate skills.

Homogenous and fixed production patterns

The input coefficients that measure inter-industry flows between sectors are 'fixed' in input-output models; at any level of output, an industry's relative pattern of purchases from other sectors is unchanged. These assumptions are likely to be inconsistent with production patterns in the local economy, since the local economy may not have on offer the range of inputs required for a given industry. Therefore, the impact of the change in output on the local economy will differ from that implied by a national multiplier.

Fixed prices

Input-output analysis assumes that prices in the economy in question are held constant, so that the additional material and labour inputs are available at existing prices and wage rates. In reality, prices of inputs may change with substantive changes in their demand. To the extent that there is an impact on prices, imputed output effects will be overstated. However, this is only a problem in input-output analysis for projects of a sufficient scale to materially shift the demand for production inputs and the total supply of industry output.

5.3.2 Implications for the LEA

Many of the above assumptions can lead to an overstatement of the impacts of a project; the resulting regional impact estimates should therefore be interpreted as an upper bound of the likely effects (Bess and Ambargis 2011, Coughlin et al. 1991).

Furthermore, and while, from a theoretical perspective, the total (Type IIA) multiplier is the appropriate choice for calculating flow-on effects (since this measure takes into account the full adjustment of the economy to a change in economic activity), total multipliers are calculated in a manner that compounds any measurement errors and breaches in the assumptions that underpin the analysis. For example, total multipliers are calculated as a progression of first, second and successive round effects, with each embodying any errors in earlier effects. From this perspective, a more conservative approach is to rely only on multipliers that capture only first-round effects (Type IA multipliers).

As noted above, there are additionally specific issues that arise in deriving local value added multipliers. Value added includes profits that are distributed on the basis of ownership of capital assets, which becomes increasingly uncertain as the analysis becomes more granular.[8] The calculation of value added multipliers at a local level is therefore not meaningful.

5.4 Flow-on effects of the project for NSW

The following sections describe the results of the analysis of flow-on impacts of the project for the State of NSW. The detailed multipliers are shown in Appendix B.

5.4.1 Agricultural flow-on effects for NSW

The results of the CBA described in Section 3 show that the project would generate direct net benefits for NSW in terms of an increase in GSP of $295 million in NPV terms (including accounting for a small change in value added in offsetting agricultural impacts). The increase in NSW GSP would give rise to corresponding flow-on effects; again, the offsetting foregone value of agricultural production needs to be taken into account.

[8] For instance, there is no way of knowing from generally available public information whether a productive asset (say, a factory) that is located in the Southern Highlands SA3 Region is owned by persons living in that region, or in NSW, or elsewhere. It then becomes very difficult to attribute the value added generated by the factory on a regional and even state basis.

The opportunity costs of foregone agricultural production on downstream and upstream industries are related to the level of agricultural output, as measured by the gross value of agricultural production. Using the Type 1A value added multiplier for NSW agriculture of 1.41 (Appendix B), the flow-on effects corresponding to the foregone value of agricultural production would be of the order of $0.7 million in NPV terms. The estimated flow-on effects arising from the change in income and employment are estimated at:

- $0.2 million in NPV terms for foregone agricultural income; and
- 0.2 FTE jobs per annum for foregone agricultural employment.

5.4.2 Combined flow-on effects for NSW

Table 5-1 shows the estimated flow-on effects for the project for NSW, taking into account the offsetting agricultural (value added, income and employment) impacts. The assumptions made for the input-output analysis are consistent with those made in the CBA. The calculation of flow-on benefits focuses on changes in disposable income, and have been adjusted to account for the expectation that a share of workers would be employed elsewhere in the absence of the project. The multipliers that were used are reported in Appendix B.

Table 5-1 indicates that the flow-on benefits in terms of additional income, employment and value added generated by the project for NSW amount to:

- $76 million in NPV terms in terms of additional disposable income, or $7 million in NPV terms annually;
- on average, an additional 62 FTE jobs per annum; and
- additional value added of $73 million in NPV terms, or $6 million in NPV terms per annum.

Table 5-1. Initial flow-on effects (Type IA) for the project – NSW (NPV A$ 2016)

	Total	Annual
Disposable income ($ millions)	$76	$7
Employment (Annual average FTE jobs)	N/a	62
Value added ($ millions)	$73	$6

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

In Table 5-1, the flow-on benefits attributable to the additional disposable income generated by the project are greater than the flow-on benefits attributable to the value added from the project. Disposable income is a component of value added, so that the value added flow-on effects should, by definition, also be greater than the income flow-on effects. However, the relative scale of the income and value added multipliers are proportional to the relative contribution of labour, capital and taxes to value added, as derived from the National Accounts. The ratio of income to value added for the mining sector as a whole is about one to five, or 20 per cent, whereas for the project the ratio is about one to two, or 50 per cent. With these differences in scale the application of an income and value added multiplier of 1.57 and 1.25 (Appendix B), generate an income flow-on effect that is greater than the value added flow-on effect.

The effect described above is a reflection of the requirement to derive state and regional multipliers to determine state and regional flow-on effects, as set out in the 2015 Guidelines. The derivation of these multipliers (explained in Section 5.1 and Appendix B) are based on employment by industry data from the ABS census, reported at the Australian and New Zealand Standard Industrial Classification (ANZSIC) 20 industry classification, which does not disaggregate coal mining from mining overall.[9] In order to present the most conservative assessment possible, the lower of the two values ($73M) has been used for this assessment.

5.5 Flow-on effects of the project for the Southern Highlands SA3 Region

The flow-on effects of the project for the local region consist of the positive flow-on effects generated by the project, but also a small offsetting impact arising from a reduction in agricultural activities. As noted in Section 5.3, the calculation of value added multipliers for a small local area is not meaningful. To determine the local flow-on impacts of the project on the local economy, we have therefore focused on income and employment.

[9] A comparison of the relative shares of income and GOS, respectively, of value added for the project, on the one hand, and for an 'average' coal mining operation (as represented in the National Accounts), on the other, shows that the project ratios align more closely with those of an average Australian coal mine. This implies that the relative size of the income multiplier would be larger and the relative size of the value added multiplier would be smaller for the coal industry than for the mining sector as a whole, because the multipliers would apply to a relatively higher share of income with respect to value added. However, the precise values of the (NSW) coal industry multipliers would depend on the relative profitability, compensation of employees and taxes for a NSW coal mine versus a NSW average mine, which is not known. Hence it not possible to state conclusively that flow on value add effects are understated.

5.5.1 Agricultural flow-on impacts

As noted in Section 3.4, we have assumed that all agricultural labour is sourced locally, so that the absolute impacts in terms of income and employment are the same as those estimated for NSW. Applying Type 1A multipliers for Wingecarribee Shire LGA (Appendix B), the local flow-on effects arising from land removed from agricultural production are approximated as:

- $0.2 million for the flow-on arising from foregone agricultural income; and
- 0.2 FTE jobs for the flow-on effects corresponding to foregone agricultural employment.

5.5.2 Combined flow-on benefits on the local region

Table 5-2 shows the estimated flow-on effects from the project for the Southern Highlands SA3 Region. The employment flow-on effects take into account the small reduction in flow-on impacts that is attributable to the displacement of agriculture by the project:

- the flow-on benefits in terms of additional disposable income generated by the project are estimated at $44 million ($4 million annually) in NPV terms; and
- the employment flow-on effects are estimated at an annual average of 34 FTE jobs.

Table 5-2. Initial flow-on effects (Type IA) for the project – Southern Highlands SA3 Region (NPV A$ m 2016)

	Total	Annual
Disposable income ($ millions)	$44	$4
Employment (Annual average FTE jobs)	N/a	34

Notes: NPVs have been derived using an annual discount rate of 7 per cent.

Source: BAEconomics analysis.

Appendix A Cost-benefit analysis

A.1 CBA accounting framework

The accounting and definitional conventions set out in the following reflect the framework used in the ASNA, as set out in ABS (2013). These conventions have been applied for deriving the incremental GOS associated with the project, as well as the net benefits accruing to the State of NSW.

Formally, gross state product (GSP) at market prices derived using the income approach (GSP(I)) measures the sum of income flows accruing to the factors of production, plus taxes less subsidies on production and imports (ABS 2013):

- GSP(I) = Compensation of employees;
- + Gross operating surplus;
- + Gross mixed income; and
- + (-) Taxes (Subsidies)on production and imports.

In the ASNA accounting framework:

- 'compensation of employees' refers to the remuneration of labour in the form of wages, salaries, and employers' social contributions;
- GOS refers to the share of income from production that can be attributed to capital inputs for incorporated businesses;
- gross mixed income (GMI) is a similar concept as GOS, and refers to the share of income from production that can be attributed to unincorporated businesses (for instance, self-employed people) and therefore also includes a labour component; and
- taxes (subsidies) on production include taxes on products, such as the Goods and Services Tax (GST), and other taxes (subsidies) on production, such as payroll taxes or subsidies, land taxes, council rates, and taxes on pollution.

Each of these items has been adjusted to determine the share accruing to NSW, as follows.

A.1.1 Compensation of employees

In order to correctly apportion wage and salary benefits to NSW, gross wages and salaries have been decomposed into disposable income, income taxes, superannuation contributions, and Medicare levies. Only incremental disposable income is assumed to constitute a full benefit to NSW.

Some share of income taxes and Medicare levies paid by the Hume Coal workforce to the Commonwealth Government can be deemed to benefit the residents of NSW. As specified in the 2015 Guidelines, the share of income taxes and Medicare levies paid by the Hume Coal workforce that accrues to NSW has been determined on the basis of population share. The most recent ABS statistics indicate that the NSW share of the Australia population is around 32 per cent (ABS 2013).

A.1.2 Gross operating surplus

One of the components of the contribution to GSP that can be attributed to the project is the GOS. GOS is a measure of the surplus accruing to incorporated enterprises owners from processes of production before the deduction of various items. It is defined as the excess of gross output over the sum of intermediate consumption (gross value added), net of compensation of employees, and taxes less subsidies on production and imports. GOS is calculated before deduction of consumption of fixed capital, dividends, interest, royalties and land rent, and direct taxes payable (ABS 2013):

- Output - Intermediate consumption;
- = Gross value added;
- - Compensation of employees;
- - (+) Other taxes (subsidies) on production; and
- = Gross operating surplus.

The components of GOS are defined as follows:

- Output: Output consists of the value of goods and services produced, valued at producer prices.
- Intermediate consumption: Intermediate consumption (or 'intermediate use') consists of the value of the goods and services consumed ('used up') as inputs to the production process, including those used directly as inputs, as well as ancillary activities. Intermediate consumption does not include the consumption of fixed capital (depreciation) and royalties.
- Compensation of employees: Compensation of employees comprises wages and salaries and employers' social (e.g. superannuation) contributions. Compensation of employees excludes payroll tax, but it includes severance, termination and redundancy payments by employers. Employees are defined as all persons engaged in the activities of incorporated business units.
- Other taxes (less subsidies) on production: Other taxes on production include payroll taxes, recurrent taxes on land or buildings, stamp duties and taxes on pollution.

Only a portion of the incremental GOS associated with the project accrues to NSW, namely:

- the coal royalties paid by Hume Coal to NSW; and
- the share of company taxes paid by Hume Coal to the Commonwealth Government that accrues to NSW.

Some share of the company taxes paid by Hume Coal to the Commonwealth Government can be deemed to benefit the residents of NSW. As for personal income taxes, there is no direct relationship between any company tax paid by Hume Coal to the Commonwealth and the resulting benefits accruing to residents of NSW. The share of company taxes paid by Hume Coal that accrues to NSW has therefore also been determined on the basis of share of population.

A.1.3 Other taxes on production accruing directly to NSW

Hume Coal makes the following payments that accrue directly to different levels of government in NSW:

- payroll taxes;
- land taxes; and
- shire rates.

Incremental tax payments have been derived by accounting for the corresponding taxes that would be paid in the counterfactual.

A.2 Labour market assumptions

A.2.1 Literature review – Newly employed persons

There is relatively little empirical information about the origin of workers who are newly employed.

According to the ABS 'Job Search Experience' survey (ABS 2014a), as of July 2013 and for Australia as a whole, 14 per cent of employed persons (1,668,700 out of 11,599,600) had started their job in the previous 12 months. Of these 14 per cent, 10 per cent (163,300) stated that this was the first job ever held, while 33 per cent (550,400) indicated that they had been out of work prior to starting a job. The share of persons transferring from occasional work, part-time work or full-time work elsewhere is not known.

In addition, a share of workers may also migrate to NSW from interstate or from overseas. According to the ABS (2016), as of 2014-15, NSW experienced net overseas migration of 66,086, and net interstate migration of -6 639.

A.2.2 Labour market assumptions

The CBA described in Section 3 and the LEA described in Section 4 consider the incremental benefits of the project accruing to NSW and the Southern Highlands SA3 Region if the project is commissioned, relative to the reference case. If the project is commissioned, employment would increase relative to the reference case between FY 2021 and FY 2041. A share of the workforce is assumed to be additional (that is, drawn from job starters or from the unemployment pool), while the remainder is assumed to be redeployed from existing positions in NSW. The central (re-) employment assumption used in this report is that 80 per cent of additionally employed persons transfer from an alternative job in NSW.

For the purpose of the LEA, this assumption was modified by the share of employees assumed to reside in the Southern Highlands SA3 Region (Table A-1). As for the CBA, 80 per cent of additional workers are assumed to transfer from alternative jobs. Additionally, the targeted mix of local versus non-local (rest of NSW) employees was preserved, so that of the additional workers in the power station, 40 per cent are assumed to live in the Southern Highlands SA3 Region.

Table A-1. Workforce (re-) employment assumptions

Analysis	Relevant geographical area	Percentage of workers redeployed	Percentage of workers from the relevant geographical area	Combined re-employment assumption
CBA	NSW	80	100	80
LEA	Southern Highlands SA3 Region	80	65	52

Source: BAEconomics.

Alternative wage

The approach that has been taken to determining the alternative wage is to apply the median employment income applicable to the relevant geographical area (Table A-2). In addition, it has been assumed that the alternative wage would increase by 1 per cent in real terms per annum.

Table A-2. Alternative wage assumptions – Median employee income ($)

Analysis	Relevant geographical area	2013	2016
CBA	NSW	$48,322	$50,970
LEA	Southern Highlands SA3 Region	$43,891	$46,296

Notes: Median incomes were converted to $2016 using the NSW wage price index.

Source: ABS, 2016. Regional Statistics by ASGS, 2010-2014, June. Wage Price index, 6345.0, Table 8b. Ordinary Hourly Rates of Pay Excluding Bonuses, All Sectors, NSW.

Construction wages

The wages of the construction workforce were estimated using average ordinary full-time adult weekly earnings in the Australian construction industry. As of May 2016, gross weekly wages and salaries (excluding annual bonuses or similar payments) were $1,503 (ABS 2016), corresponding to $78,151 per annum.

A.2.3 Other assumptions

Table A-3 summarises other assumptions used to derive the net benefits to NSW.

Table A-3. Other CBA assumptions

Assumption	Numerical value	Sensitivity	Source
Benchmark export thermal coal price, average FY 2020 to FY 2040 (US$ per tonne)	$66.47	$49.85 to $83.03	Wood Mackenzie HCC and Thermal Coal Price Forecasts - H1 2016
Benchmark HCC price, average FY 2020 to FY 2040 (US$ per tonne)	$110.91	$83.18 to $138.63	As above
Exchange rates (US$ / AU$)	$0.77	$0.58 to $0.96	Hume Coal
Inflation *	2.5 per cent	N/a	BAEconomics
Real wage indexation	1 per cent	N/a	BAEconomics

Note: * An inflation assumption is required for the company tax calculation.

Appendix B Analysis of flow-on effects

B.1 Derivation of multipliers

This annex describes the methods used to calculate the flow- on effects of changes in the level of mining investment and production in NSW and the Mid and Upper Hunter region.

A number of practical difficulties arise in estimating regional or state-wide input-output multipliers for the purpose of conducting a regional impact analysis. Regardless of the approach that is adopted, regional impact analysis depends on national account statistics that, in Australia, are derived for the economy as a whole. The difficulty that then arises in assessing regional economic impacts is the inability to accurately account for the flow of goods and resources within and between regions.

In the past, apportioning national input-output multipliers to a regional or state level required assumptions that could not be verified. However, the collection of regional employment statistics in the 2011 census now provides a consistent and transparent method of deriving regional economic impacts at a reasonably granular level. The approach we have adopted here therefore makes use of 2011 census figures at an LGA level and the most recent national accounts figures compiled by the ABS for 2009-10, as set out below.

B.1.1 Concordance of the national accounts with census employment data

The Australian National Accounts input-output tables set out the flows of industry inputs (columns) and outputs (rows) for 114 industry classifications. The ABS census records employment an aggregated level with 19 industry classifications. The concordance between the census and the accounts is set out in Table B-1.

Table B1. Industry concordance between the industries in the National Accounts and industry level employment data in the 2011 census

2011 ABS census	ABS National Accounts industry codes	
Aggregate Industry	Starting from	Ending with
Agriculture, forestry and fishing	101	501
Mining	601	1001
Manufacturing	1101	2502
Electricity, gas, water and waste services	2601	2901
Construction	3001	3201
Wholesale trade	3301	3301
Retail trade	3901	3901
Accommodation and food services	4401	4501
Transport, postal and warehousing	4601	5201

Information media and telecommunications	5401	6001
Financial and insurance services	6201	6401
Rental, hiring and real estate services	6601	6702
Professional, scientific and technical Services	6901	7001
Administrative and support services	7210	7310
Public administration and safety	7501	7701
Education and training	8010	8210
Health care and social assistance	8401	8601
Arts and recreation services	8901	9201
Other services	9401	9502

Source: 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2009-10. 2011 ABS census.

To construct the flows of industry inputs and outputs at the same level of the census, the rows and columns are summed. For example, there are seven industries classified as being part of the broader agriculture classification. Summing the seven rows aggregates the outputs of agriculture as a whole into each of the 114 industries. Summing the resulting new rows across the seven individual agricultural industries give the total input requirements for agriculture as a whole from each the 114 regions. The final result is a balanced flow table with 19 industry classifications.

The balancing items include rows and columns that are important for the regional impact analysis:

- there are rows for wages and salaries, imports and value added, respectively; and
- there are columns for household consumption, as well as for other final demands.

B.1.2 Requirements matrix and first-round (Type IA) output multipliers

The initial requirement for an extra dollar's worth of output of a given industry is called the initial output effect. It equals one in total for all industries, since an additional dollar's worth of output from any industry will require the initial one dollar's worth of output from that industry plus any induced extra output. The first-round effect is the amount of output required from all industries of the economy to produce the initial output effect.

First-round effects can be measured by deriving the 'direct requirements matrix'. In this matrix, the coefficients in a given industry's column show the amount of extra output required from each industry to produce an extra dollar's worth of output from that industry. The requirements matrix has been constructed from the Australian input-output (flows) table by standardising the inputs into each industry to produce one unit of output in each industry. This is achieved by dividing each row of the table by the total output on an industry-by-industry basis.

The first-round impact multiplier is then the sum of the standardised inputs for a given industry. For example, each element of the column for agriculture is divided by total agricultural output and then summed to obtain the total input requirement for one addition unit of output. The initial multiplier can be interpreted as the direct costs of an additional unit of production at current prices. Given these inputs are supplied domestically, the costs are other industry outputs and therefore contribute to total economic output. The sum of the initial output effect (which equals one) and the first-round effect is the Type IA output multiplier. This is simply the total first-round contribution of a project to the economy. For a project that is small when compared to the size of the industry, the first-round and Type IA impact multipliers are valid given the requirements are representative of those used in the project.

B.1.3 Simple output or Type IB multiplier

The simple Type IB multiplier takes into account the inputs required for the increased agricultural output (for example) that must also be produced, which requires the expansion of these industries and those that support them. These may be seen as series of flow-on effects that continue until the overall industry flows are again balanced.

Calculation of the simple multipliers requires solving a matrix equation. Let A be the 19 by 19 matrix of industry requirements (as discussed above), x a vector of inputs used in each of the industries and y a vector of net outputs from the economy. Net output can be standardised to 1 for each industry, giving rise to the simple linear input-output equation:

$$Ax - x = 1$$

Solving for the overall input requirement to one additional unit of output from each industry:

$$x = (I - A)^{-1}$$

where I is an identity matrix with ones along the main diagonal and zeros elsewhere, and the superscript -1 denotes the matrix inverse. Summing the columns of $(1-A)^{-1}$ gives the simple multipliers. For example, summing the agricultural column gives the total inputs from all industries needed to sustain the production of one additional unit of net agricultural output at the national level.

The simple multiplier represents a shift in the composition of industry output, as well as the total level of industry output assuming constant prices. This may be reasonably valid for a small increase in, for example agricultural, output. However, for large change like what has occurred in the Australian mining industry, output prices for most industries will adjust in an offsetting manner. That is, the relative prices for the outputs that are used more extensively in mining will rise, while prices for those that are less extensively use will fall. The implication is that the simple multiplier will, for a given increase in mining output, overstate the flow-on effects in industries where relative prices rise and understate flow-on effects where relative prices fall.

For a project that is small relative to the size of industry the price effects will be small and the bias in the simple multiplier may be ignored. However, the composition of flow effects will vary if the input requirements for the project differ from those of the industry. A comparison can lead to useful caveats regarding the simply multiplier effects on other industries.

B.1.4 The total or Type IIA output multiplier

The total multiplier takes into account the relationship between wages and household demand, that is, the increase (decline) in household demand that results from a rise (fall) in household income. This is derived by adding the wages row and the household expenditure column to the A matrix from the requirements table. Let the expanded matrix be denoted B. The total multipliers are analogous to the simple multiplier and given by the column sums of the matrix $(I-B)^{-1}$.

The key issue with the total multiplier is that wage rates and output price changes will tend to offset the effect. In a limiting case, an increase in wage rates will result in an increase in output prices and leave total output and real household expenditure unchanged. However, if the project is small relative to the size of the economy the effects on household income and wages can be ignored.

B.1.5 Employment, income and value added multipliers

First-round, simple and total employment, income and value add multipliers can be calculated in much the same way as the output multipliers. The caveat noted for wage rates and employment in the previous section applies.

Employment multipliers

To calculate employment multipliers requires information about employment by industry that is provided in the ABS National Accounts (Table 20). For each industry, the FTE level of employment is divided by total industry output. This creates a vector of employment requirements per unit of output (denoted h) that can be used to convert the physical input requirements per additional unit of industry output into requirements for labour. The sum of these labour requirements constitute the employment multipliers, written in matrix notation as:

- Type IA: hA;
- Type IB: $h(I-A)^{-1}$; and
- Type IIA: $h(I-B)^{-1}$.

These multipliers give the FTEs of employment needed to support an additional unit of output. These multipliers can be adjusted to Type IA, Type IIA multipliers by expressing the multiplier as the total employment needed per person directly employed on the project. This is done by dividing each of the multipliers above by the number of workers required per unit of output. They are not the number of jobs created as this will be impacted by the number of part-time work that are converted to full-time workers or vice versa.

Income multipliers

The calculation of the income multiplier is done in the same way. The wage and salary requirement per unit are given in the requirements table. Designating these as a vector w the income multipliers written in matrix notation are:

- Type IA: wA;
- Type IB: $w(I-A)^{-1}$; and
- Type IIA: $w(I-B)^{-1}$.

These multipliers can be adjusted to Type IA, Type IIA multipliers by expressing the multiplier as the total income per dollar of salaries and wages expended directly on the project. This done by dividing each of the multipliers above by the salaries and wages required per unit of output.

Value added multipliers

Value added is the value of industry output less the costs of inputs, whether produced domestically or imported (the contribution to regional GDP). This can again be calculated, as a vector, v, from the requirements table as value added per unit of industry output. The multipliers are then calculated in an identical way to employment and income:

- Type IA: vA;
- Type IB: $v(I-A)^{-1}$; and
- Type IIA: $v(I-B)^{-1}$.

These multipliers can be adjusted to Type1A, Type 2a multipliers by expressing the multiplier as the total income per dollar of value added by the project. This done by dividing each of the multipliers above by the valued added per unit of output.

B.1.6 Regional impacts

It is not possible to maintain the level of consistency that exists in national input output tables at a regional level. Comprehensive data on industry composition, household consumption and the flow of goods and services to and from regions is not available.

A standard approach that can be reproduced across different regional definitions in a consistent manner is to use employment by industry data to form what are known as location quotients (LQs). LQs are used to translate economy-wide input-output relationships into regional relationships. For instance, while coal mining only accounts for a small share of employment at a national level, employment in coal mining in the Mid and Upper Hunter region is very significant. Hence national input-output tables need to be adjusted to better reflect the characteristics of the local economy.

Locational quotients

A raw LQ is simply the percentage of FTE employment in a given industry and region, divided by the percentage of FTE employment in a given industry at the national level. This may be written for the i^{th} industry and the j^{th} region as:

$$LQ_{i,j} = \frac{\text{employment}_{i,j}}{\frac{\sum_i \text{employment}_{i,j}}{\sum_j \text{employment}_{i,j}}} \Bigg/ \frac{}{\sum_i \sum_j \text{employment}_{i,j}}$$

The LQ has a natural interpretation for an industry within a region:

- if the LQ is less than one, the goods and services from that industry will tend to be imported into the region to meet demand; while
- if the LQ is greater than one, the goods and services from that industry will tend to be exported into the region to meet demand elsewhere.

Given that goods and services and labour requirements are the same in all regions, the relationship will tend to be proportional so long as the actual size of the labour force does not represent a constraint. These are standard assumptions in an input output analysis. However, at the regional level, the violation of these assumptions can often be more apparent. For example, specialised good or services demanded for a project may simply not be produced domestically and may have to imported, with a consequent reduction in regional flow-on effects. However, this can be addressed within the context of the requirements table if project information on where purchases are made is available.

Total employment may not be a constraint for a large region, such as a state. However, while a large proportion of people may be employed in an industry in a small region, the overall workforce in that industry may not be sufficient to meet labour requirements. While this may in part be offset by migration, it can simply be more efficient to import goods and services into the region.

It is recommended practice (Bess and Ambargis 2011) to adjust the raw LQs in small regions by the following formula:

$$LQ_{i,j} = \begin{cases} LQ_{i,j} & if \quad LQ_{i,j} < 1 \\ 1 & if \quad LQ_{i,j} >= 1 \end{cases}$$

LQs consist of the ratio of an industry's share of regional earnings to the industry's share of national earnings. This adjustment has the effect of holding constant or reducing regional flow-on effects. The basic idea is that industries in the region are not likely to produce all of the intermediate inputs required to produce the change in final demand. In these cases, local industries must purchase intermediate goods and services from producers outside the region, thereby creating leakages from the local economy.

Regional multipliers

Given LQ is a vector of location quotients, the regionally adjusted Type IA and Type IB input multipliers are calculated by multiplying the industry requirements by the quotients. The output multipliers are the column sums of:

- Type IA: $LQ \times A$;
- Type IB: $\left(I - LQ \times A\right)^{-1}$; and
- Type IIA: $\left(I - LQ \times B\right)^{-1}$.

Where × denotes element-by-element multiplication of each column of A by LQ.

The income, employment and value add multipliers are calculated in the same manner as the national multipliers.

B.1.7 Adjusted mining and agricultural industry expenditures

The LQ adjusts for locally sourced intermediate inputs. Therefore, the expenditure column of the input-output matrix, which includes wages, gross operating surplus, taxes and imports needs to be rebalanced to sum to total industry output. The balancing item is imports. The adjusted State and regional mine and agricultural expenditure are shown in Table B-2.

Table B-2. NSW and Southern Highlands LQ adjusted mine and agricultural expenditures

	NSW		SA3 Region	
Expenditure	**Mining**	**Agriculture**	**Mining**	**Agriculture**
Agriculture, forestry and fishing	0.2%	12.0%	0.3%	14.0%
Mining	3.6%	0.2%	3.8%	0.2%
Manufacturing	4.4%	6.5%	4.8%	7.1%
Electricity, gas, water and waste services	1.8%	2.1%	1.7%	2.0%
Construction	4.2%	2.5%	4.3%	2.5%
Wholesale trade	2.1%	4.0%	2.1%	4.0%
Retail trade	0.5%	1.1%	0.6%	1.1%
Accommodation and food services	0.7%	0.3%	0.7%	0.3%
Transport, postal and warehousing	2.5%	2.8%	2.2%	2.4%
Information media and telecommunications	0.2%	0.2%	0.2%	0.2%
Financial and insurance services	3.2%	4.0%	2.1%	2.6%
Rental, hiring and real estate services	1.3%	1.7%	1.3%	1.7%
Professional, scientific and technical Services	4.4%	2.6%	3.4%	2.0%
Administrative and support services	0.6%	0.8%	0.6%	0.8%
Public administration and safety	0.5%	0.1%	0.4%	0.1%
Education and training	0.1%	0.0%	0.1%	0.0%
Health care and social assistance	0.0%	0.0%	0.0%	0.0%
Arts and recreation services	0.1%	0.0%	0.1%	0.0%
Other services	1.6%	0.7%	1.5%	0.7%
Total domestic inputs	32.0%	41.6%	30.2%	41.7%

B.2 Estimates of multipliers

B.2.1 Mining

The multipliers reported in the following were derived from national level multipliers in accord with guidelines provided by the ABS (n.d.). State and regional multipliers were derived using employment LQs to translate economy-wide input-output relationships into regional relationships. Table B-3 shows the NSW mining multipliers derived from the 2013-14 National Accounts tables for:

- gross output (production);
- income;
- employment (FTE equivalent); and
- value added (contribution to GDP).

Table B-3. NSW input-output multipliers (mining)

Multiplier	NSW		
	Type IA	Type IB	Type IIA
Income	2.12	3.98	6.43
Employment	1.57	3.02	4.08
Value added	1.25	2.45	2.98

Source: ABS, 2016. 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2013-14; 6291.0.55.003 - Labour Force, Detailed, Quarterly, August.

Table B-4 shows the corresponding multipliers for the Southern Highlands SA3 Region.

Table B-4. Southern Highlands SA3 Region input-output multipliers (mining)

Multiplier	Southern Highlands SA3 Region		
	Type IA	Type IB	Type IIA
Income	2.04	3.15	5.85
Employment	1.52	2.29	3.77

Source: ABS, 2016. 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2013-14; ABS, 2011 Census.

B.2.2 Agriculture

Table B-5 shows the NSW agriculture multipliers; Table B-6 shows these multipliers for the Southern Highlands SA3 Region.

Table B-5. NSW input-output multipliers (agriculture)

Multiplier	NSW		
	Type IA	Type IB	Type IIA
Income	1.36	2.62	3.19
Employment	1.82	3.56	4.90
Value added	1.41	1.75	3.40

Source: ABS, 2016. 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2013-14; 6291.0.55.003 - Labour Force, Detailed, Quarterly, August.

Table B-6. Southern Highlands SA3 Region input-output multipliers (agriculture)

Multiplier	Southern Highlands SA3 Region		
	Type IA	Type IB	Type IIA
Income	1.37	2.61	3.10
Employment	1.79	3.42	4.57
Value Add	1.40	2.69	3.25

Source: ABS, 2016. 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2013-14; ABS 2011 Census.

References

Australian Bureau of Statistics 2016. 6302.0 Average Weekly Earnings, Australia, Table 10g, May.

_____ 2016a. 5209.0.55.001 - Australian National Accounts: Input-Output Tables, 2013-14, June.

_____ 2014, 62220DO007_201307 Job Search Experience, Australia, July 2013, 5 February.

_____ 2013, Australian System of National Accounts, Concepts, Sources and Methods, Catalogue No. 5216.0.

_____ 2012, 7121.0 - Agricultural Commodities, Australia, 2010-11'; at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/7121.0Main+Features12010-11?OpenDocument; accessed on 18 September 2016.

_____ n.d., Information Paper, Australian National Accounts, Introduction to Input-Output Multipliers, Catalogue No. 5246.0.

_____, 2010, 3412.0 - Migration, Australia, 2008-09, 29 July.

Bess, Rebecca, and Zoë O. Ambargis 2011, Input-Output Models for Impact Analysis: Suggestions for Practitioners Using RIMS II Multipliers; in: 50th Southern Regional Science Association Conference, New Orleans, Louisiana.

Cayen, Jean-Philippe, Donald Coletti, Rene Lalonde and Philipp Maier 2010. 'What Drives Exchange Rates? New Evidence from a Panel of U.S. Dollar Bilateral Exchange Rates,' Working Papers 10-5, Bank of Canada.

Commonwealth of Australia 2006, *Handbook of Cost-Benefit Analysis*, January.

Council of Australian Governments n.d., Intergovernmental Agreement On Federal Financial Relations, Schedule D.

Coughlin, Cletus, and Thomas B. Mandelbaum 1991, A consumer's guide to regional economic multipliers, Federal Reserve Bank of St. Louis Review, January/February, 73(1).

Department of Environment, Climate Change and Water NSW 2011, Biodiversity Certification Assessment Methodology, February.

Department of Treasury and Finance, Victoria 2013, Economic Evaluation for Business Cases, Technical guidelines, August.

Destination NSW 2015. LGA Profile – Wingecarribee.

European Commission (1997), *Guide to Cost-Benefit Analysis of Major Projects: In the context of EC Regional Policy*, 1997 edition; at: http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/pdf/3_full_en.pdf; accessed 12 October, 2016.

Lequiller, François, and Derek Blades, 2007. *Understanding national accounts*. OECD Publishing.

NSW Government 2015, Guidelines for the economic assessment of mining and coal seam gas proposals, December.

_____ 2015a, Greenhouse Gas Emissions Valuation Workbook.xlsm, at: http://planspolicies.planning.nsw.gov.au/index.pl?action=view_job&job_id=7312; accessed on 18 September 2016.

_____ 2013, Agricultural Impact Statement technical notes, A companion to the Agricultural Impact Statement guideline.

_____ 2012, Strategic Regional Land Use Policy, Guideline for Agricultural Impact Statements, October.

NSW Office of Environment and Heritage 2016; at: http://www.environment.nsw.gov.au/biocertification/; accessed on 10 October 2016.

NSW Department of Primary Industry 2016, Livestock gross margin budgets', at: http://www.dpi.nsw.gov.au/content/agriculture/farm-business/budgets/livestock; accessed on 18 September 2016.

NSW Treasury 2007, NSW Government Guidelines for Economic Appraisal, July.

Parliament of Australia 2013, Emissions trading schemes around the world, 6 June.

Pearce, D., G. Atkinson and S. Mourato 2006, *Cost-benefit Analysis and the Environment: Recent Developments*, OECD.

Planning NSW 2002, Guideline for economic effects and evaluation in EIA, November.

United Nations, 2003. National Accounts: A Practical Introduction, Studies in Methods Series F, No.85, Handbook of National Accounting. New York.