Federation Project
Economic Assessment

Final Report

Prepared for

Hera Resources Pty Limited

By

Gillespie Economics
Tel: (02) 9804 8562
Email: gillecon@bigpond.net.au
Web: gillespieeconomics.com

November 2021

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

BOXES

EXECUTIVE SUMMARY

The Federation Project (the Project) involves the development and operation of an underground metalliferous mine located approximately 15km south of the Nymagee township in the Cobar Local Government Area.

This Economic Assessment for the Project has been prepared for Hera Resources Pty Limited (Hera Resources), to form part of a Development Application to support an application for State Significant Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project.

Specifically, the Economic Assessment addresses the Planning Secretary's Environmental Assessment Requirements (SEARs) and provides:

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

- A local effects analysis (LEA) using a methodology developed by the NSW Government (2015), to assess some of the impacts of the Project in the locality, specifically:

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

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

Cost Benefit Analysis

A CBA of the Project indicated that it would have net production benefits to NSW of $70M, present value at 7% discount rate. Provided the residual environmental, social, and cultural impacts of the Project that accrue to NSW are considered to be valued at less than $70M, the Project can be considered to provide an improvement in economic efficiency and hence relative to the "without Project" scenario is justified on economic grounds.

Adverse uncompensated environmental, social and cultural impacts of the Project have been minimised through project design and mitigation, offset and compensation measures. The cost of implementing these measures have already been incorporated into the estimate of net production benefits, including the cost of using land resources, provision of biodiversity offsets and road maintenance and upgrades. Expert technical investigations indicate no material impacts are envisaged in relation to air quality, noise, surface water, visual amenity, Aboriginal Heritage, Historic Heritage, public infrastructure, or loss of surplus to other industries. Impacts that were quantified included greenhouse gas generation and groundwater water access licence (WAL). However, these costs are minor compared to the estimated net production benefits of the Project.

There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $96M, present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of between $69M (without employment benefits) to $165M (with employment benefits), present value at 7% discount rate and hence relative to the "without Project" scenario is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would

need to be valued at greater than between $69M and $165M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The key driver of the net social benefits to NSW is revenue (reflecting production levels, the value of gold in USD and the AUD/USD exchange rate) and to a lesser extent, operating costs. The estimates are less sensitive to assumptions about land opportunity costs, development capital costs, residual values, operating costs or environmental costs that have not already been internalised into production costs, such as GHG and groundwater costs. The Project has net social benefits to NSW under all sensitivity testing scenarios, apart from a sustained 20% reductions in revenues/prices.

Local Effects Analysis

The Project will provide 100 direct construction jobs and a minimum of 200 direct operational jobs. Under the strict LEA assumptions of full regional employment and no in-migration of labour, the Project provide an increase in regional wages equivalent to 1 job during construction and 12 jobs during operation.

Local externality impacts are not considered material.

Supplementary Local Effects Analysis using Input-Output Analysis

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

Using this approach, the total annual impact of peak year of construction on the regional economy is estimated at up to:

- $65M in annual direct and indirect regional output or business turnover;
- $27M in annual direct and indirect regional value added;
- $16M in annual direct and indirect household income; and
- 130 direct and indirect jobs.

The Project operation is estimated to make up to the following contribution to the regional economy:

- $214M in annual direct and indirect regional output or business turnover;
- $98M in annual direct and indirect regional value-added;
- $41M in annual direct and indirect household income; and
- 350 direct and indirect FTE jobs

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

1 INTRODUCTION

1.1 Introduction

Gillespie Economics has been engaged by Hera Resources Pty Limited (Hera Resources) to complete an Economic Assessment for the Federation Project (the Project). The purpose of the Economic Assessment is to form part of a Development Application being prepared by SLR Consulting to support an application for State Significant Development Consent under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project.

1.2 Legislative Context and Guidelines

This Economic Assessment has been carried out in accordance with:

- the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Planning, Industry and Environment for the Project that relate to economics i.e:

  - an assessment of the likely economic impacts of the development, paying particular attention to:
    - the significance of the resource - assessed separately in Environmental Impact Statement (EIS);
    - economic benefits of the project for the State and region - assessed in Chapters 4,5 and 6 of this report;
    - the demand for the provision of local infrastructure and services - assessed separately in the Social Impact Assessment; and
    - consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services - assessed separately in the EIS.

- Clause 7(1)(f) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* which requires environmental impact statements to provide *"the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations…*" Note to Clause 7 (1) (f) states that *"A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."*

- Section 4.15 of the EP&A Act which requires the following two matters to be taken into consideration by the consent authority in determining a development application:

  - the public interest (taken as the collective public interest of households in NSW); and
  - the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.

- the following standards, guidelines and policies:

  - NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*;
  - NSW Government (2018) *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*; and
  - NSW Treasury (2017) *NSW Government Guide to Cost-Benefit Analysis*.[1]

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

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

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

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

  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.[2]

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

1.3 Report Outline

Section 2 outlines the scope of the Project, the proposed economic impact mitigation measures, and key economic assumptions. This is the information on which the Economic Assessment is based. Section 3 provides an overview of the CBA and LEA approach used in this study. Section 4 and 5 document the CBA and LEA of the Project, respectively. Section 6 provides a supplementary LEA using Input-Output (IO) analysis. Conclusions are provided in Section 7.

[2] Refer to Attachment 2 for an introduction to economic methods.

2 PROJECT DESCRIPTION

2.1 Project Overview

Hera Resources is a wholly owned subsidiary of Aurelia Metals Limited (Aurelia). Hera Resources currently own and operate the Hera Mine located approximately 80km south-east of Cobar and approximately 5km south of the township of Nymagee in western NSW. Aurelia owns and operates the Peak Gold Mine (PGM) near Cobar in western NSW.

Hera Resources is evaluating the development of the Project, a proposed underground metalliferous mine development. The Project comprises underground mining activities and surface infrastructure at the Federation Site, amendments at Hera Mine to facilitate processing of ore from the Federation Site, and a Services Corridor connecting the Federation Site with Hera Mine. The Federation Site is located approximately 15km south of the Nymagee township and 10km south of the Hera Mine.

The Project will be a State Significant Development (SSD) (the Project) as defined by the State Environmental Planning Policy (State and Regional Development) 2011 (the SRD SEPP).

2.2 Background

Hera Mine has been operational since 2012 and produces gold and silver doré (unrefined bars) and a zinc/lead concentrate. Waste rock and metalliferous ore are extracted using underground open stope mining methods and underground load and haul operations. Hera Mine is approved to process up to 505,000 tonnes of ore on site annually, with lead/zinc concentrate transported to the Hermidale rail siding located approximately 75km to the north-east. The Hera Mine Project Approval was modified in June 2021 to allow for operations up to 31 December 2025.

In April 2019 high grade lead, zinc and gold mineralisation was discovered at the Federation deposit. Subsequent surface drilling programs have delineated a substantial gold-lead-zinc-copper-silver mineral deposit. Hera Resources is evaluating the development of a satellite underground mine at the Federation Site that leverages established infrastructure at the Hera Mine to minimise environmental impacts and allow for the continuation of mining operations in the Nymagee area. Mining of the Federation deposit will allow for a transition of mining operations from Hera Mine to Federation, as ore from the Federation deposit replaces ore from the Hera Mine.

2.3 Project Overview

The Project comprises:

- the establishment and operation of underground gold and metalliferous mining activities, with supporting surface infrastructure, mining approximately 6.95 million tonnes (Mt) of ore over a period of 12 to 14 years, referred to as the Federation Site.
- amendments at the Hera Mine to facilitate mining and processing of Federation ore, including new process plant and disposal of tailings in the Hera Mine tailings storage facility (TSF).
- services Corridor between the Federation Site and Hera Mine, including powerline, water pipeline and access track.

Total ore production from the Federation Site is approximately 6.95 Mt over the life of the mine. Most of the ore produced will be sent to Hera Mine for processing. However up to 200 thousand tonnes per annum (ktpa) will be transported to PGM in the initial four years of production (total of 750 kt over this period), whilst the new processing plant at Hera Mine is being commissioned and ramped up.

Access to the underground mine will be via a portal developed through the base of a box cut. The main decline will be developed to gain access to all production levels, where stopes will be excavated. The loosened ore from the stopes will be brought to the surface via underground truck and placed on the

Federation Site Run of Mine (ROM) ore stockpile near the boxcut. Ore will then be transported by surface trucks via Burthong Road to the Hera Mine ROM stockpile at the Hera Mine process plant.

Hera Mine infrastructure is proposed to be modified to facilitate the Project including a new 750 ktpa processing plant and solar farm. The existing processing plant will continue to operate at Hera Mine until the commissioning of the new plant. The new plant will be within the existing approved footprint of Hera Mine. The new processing plant will produce silver and gold doré and separate lead, zinc and copper concentrates.

A total of 5.8 Mt of tailings will be generated from the processing of the ore from Federation. Of this approximately 5.2 Mt will be produced at Hera Mine, with the remaining 0.6 Mt at PGM. Approximately 60% of total tailings produced will be returned to Federation Site to backfill underground stopes.

Hera Mine and Federation Site will be connected by a Services Corridor. The nominated width of the corridor is 23 m with an approximate length of 14.3km. Clearing of existing vegetation will be required to install the proposed services infrastructure, including a power transmission line, water pipeline, access track and potentially a tailings slurry pipeline. The access track will be used for maintenance and inspection requirements and will not be used for haulage or ore.

Concentrate from Hera Mine will be trucked to the Hermidale rail siding for transport, as per the current concentrate transport methods and truck sizing. Concentrate from PGM will be transported to Hermidale or Dubbo rail sidings, as per the current concentrate transport methods and truck sizing.

2.4 Transitional Period

It is anticipated that approval for the Project will be obtained in early 2023. Prior to the construction and operation of the Project, an Exploration Decline Program will be undertaken. This activity will be undertaken under a separate approval to that being sought for the Project. The main objectives of the Exploration Decline Program are to further define the mineral resources associated with the Federation deposit, including permitting drilling of exploration drill holes from underground.

Key components of the Exploration Decline Program include:

- establishment of a surface infrastructure area required to support the exploration decline.
- development of a box cut, portal, exploration decline, two ventilation rises and one escapeway.
- transportation to and storage of waste rock within the Surface Infrastructure Area, with subsequent transport of waste rock to Hera Mine.
- establishment and use of an approximately 14.8km surface pipeline to transfer water from the exploration decline to Hera Mine.
- exploration drilling from the exploration decline.
- extraction of one or more bulk samples together totalling no more than 20,000t and transportation of that material to Hera Mine processing plant via Burthong Road.

It is anticipated that the Exploration Decline Program will commence in November 2021 with the surface infrastructure area established and waste rock being generated from the decline. It is anticipated that ore from the bulk sample will be extracted and processed between the third quarter of 2022 and first quarter of 2023. Based on the current schedule for the Project, there will be a transitional period between Exploration Decline Program activities, mining operations at Hera Mine, and Project construction and operations. Following approval of the Project:

- construction of Project infrastructure (including the new process plant) will commence in the first half of 2023
- Exploration Decline Program activities will transition into mining operations at the Federation Site
- Hera Mine operations may continue over a period of 6 to 12 months.

From early 2024, it is anticipated that all activities will be related to the Project operations. The operational workforce numbers will be transitioned from Hera Mine operations to Project operations.

2.5 Project Detailed Overview

Provided in **Table 1** is a detailed overview of aspects of the Project.

Table 2.1 - Detailed Project Overview

Project Aspect	Project Details
Tenements	**Hera Mine and Federation Project** Mining Lease 1686 Mining Lease 1746 Exploration Licence 6162 Exploration Licence 7447
Current Approvals	**Hera Mine** Major Project Approval - (PA) 10_0191 Environment Protection Licence 20179 **Hera Mine Accommodation Village** Development Consent 2012/LD-00004 Development Consent 2021/LD-00010
Federation Deposit	The July 2021 Mineral Resource Estimate (MRE) reports that the Federation deposit has an estimated combined Indicated and Inferred MRE totalling 5.1Mt at 5.5% Pb, 9.3% Zn, 0.9g/t Au, 7g/t Ag and 0.3% Cu. There is an additional 1.9 Mt of unclassified material, bringing the total potential mineralisation to 7 Mt.
Mining Method	Underground mine stoping method. Access to the underground mine will be via a portal developed through the base of a box cut and decline. The proposed mining method requires excavation via drilling to a depth of approximately 530m to access areas of economically viable mineral resource deposits. Once the mineral deposit is accessed, stopes will be excavated via drilling and blasting. Bench stopes will be progressively backfilled with waste rock and returned tailings from Hera Mine, which will be processed by a pastefill plant located on the Federation Site.
Mine Ventilation	The ventilation infrastructure is subject to further detailed design and is expected to be staged. The conceptual design has a first stage with installation of twin 110kW decline fans, and a Return Air Rise. Second stage with installation of a twin 500kW primary ventilation system consisting of two 250kW primary fans located on surface. Secondary ventilation fans will also be required as the mine is developed.
Processing	A new 750 ktpa process plant design is proposed to be commissioned at Hera Mine. The existing processing plant will continue to operate at Hera until the completion of the new plant. The new plant will be within the existing approved footprint of Hera Mine. The new processing plant involves: • Three stages of crushing followed by ball milling with hydrocyclone classification. • Gravity separation to recover gold from the milling circuit recirculating load, followed by cyanide leaching of the gravity concentrate. • Sequential flotation to produce separate copper, lead and zinc concentrates. • Concentrate thickening and filtration. • Tailings thickening and disposal by underground backfill placement in the stopes at the Federation Site and surface storage in the Hera Mine TSF. The primary difference between the proposed plant and the current plant, is that each concentrate (e.g. zinc concentrate) will be produced through dedicated processing circuits.
Waste Rock Management	Two waste rock stockpiles will be located at the Federation Site to store waste rock generated from the development of the boxcut, decline and the lateral and vertical development. One stockpile will be for the storage of non-acid forming (NAF) materials and the other for potential acid forming (PAF) materials. Should a greater proportion of waste rock be identified as PAF material, all or part of the NAF waste rock stockpile area will be managed as a PAF waste rock stockpile. PAF waste rock will be stored on surface with drainage to a lined leachate pond and used as backfill underground during or post mine life. NAF waste rock will be stored on surface for later use in rehabilitation, such as backfilling the box cut.

Project Aspect	Project Details
Ore Transport	Ore from the Federation deposit, that will be processed at Hera Mine, is proposed to be transported approximately 11km along Burthong Rd. Ore proposed for processing at PGM will be transported along Burthong Rd, Priory Tank Rd and Kidman Way (the same as the currently approved alternate concentrate haulage route). Ore will be transported in trucks with an approximate 50t payload.
Tailings Storage	The approved Hera Mine TSF will continue to be used to store tailings from the Hera processing plant which will process ore from the Federation Site. It is estimated over the life of the Project 5.2 Mt of tailings will be produced from Federation, of which 3.5 Mt will be returned to the Federation Site to be used as backfill. The remaining 1.7 Mt will be placed into the approved TSF.
Surface Infrastructure – Federation Site	Site roads, laydown and access control Explosives magazines x 2 Mobile equipment maintenance workshop and warehouse Hydrocarbon storage Heavy and light vehicle washdown facilities Administration building Change house and laundry Sewerage treatment plant Potable Water Treatment Plant Substation Soil stockpiles Pastefill Plant Batch Plant Communications Tower Quarry
Water Supply	Water will primarily be supplied from dewatering of the underground workings. As part of the mine development, a new borefield will be established for the supply of water from production bores. There are existing water supply bores supplying water to Hera Mine, which will continue to operate. Hera Resources holds WAL 43173, which permits the extraction of 543ML of water annually. There is no planned increase to this limit as part of the Project.
On-site water management	The Project will have an integrated water management system across the Federation Site and Hera Mine. A water pipeline within the Services Corridor, and pumps at the Federation Site and Hera Mine, will allow for transfer of water. Water management infrastructure to be constructed at the Federation Site includes: • Mine water dam for dewatering the underground workings with approximate dimensions of 50m x 50m with a capacity of 10 ML. • Leachate pond(s) for collection of runoff from the PAF waste rock pad(s) and ROM pad. Water from the leachate pond(s) will be pumped to the mine water dam. • Sediment retention dam designed to limit fugitive sediment emissions, which will collect runoff from disturbed areas that do not contain contaminants. The dam has been sized to collect a 1:100-year 72-hour rainfall event from a catchment of approximately 25 ha. • Potentially other minor sediment dams, which would flow to the primary sediment dam. • Drainage infrastructure to separate clean water, sediment water and potentially contaminated water. The catchment areas, which store potentially contaminating materials such as the fuel, hydrocarbons or PAF waste rock will have their own contained catchments and have been limited in extent to minimise the generation of contaminated surface run-off.
Power Supply	A new solar farm will be commissioned at Hera Mine, which will be located 200m south of the existing heavy vehicle access road. The solar farm will be connected to the gas fired power plant on site via a new transmission line. The new plant will increase power production to meet the additional requirements of the Federation Site, as well as the anticipated increase in demand at the Hera Mine from increased processing plant capacity.
Concentrate Transport	Concentrate from Hera Mine will be trucked to the Hermidale rail siding for transport, as per the current concentrate transport methods and truck sizing (50 tonne payload). Concentrate from PGM will be transported to Hermidale or Dubbo rail sidings, as per the current concentrate transport methods and truck sizing.
Hours of Operation	Construction activities will be undertaken 7 days per week during daylight hours, unless a particular aspect of construction requires 24/7 activities. Transport of ore along Burthong Road will be undertaken during daylight hours. Operations at the Federation Site and Hera Mine will be 24 hours per day 7 days per week.

Project Aspect	Project Details
Workforce	It is estimated that a workforce of approximately 100 people will be employed during construction, with a workforce of 200 - 250 for Project operations, depending on the mining and processing production rates. There is a workforce of approximately 150 people for the current Hera Mine operations. Other than the 12-month construction phase, the Project maintains a reasonably consistent workforce, with some increases in the transition from Hera Mine to the Project.
Mining Equipment	Twin boom jumbo Production drill rig 50t trucks 17t loaders Shotcrete sprayer Shotcrete agitator Explosives charging unit Integrated toolcarrier (IT) Service truck Grader Water truck Truck and Loader
Decommissioning and Rehabilitation	Rehabilitation and decommissioning of the Project, including the Hera Mine site, would be undertaken on completion of extraction of the Federation deposit, with underground exploration continuing at Hera Mine during extraction from the Federation deposit. Backfilling of the stope voids will occur throughout operations. A Rehabilitation Management Plan will be developed for the Project which will outline the rehabilitation objectives and final landform for the Project.

2.6 Environmental, Social and Cultural Impacts and Mitigation Measures

Assessment of the environmental, social and cultural impacts of the Project, together with a range of measures to mitigate, offset and compensate for potential impacts of the Project, is provided in the technical assessment reports and summarised in the EIS.

In addition to the mitigation measures identified in other technical assessment reports and the EIS, Hera Resources proposes to work in partnership with local government and the local community to maximise the regional economic benefits of the Project and to minimise any adverse impacts, as far as possible. In this respect, Hera Resources is proposing several specific economic impact mitigation measures including:

Local employment, training and engagement

- Hera Resources will ensure that preference is given to local employees where they have the requisite set of skills.
- Hera Resources will work with local communities to facilitate pathways into entry level roles where members of the community do not have the requisite skills to work in mining.
- Hera Resources will actively engage with the local community and affected individuals and groups and provide feedback and endeavour to resolve any complaints on mining operations.

Potential business impacts

- Hera Resources will collaborate with Council, economic development organisations, local chambers of commerce and State Government to:

  - inform local business of the goods and services required of the Project, service provision opportunities and compliance requirements of business to secure contracts.
  - collaborate with local business and encourage local business to meet the requirements of the Project for supply contracts.
  - develop relevant networks to assist qualified local and regional businesses tender for provision of goods and services to support the Project.

2.7 Key Economic Assumptions

The Economic Assessment was based on a detailed financial model of the Project provided by Hera Resources. This financial model is commercial-in-confidence, but key assumptions are summarised in Table 2.2. It should be noted that economic costs and benefits are discounted to today's (2021) values. Estimates of net production benefits are not equivalent to estimates of pre-tax financial net present value of the Project due to difference in timing, exclusion of royalties as a cost and inclusion of opportunity cost of land and capital equipment and are not equivalent to accounting profit which requires inclusion of depreciation, debt financing and accounting practices.

Table 2.2 Key Assumptions Underpinning the Economic Assessment

Item	Assumption
Mining Methods	Underground mine stoping method
Resources and Reserves	Total potential mineralization of 6.9 Mt
Total Saleable Product	94,954 oz gold
	298,243 oz silver
	229,319 t lead
	347,772 t zinc
	8,596 t copper
Life of Analysis	16 years comprising:
	1 years pre construction
	15 years project life including 13 years of operation
Workforce	*Construction* • Average annual construction workforce of 100 FTE) *Operations* • Average annual operational workforce – 200 to 250 FTE
Price	Gold – USD 1,438/oz
	Silver – USD 19/oz
	Lead – USD 1,994/t
	Zinc – USD 2,596/t
	Copper - USD 6,646/t
AUD:USD Exchange Rate	0.70
Capital Expenditure	Life of Project capital expenditure, including sustaining capital, rehabilitation, biodiversity offsets, land compensation payments - $258M
Average annual operating costs (net of royalties)	AUD113M
State Royalties	4% ex-mine value (value less allowable deductions)

2.8 Assessment of Externalities

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

Where impacts are compensated, offset, or mitigated to have immaterial residual impacts, there are no externality impacts for consideration in the CBA. The biophysical assessments undertaken for the EIS are considered in economic terms in Section 4.4.2.

3 ECONOMIC ASSESSMENT METHODS

3.1 Introduction

The economic methods used to assess the Project are outlined below.

3.2 Cost Benefit Analysis

3.2.1 Background

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

CBA has its theoretical underpinnings in neoclassical welfare economics. CBA applications in NSW are guided by these theoretical foundations as well as NSW Treasury (2017). CBA applications within the NSW Environmental Impact Assessment (EIA) framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals and* NSW Government (2018) *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.

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

3.2.2 Definition of Society

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

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

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

With respect to the application of CBA in relation to coal mining proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW. NSW Treasury (2017) also makes it clear that a CBA should focus on impacts (costs and benefits) to the NSW community. The SEARs for the Project also refer to the requirement to provide consideration of the economic benefits of the Project for the State.

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

3.2.3 Definition of the Project Scope

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

Mine products are intermediate goods i.e. are inputs to other production processes. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects (NSW Treasury 2007; NSW Treasury 2017). The definition of the Project is therefore as summarised in Section 2 and includes mining and domestic delivery, as well as all mitigation, offset and compensation measures.

3.2.4 Net Production Benefits

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

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

Net production benefits can be estimated based on market data on the projected financial[3] value of the resource less the capital and operating costs of projects, including opportunity costs of capital and land already in the ownership of the proponent. This is normally based on commercial-in-confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

3.2.5 Environmental, Social and Cultural Impacts

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

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

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

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

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

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

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

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

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

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

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

3.2.6 Consideration of Net Social Benefits

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

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

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

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

Any other residual environmental, cultural, or social costs that remain unquantified in the analysis[4] can also be considered using the threshold value approach. The costs of these unquantified environmental,

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

cultural, and social impacts would need to be valued by society at greater than the quantified net social benefit of a project to make it questionable from an economic efficiency perspective.

3.2.7 Consideration of the Distribution of Costs and Benefits

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

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

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

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

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

3.2.8 Consideration of other Objectives of Government

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

3.2.9 Key steps in Cost Benefit Analysis

The key steps in CBA are summarised in Box 1.

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

Source: NSW Government (2015)

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

3.3 Local Effects Analysis

3.3.1 Introduction

LEA aims to address the consequences of the proposal in its "locality" as required by Section 4.15 of the EP&A Act. It is intended to complement CBA by translating effects at the NSW level to impacts on the communities located near the project site. It also provides additional information to describe changes that are anticipated within a locality, such as employment changes. LEA is intended to inform the scale of change rather than being representative of costs and benefits to the local community.

For a LEA, the locality is defined as the Local Government Area(s)[5] (LGAs) that contains the proposed project. The relevant population group is defined as those people ordinarily resident in the locality at the time of the proposal.

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

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

3.3.2 Direct Effects Relating to Local Employment

The Guidelines (NSW Government 2015) prescribe that only employment of people ordinarily resident in the region at the time of the proposal should be included in the initial estimation of direct local employment increases.[6]

[5] In this case the Cobar LGA has been chosen to represent the locality.
[6] Employment filled by those migrating into a region to live are excluded as are jobs filled by those who reside outside the region.

The Guidelines assume that these people would otherwise be employed in the region and so the increased disposable wages for the region because of a project is the difference between the average net income of these people in the mining industry and the average net income in other industries.[7]

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

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

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

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

3.3.3 Estimating Effects Related to Non-labour Project Expenditure

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

3.3.4 Second Round/Flow-on Effects

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

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

3.3.5 Effects on Other Local Industries

The LEA should also consider potential impacts such as:

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

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

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

3.3.7 Input-output Analysis

Section 5 undertakes a LEA as identified above and consistent with the NSW Government Guidelines (2015). In addition, an IO analysis (refer to Attachment 4) of the Project is undertaken in Section 6 to identify the gross incremental regional economic activity that the Project will provide to the region. As identified in Attachment 3, incorporation of consideration of the "job chain" effect means that the direct incremental employment and income to a region approximates the total income of those employed in the region who already reside in the region or migrate into the region to live i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect.

IO analysis essentially involves two steps:

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

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

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

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

- gross regional output – the gross value of business turnover;
- value-added – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output. These costs exclude income costs;
- income – the wages paid to employees including imputed wages for self-employed and business owners; and

- employment – the number of people employed (including self-employed, full-time and part-time).

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

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

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

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

4 COST BENEFIT ANALYSIS OF THE PROJECT

4.1 Introduction

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

4.2 Identification of the Base Case and Project

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

In this Economic Assessment, the base case or “without Project” scenario involves the continuation of existing rural production on the subject land – mainly feral goat production - and the cessation of mining and processing at the Hera Mine. In contrast to the “base case”, the Project is as outlined in Section 2.

CBA is primarily concerned with the evaluation of a Project relative to the counterfactual of the “without Project” scenario. Where there are several alternatives to a project, these can also be evaluated using CBA. However, alternatives need to be feasible to the proponent. The Project assessed in the EIS and evaluated in the CBA is considered by Hera Resources to be the most feasible alternative for minimising environmental, cultural, and social impacts whilst maximising resource recovery and operational efficiency. It is therefore this alternative that is proposed by Hera Resources and was subject to detailed economic analysis.

4.3 Identification of Benefits and Costs

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

Table 4.1
Potential Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits	• Opportunity costs of capital equipment from Hera Mine in 2024 • Opportunity cost of Hera Mine land in 2024 • Development costs including land, labour, capital equipment, sustaining capital, and acquisition costs for impacted properties and biodiversity offsets[1] • Operating costs, including administration, mining, processing, transportation to port, labour costs and mitigation, offsetting and compensation measures • Decommissioning and rehabilitation costs of both Hera Mine site and Federation Mine site at cessation of the Project	• Avoided decommissioning of Hera Mine in 2024 • Value of metal doré and concentrates • Residual value of capital and land at the cessation of the Project
Potential environmental, social and cultural impacts	• Surface water • Groundwater impacts • Air quality impacts • Noise and vibration impacts • Ecology and biodiversity impacts • Aboriginal heritage impacts • Historic heritage impacts • Traffic and transport impacts • Visual amenity impacts • Greenhouse gas generation • Agricultural impacts • Net public infrastructure costs • Loss of surplus to other industries	• Wage benefits to employment • Non-market benefits of employment • Economic benefits to existing landholders • Economic benefits to suppliers

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

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

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

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

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

4.4 Quantification/Valuation of Benefits and Costs

Consistent with NSW Government (2015) the analysis was undertaken in 2021 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%.

The analysis period is 16 years, coinciding with the Project life of 15 years (plus one year's pre-Project commencement). Any impacts that occur after this period are included in the final year of the analysis as a terminal value.

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

An attempt has also been made to estimate environmental, cultural, and social impacts using market data and benefit transfer[8] and incorporate them into an estimate of the net social benefit of the Project. This estimated net social benefit of the Project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the Project questionable from an economic efficiency perspective.

4.4.1 Production Costs and Benefits[9]

Production Costs

Opportunity Cost of Hera Capital

Some capital equipment from the Hera Mine site and already owned by Hera will be applied to the Project. There is an opportunity cost of carrying this equipment forward into the Project rather than sale. This opportunity cost is included in 2024, when it could otherwise be sold. Its market value is estimated by Hera Resources at $3M.

Opportunity Cost of Hera Land

Land at the Hera Mine site will continue to be used for the Project, instead of being able to have its value realised via sale in 2024. There is therefore an opportunity cost of using this land for the Project. This opportunity cost is estimated at $10,800 based on 108 ha of land and a market value of $100/ha.

Development Cost of the Project

The development costs of the Project include land payments; capital equipment; mine development; onsite infrastructure; offsite infrastructure; sustaining capital; decommissioning and rehabilitation costs; and mitigation, offset and compensation measures including for biodiversity offsets. These capital costs over the life of the Project are estimated by Hera Resources at in the order of $258M. These costs are included in the economic analysis in the years that they are expected to occur.

Annual Operating Costs of the Project

The annual operating costs of the Project include those associated with mining, environmental management and monitoring, mineral processing, administration, product transport and road maintenance costs. Average annual operating costs of the Project (excluding royalties) are estimated at $113M.

While royalties are a cost to Hera Resources, they are part of the overall producer surplus benefit of the Project that is paid to the NSW Government and then redistributed. Royalties are therefore not included

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

in the calculation of the resource costs of operating the Project. Two types of royalties are associated with the Project:

- royalties to the NSW Government, estimated at $63M (life of Project), or $34M in present value terms (at 7% discount rate).

- royalties to third parties (investors) estimated at $4M (life of Project), or $3M in present value terms (at 7% discount rate).

Decommissioning and Rehabilitation Costs of Facilities

At the end of the Project life site decommissioning and rehabilitation would occur at both the Hera Mine site and Federation Mine site. These costs are estimated at $25M and are included in the capital costs of the Project. Notwithstanding, it should be noted that Hera Resources is required to pay a rehabilitation security deposit to the NSW Department of Planning, Industry and Environment – Division of Resources and Geoscience (DPIE-DRG).

Production Benefits

Avoided Decommissioning of Hera Mine

Without the Project, mining at the Hera Mine would cease in 2023 with associated decommissioning and rehabilitation in 2024. With the Project the Hera Mine infrastructure continues to be used for processing and so site decommissioning and rehabilitation is avoided at this this time. These avoided costs in 2024 are estimated by Hera Resources at $15M.

Value of Doré and Concentrate

The main economic benefit of the Project is the market value of the metal doré concentrates that are produced. This reflects the production and processing profile, metal prices which are quoted in USD and the USD/AUD exchange rate.

Total metal production over the life of the Project is summarised in Table 4.3.

Table 4.3– Project Production

Sales Volumes	Unit	Quantity
Gold	[oz]	94,954
Silver	[oz]	298,243
Lead	[t]	229,319
Zinc	[t]	347,772
Copper	[t]	8,596

Assumed metal prices over the life of the Project are summarised in Table 4.4.

Table 4.4 – Price and Exchange Rate Assumptions

	Units	FY24	FY25	FY26-36
Gold	[US$/oz]	1,568	1,525	1,438
Silver	[US$/oz]	19	19	19
Lead	[US$/t]	1,914	1,934	1,994
Zinc	[US$/t]	2,425	2,501	2,596
Copper	[US$/t]	6,657	6,663	6,646
AUD/USD		0.73	0.72	0.70
Gold	[A$/oz]	2,148	2,133	2,055
Silver	[A$/oz]	26	27	27
Lead	[A$/t]	2,622	2,705	2,848
Zinc	[A$/t]	3,322	3,498	3,709
Copper	[A$/t]	9,120	9,319	9,495

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment is assumed to have zero residual value, land at Hera Mine (108ha) and Federation Mine (92ha) that is in the disturbance boundary, is estimated to have an undiscounted residual value of $20,000.

4.4.2 Environmental Social and Cultural Costs and Benefits

Agricultural Production

The present value of foregone agricultural production is reflected in land prices. The value of foregone agricultural production, because of the Project infrastructure, disturbance areas and offsets, has therefore already been incorporated into the CBA through inclusion of its market value in the opportunity cost of land and the development costs of the Project.

Surface Water

Surface water (and groundwater) is a potential input into numerous alternative production processes and so its use for mining has an opportunity cost i.e. its value in the next best alternative use. In NSW the government has established a market framework to facilitate the allocation of surface water (and groundwater). Water access and use is only permissible with possession of a WAL (except in the case of harvestable rights, native title rights and some stock and domestic rights). Water Sharing Plans that are prepared under the *Water Management Act 2000* set the rules by which water is shared between all users, including the environment, in each water management area in NSW. These plans also set rules for water trading, that is, the buying and selling of water licences and also annual water allocations (Montoya 2010). Consequently, the market value for water can be considered to give a reasonable indication of its economic value in alternative uses i.e. its opportunity cost.

The Surface Water Impact Assessment identified that:

- the water requirements of the Project are expected to bet met with the existing WAL groundwater entitlements already held for Hera Mine. No extraction of surface water from third order watercourses is proposed as part of the Project.
- the Project will not result in any change to the flow regime in Box Creek or Sandy Creek
- with the proposed water management infrastructure, the potential surface water quality impacts of Project are expected to be negligible.

- the water balance modelling forecasts no adverse change in the likelihood, frequency or volume of off-site discharges from Hera Mine or Federation Site.
- there would be no impacts to downstream water users.
- there would be no change in cumulative impacts.

Consequently, there are no economic implications associated with surface water for inclusion in the CBA.

Groundwater

The Groundwater Assessment found that:

- modelled drawdown at all landholder bores is less than 2 m except for two bores where make good provisions will apply under the Level 1 minimal impact considerations outlined in the NSW Aquifer Interference Policy (AIP).
- there are no high priority GDEs, or culturally significant sites listed in the WSP within 20 km of Federation. It is considered unlikely that there are any GDEs in the vicinity of Hera Mine, Federation and proposed production bores due to the depth to water table. The depth to water table varies from 45 m to 90 m below ground level, which is well below the expected depth of any root systems. Therefore, potential impacts on high priority GDEs and culturally significant sites are within the Level 1 minimal impact considerations for GDEs from the NSW AIP.
- water quality impacts from proposed mining at Federation will not lower the beneficial use category of the groundwater source. Therefore, potential impacts on groundwater quality will meet the Level 1 minimal impact considerations for groundwater quality from the NSW AIP.
- total groundwater take in the year of maximum modelled groundwater inflow to Federation is 536 ML/year. This is less than the WAL entitlement held by Aurelia. Therefore, Aurelia holds sufficient WAL entitlement for the Project. Notwithstanding, there is an opportunity cost in 2024 of continuing to hold these WALs, assumed at $2,000/ML i.e. $1.1M. This groundwater impact has been included in the analysis in 2024.

Air Quality

The impact of the Project emissions can potentially be valued using the property value method, where the change in property value because of the air quality impacts are estimated, the cost of illness method where changes in health episodes because of emissions are estimated and/or the defensive expenditure method and damage cost method where the costs of mitigation are estimated.

The Air Quality and Greenhouse Gas Assessment provided estimates and dispersion modelling for total suspended particulates (TSP), particulate matter less than 10 micrometres (µm) in aerodynamic diameter (PM10), and particulate matter less than 2.5 µm in aerodynamic diameter (PM2.5).

The results show that there are no predicted exceedances at sensitive receptor locations of the NSW EPA impact assessment criteria for any of the annual average parameters. For 24-hour average PM2.5, there are no predicted exceedances at sensitive receptor locations of the NSW EPA impact assessment criteria. For 24-hour average PM10, there is one predicted exceedance of the NSW EPA impact assessment criteria, experienced at all sensitive receptor locations. This exceedance is due to background concentrations already exceeding the criteria. There are no additional exceedances at sensitive receptor locations of the 24-hour average PM10 criterion caused by Project contributions. Overall, the air quality assessment concludes that the operation of the proposed Federation Project activities is not anticipated to result in adverse air quality impacts under normal operating conditions.

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

Noise

The impact of the Project noise and vibration on nearby properties can potentially be valued using the property value method, where the change in property value (or acquisition costs) because of the noise impacts are estimated, or the defensive expenditure method and damage cost method where the costs of mitigation or damage are estimated.

The Noise and Vibration Impact Assessment found that:

- operational noise levels would achieve the relevant NSW Environment Protection Authority's (EPA's), Noise Policy for Industry (NPI), 2017 criteria for all assessment periods at each assessed receiver location. The assessment considered operations at both the Federation Site and the Hera Mine, including the simultaneous operation of the existing and new processing plants.
- that noise emissions are predicted to remain below the EPA maximum noise trigger levels for sleep disturbance at all receiver locations.
- Operational noise levels are not predicted to exceed the trigger levels for voluntary acquisition or vacant land acquisition at any receiver locations.
- the road noise criteria as specified in the NSW Department of Environment, Climate Change and Water (DECCW), Road Noise Policy (RNP), 2011 will be satisfied for the nearest residential receivers adjacent to each of the proposed haul routes.
- airblast overpressure and ground vibration levels are predicted to meet the criteria at all assessed receivers for surface blasts for the maximum probable MIC of 50kg during mining activities.
- ground vibration levels are predicted to meet the criteria at all assessed receivers for the maximum probable MIC of 450kg for underground blasting.

Consequently, there are no material residual impacts for inclusion in the CBA.

Ecology and Biodiversity

Any vegetation, and associated fauna, that is impacted by a project is likely to have non-use values to the community that would be lost. These values could potentially be estimated using non-market valuation methods. However, it is government policy that biodiversity offsets are provided that improve or at least maintain biodiversity values. The provision of offsets therefore provides gains in non-use values to the community. Provided the values held by the community for the offsets are equal or greater than values that would be lost from a project then there are no additional economic costs that warrant inclusion in a CBA of a project, apart from the costs of providing the offsets.

The Biodiversity Development Assessment Report identified potential impacts on some species that are listed under both the *Environment Protection and Biodiversity Conservation Act 1999* and the *Biodiversity Conservation Act 2016.* For these dual listed species, a mandatory offsetting obligation has been generated under the NSW Biodiversity Offsetting Scheme (BOS). The estimated cost of providing offsets is included in the capital cost of the Project i.e. an allowance of $5M for purchase of purchase of credits. To the extent that the offsets provide community values that are equivalent to the values lost from clearing, there will be no net loss in community values.

Sensitivity testing of these costs in Section 4.8 is sufficient to incorporate substantial changes in the costs of offsets.

Aboriginal Heritage

Impacts on Aboriginal cultural heritage can have use and non-use values to both Aboriginal and non-Aboriginal people that can be potentially estimated used nonmarket valuation methods such as choice modelling.

The Aboriginal Cultural Heritage Assessment and Archaeological Survey Report (ACHAASR) identified 28 Aboriginal sites in the vicinity of the Project. All sites except one are outside the proposed impact footprint for the Project. The one site within the impact footprint will remain in situ and contain a ten-metre buffer. With implementation of proposed mitigation measures the ACHAASR identified that there would be no impact on the significance of the sites.

Consequently, there are no economic implications associated with Aboriginal cultural heritage for inclusion in the CBA.

Historic Heritage

Impacts on historical heritage can have use and non-use values that can be potentially estimated using nonmarket valuation methods such as choice modelling.

The assessment of Historic Heritage found that there are no items of listed historic heritage within proximity to the Project. Consequently, there are no economic implications associated with Historic Heritage for inclusion in the CBA.

Traffic and Transport

Traffic impacts can potentially be valued by the cost of measures to mitigate impacts i.e. the defensive expenditure approach.

A Road Transport Assessment found that *"the existing road network and intersections have adequate capacity to accommodate the Project-generated traffic together with unrelated traffic changes in the region, while maintaining the efficiency and safety of the road network operations at good standards."*

Hera Resources will enter a Planning Agreement with Cobar Shire Council and Bogan Shire Council regarding annual contributions for road maintenance and repairs on the relevant length of Burthong Road over the life of the Project. An allowance for these contributions has been included in the operating costs of the Project.

The capital costs of the Project also include and allowance for the construction of the intersections of Burthong Road with the proposed Federation Site access roads as road intersections, with BAL and BAR treatments, designed to accommodate the swept path of the relevant design vehicles.

Consequently, there are no material residual economic implications associated with traffic and transport for inclusion in the CBA.

Visual Amenity

Visual impacts can impact the amenity of others and hence have impacts on people's use values. An assessment of the visual impacts of the Project indicated no significant visual impacts.

Consequently, there are no economic implications for inclusion in the CBA.

Greenhouse Gas Generation

The Project will generate in the order of 22,382 tonnes (t) of Scope 1 emissions per annum. The Project will not generate any Scope 2 emissions.[10]

[10] It should be noted that greenhouse gas generation associated with Scope 3 emissions is considered to be outside of the scope of the CBA of the Project, as they relate to downstream processing and are part of a separate project that has its own set of costs and benefits.

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. Three shadow prices were used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US EPA Social Cost of Carbon. Under these shadow prices the present value of greenhouse gas emission cost is between $2M and $11M dollars, present value. This is a global damage cost of carbon i.e. the cost of carbon emissions to the population of the whole world.

Consistent with the Guidelines (NSW Government 2015), the focus of this CBA of mining projects is on costs and benefits to the population of NSW. In the absence of any studies that have focused on the social damage cost of carbon emissions to NSW residents, some means of apportioning global damage costs borne by Australians is required. For the Economic Assessment this has been undertaken using Australia's share of the global population (around 0.3%) and NSWs share of the Australian population (32%). NSW DP&E has previously supported this approach (NSW DP&E 2017).

On this basis the present value of the cost of greenhouse gas emissions from the Project to Australia is estimated at between $8,000 and $33,000 dollars (present value), with an average of $18,000. The cost of greenhouse gas emissions to NSW is estimated at between $2,000 and $10,000 dollars (present value), with an average of $6,000.

Market Benefits to Workers

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). This approach assumes labour markets clear, with no involuntary unemployment i.e. full employment, and no other distortions (Bartik, 2012). However, where there is involuntary unemployment, a Project may result in a wage benefit to workers. Workers who transfer to the mining sector and earn higher wages are in effect increasing their productivity. The value of their output for given work hours is increasing i.e. the marginal value product of labour. The real benefit for the worker is the difference between the wage that workers are paid in mining and their minimum reservation wage (i.e. the minimum wage they would accept) for working in the mining sector (which reflects their relative occupational preference) (NSW Government, 2012, p. 7).

The NSW Guidelines (2017) identifies that:

"Although a zero-wage premium is a useful starting assumption, the appropriateness of this assumption must be assessed on a case-by-case basis. This is because ***benefits to workers can be one of the major economic benefits from a project.*** *If a proponent considers that a project will generate positive benefits for workers, the economic assessment should clearly explain the reasons for this conclusion and present evidence in support of the valuation that has been adopted."*

The fundamental justification for inclusion of wage benefits in a CBA is that the economy is rarely at full employment and even if it is temporarily, there is a constant stream of new entrants to the labour market that are looking for jobs i.e. the market for labour is dynamic. A mining project can directly employ people from the unemployment pool, new entrants to the labour force or already employed people e.g. in mining, agriculture, construction, manufacturing etc. All these potential sources of labour are reflected on the labour supply curve for a project. The labour supply curve represents the lowest wage rate (allowing for risks and disutility) at which workers would be willing to accept a job in the mining sector. The labour supply curve is upward sloping. For those people at the margin, say those already employed in the mining sector, their reservation wage is likely to be similar to the wage that they receive in the new project. However, for infra-marginal labour there would be a wage benefit, with a larger wage benefit to people sourced from the involuntary unemployment pool i.e. lower down the labour supply curve. The wage benefit for otherwise unemployment people can be even greater when search and retraining costs, scarring, stigma and physical and mental health effects of unemployment are taken into account (Haveman and Weimer 2015). For people already employed in other sectors the direct wage benefit would likely be between those of the unemployed and those already in the mining sector. However, even the direct wage benefit for those employed from the mining sector or other sectors but may be larger

than the estimated direct wage benefits, due to job chain effects and occupational upgrading i.e. where a person is employed from another job, which creates a vacant job for others to upgrade their employment, which creates a further vacancy to be filled, and so on (Bartik, 2012). With job chain effects what is important is not the reservation wage of those immediately hired by the project, but the reservation wage of those at the end of the job chain (Bartik, 2012).

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

Some indication of the potential magnitude of these benefits can be gained by making several assumptions. Following the general approach of Streeting and Hamilton (1991)[11] if it were assumed that 10% of the direct workforce of the Project[12] (20 out of a total of 200 jobs) would otherwise be unemployed for three years and that the reservation wage for these people was $59,700[13] compared to a mining wage of $140,000, then the market employment benefit in terms of income would be $3M present value, at a 7% discount rate. Values at alternate discount rates and percentages of unemployed are provided in the following table. These calculations exclude any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

Table 4.5 - Potential Economic Benefits to Workers ($M)

	Discount Rate		
% Unemployed for 3 years	**4%**	**7%**	**10%**
Scenario 1 - 5% UE	$2.0	$1.7	$1.5
Scenario 2 - 10% UE	$4.0	$3.4	$3.0
Scenario 3 - 15% UE	$5.9	$5.2	$4.5
Wage premium benefit for Rest of Employment			
Scenario 1 - 5% UE	$30.6	$26.5	$23.1
Scenario 2 - 10% UE	$32.3	$28.0	$24.4
Scenario 3 - 15% UE	$28.9	$25.1	$21.9
Total Wage Benefit			
Scenario 1 - 5% UE	$32.5	$28.3	$24.6
Scenario 2 - 10% UE	$36.2	$31.5	$27.4
Scenario 3 - 15% UE	$34.8	$30.2	$26.4

This estimate makes no allowance for the wage benefits to already employed workers and job chain effects. Assuming, the remaining workers, after job chain effects, are evenly located along the labour supply curve, the average wage in NSW ($64,706[14]) gives an indication of a potential average reservation wage. Further, assuming a 10% increase in average reservation wage is required to reflect any disutility in the mining sector, and that these wage benefits are only obtained for 3 years, then the additional wage benefits associated with the 90% of workers who would otherwise be employed in other jobs is estimated at $28M present value, at a 7% discount rate. Values at alternate discount rates and percentages of already employed people are provided in the Table 4.5.

Based on these assumptions the potential market-based benefits of employment are in the order of $30M present value at 7% discount rate.

[11] Streeting and Hamilton (1991) *An Economic Analysis of the Forests of South-Eastern Australia*, Resource Assessment Commission, Research Paper Number 5.
[12] All sourced from NSW.
[13] As estimated by the unemployment benefits plus income tax payable on a mining wage, following the reservation wage rate approach used by Streeting and Hamilton (1991).
[14] Mean employee income 2018 NSW (ABS Regional Statistics 2018).

There is some political contention around the inclusion of these values in CBA. Consequently, the results have been reported "with" and "without" these potential wage benefits to workers.

Non-market Value of Employment

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

Empirical evidence for these values was found in three choice modelling studies of mining projects in NSW. In a study of the Metropolitan Colliery in the NSW Southern Coalfields, Gillespie Economics (2008) estimated the value the community would hold for the 320 jobs provided over 23 years at $756M (present value). In a similar study of the Bulli Seam Operations, Gillespie Economics (2009a) estimated the value the community would hold for the 1,170 jobs provided over 30 years at $870M (present value). In a study of the Warkworth Mine extension, Gillespie Economics (2009b) estimated the value the community would hold for 951 jobs from 2022 to 2031 at $286M (present value). These studies are considered reasonable for benefit transfer since they relate to resource extraction in NSW with the population sampled being NSW households.

The Project would provide a minimum of 200 average annual direct operational jobs during operations, for approximately 13 years. Using the more conservative Bulli Seam Operation employment value gives an estimated $64M for the employment benefits of the Project. There is some political contention around these values, even though they have a solid foundation in theoretical and applied economics. Refer to Attachment 7. Consequently, the results have been reported "with" and "without" nonmarket employment benefits.

Economic Benefits to Existing Landholders

Payments to landholders (who own the properties on which the Project will occur), that exceed the opportunity cost of the land, are an economic benefit to the landholder. The cost of compensating existing landholders (lease owners) is included in the capital costs of the Project. To the extent that the compensation cost exceeds the opportunity cost of the land, then resource costs of the Project may be overstated, and some benefits may accrue to the current landholder. However, conservatively these potential benefits are excluded from the CBA.

Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. Conservatively, this convention is adopted and hence no secondary benefits to the economic are included.

Net Public Infrastructure Impacts

Potential impacts of the Project on public infrastructure include the use of utilities. However, the use of utilities will be paid for by user fees which are included in the Project operating costs. Impacts on road infrastructure will also be compensated for by payments to the relevant Councils responsible for maintenance. Consequently, no net infrastructure costs to government are envisaged because of the Project.

Loss of Surplus to Other Industries

The land that is the proposed site of the Project is currently used for goat production (herding feral goats). There is a producer surplus associated with this use which will be foregone when the land is used for mining. However, as identified above the value of this surplus is reflected in the market value of the land and hence the compensation payment that will be made to the landholders. This opportunity cost will therefore be borne by Hera Resources. Consistent with the partial equilibrium nature of CBA and the general approach of not including secondary costs and benefits in CBA no other impacts on other industries are included in the analysis.

4.5 Consolidation of Value Estimates

4.5.1 Net Production Benefits

The present value of production costs and benefits, using a 7% discount rate, is provided in Table 4.6.

The Project is estimated to have global net production benefits of $162M (present value at 7% discount rate), relative to the base case.

The proponent, Hera Resources, is estimated to be 81% Australian owned and third-party royalties accrue to a foreign investment firm. Consequently, net production benefits that accrue to Australia are $147M comprising NSW Royalties, Company tax, 0% of third-party royalties and 81% of residual net production benefits

The net production benefits can be further apportioned to NSW by assuming that all royalties accrue to NSW, all Australian residual net production benefits and company tax benefits accrue to NSW based on its population share. On this basis, the net production benefits of the Project that accrue to NSW are estimated at $70M (present value at 7% discount rate).

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

Provided the value of the residual environmental impacts of the Project, to Australian and NSW households, after mitigation, do not exceed the respective net production threshold values, then the Project will have net benefits to the Australian and NSW communities.

Table 4.6 - Net Production Benefits of the Project ($M Present Values at 7% Discount Rate)

	$M
Costs	
Opportunity cost of land	$0
Opportunity cost of capital equipment	$2
Capital costs	$191
Operating cost (ex royalties), including rehabilitation and decommissioning	$865
Rehabilitation and decommissioning costs	Included in operating costs
Sub-total	***$1,058***
Benefits	
Avoided decommissioning costs at Hera	$11
Revenue	$1,208
Residual value of land	$0
Residual value of capital equipment	$0
Sub-total	***$1,219***
Global Net Production Benefits	**$162**
Royalties to NSW Govt	$34
Royalties to third party	$3
Company Tax	$61
Residual Net Production Benefits	$63
Global Net Production Benefits	***$162***
Royalties to NSW Govt	$34
Royalties to third party	$0
Company Tax	$61
Residual Net Production Benefits	$51
Australian Net Production Benefits	***$147***
Royalties to NSW Govt	$34
Royalties to third party	$0
Company Tax	$20
Residual Net Production Benefits	$16
NSW Net Production Benefits	**$70**

Note: totals may have minor discrepancies due to rounding.

4.5.2 Externalities

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to qualitatively consider and where possible quantify the main environmental, cultural, and social impacts of the Project to Australia and NSW. Table 4.6 summarises the results of the consideration of externalities in Section 4.7.

Table 4.7 – Externality Impacts of the Project ($M Present Values at 7% Discount Rate)

Benefits	**Australia**	**NSW**
Wage benefits to employment	$31	$31
Nonmarket benefits of employment	$64	$64
Economic benefits to existing landholders	$0	$0
Economic benefits to suppliers	Unquantified	Unquantified
Sub-total	**$96**	**$96**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.018	$0.006
Agricultural impact	Agricultural impacts included in net production costs via opportunity cost of land	
Operational noise	No material residual impact*	
Road transport	Road maintenance costs and upgrades included in net production benefits - No material residual impact*	
Air quality	No material impact*	
Groundwater	Opportunity cost of WALs - $1	
Surface water	No material impact*	
Biodiversity	Impacts offset with costs included in net production benefits - No material residual impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	

*discrepancies in totals are due to rounding.

From Section 4.5.2, it is evident that the main potential impacts of the Project are internalised into the production costs through mitigation, compensation, and offset measures. Other costs not already included in the production costs of the Project are associated with opportunity cost of groundwater entitlements and GHG costs. Although from Table 4.7, it is evident that these impacts to Australia and NSW are small or immaterial.

4.5.3 Net Social Benefits to Australia and NSW

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

The results from Table 4.6 and Table 4.7 are combined in Table 4.8 to estimate the net social benefits of the Project to Australia and NSW, relative to the base case.

Table 4.8 – Net Social Benefits of the Project ($M Present Value @ 7% Discount Rate)

Benefits	Australia	NSW
Net Production Benefits		
Royalties to Government	$34	$34
Company Tax	$61	$20
Residual Net Production Benefits	$51	$16
Sub-total	***$147***	***$70***
Other Benefits		
Wage benefits to employment	$31	$31
Nonmarket benefits of employment	$64	$64
Economic benefits to existing landholders	$0	$0
Economic benefits to suppliers	Unquantified	Unquantified
Sub-total	***$96***	***$96***
Total Benefits (with and without empl benefits)	**$147M to $243M**	**$70M to $166M**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.018	$0.006
Agricultural impact	Agricultural impacts included in net production costs via opportunity cost of land	
Operational noise	No material residual impact*	
Road transport	Road maintenance costs and upgrades included in net production benefits - No material residual impact*	
Air quality	No material impact*	
Groundwater	Opportunity costs of WALs - $1	
Surface water	No material impact*	
Biodiversity	Impacts offset with costs included in net production benefits - No material residual impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
Sub-total	***$1***	***$1***
Net Social Benefits (with and without employment benefits)	**$146M to $242M**	**$69M to $165M**

*Discrepancies in totals are due to rounding.

Overall, the Projects is estimated to have net social benefits to both Australia and NSW relative to both the base case, and hence is desirable and justified from an economic efficiency perspective.

While the major environmental, cultural and social impacts have been quantified and included in the CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $146M to $242M and $69M to $165M for the Project to be questionable from an Australian and NSW economic efficiency perspective, respectively.

4.7 Distribution of NSW Costs and Benefits

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

The costs and benefits of the Project to NSW are potentially distributed among a range of stakeholders as identified in Table 4.9.

Table 4.9 - Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	($M Present Value @ 7% Discount Rate)
Share of Net Production Benefits		
Royalties	NSW Government and NSW households	$34
Company tax	NSW Government and NSW households	$20
Residual net production benefits	NSW shareholders	$16
Additional benefits		
Wage benefits to employment	Local and NSW workers employed by the Project	$31
Nonmarket employment benefits	NSW households	$64
Economic benefits to existing landholders	Local landholders who lease land required for the Project	Not reported
Economic benefits to suppliers	Regional and State suppliers of inputs to production	Unquantified
Environmental, social and cultural costs*		
Greenhouse gas emissions (Scope 1 and 2)	Local and NSW households	$0.006
Agricultural impacts	Owners of the Project land	Agricultural impacts included in net production costs – landowners compensated
Operational noise	Adjoining landholders	No material residual impact*
Road transport	Local residents	Road maintenance costs and upgrades included in net production costs - No material residual impact*
Air quality	Adjoining landholders	No material impact*
Groundwater	Water users	Opportunity costs of WALs - $1 – cost borne by Hera Resources. Make good agreements for any water users impacted by drawdown
Surface water	Water users	No material impact*
Biodiversity	Local and NSW households	Impacts offset - No material residual impact*
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impact*
Historic heritage	Local and NSW households	No material impact*
Visual amenity	Adjoining landholders and motorists	No material impact*
Net public infrastructure costs	NSW Government and NSW households	No material impact*
Loss of surplus to other industries	Not applicable	Agricultural impacts included in net production costs – landowners compensated

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

4.8 Risk and Sensitivity Analysis

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

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

The NSW DPIE has previously identified that the financial viability of projects is a risk assumed by the project owners. Nevertheless, it should be noted that it is highly unlikely that Hera Resources would invest in the Project if it were not financially viable. However, any risk that the Project may commence and then cease operation for financial reasons leaving unmet rehabilitation liabilities is mitigated by the fact that Hera Resources is required to pay a rehabilitation security deposit to the DPIE – Division of Resources and Geoscience (DPIE-DRG) as the holder of a mining authority under the Mining Act 1992. This security deposit would be held by DPIE-DRG to ensure that the legal obligations in relation to rehabilitation and safety of the site can be met following mine closure. If rehabilitation obligations were not met to the satisfaction of the Minister, then the security deposit funds would be used by DPIE-DRG to meet the relevant requirements.

The provision of biodiversity offsets can be associated with several risks, including in relation to the biodiversity benefits of additional management of offsets, success in reconstruction of ecological communities, time-lags between impacts and provision of offsets as well as between management actions and achievement of ecological outcomes. These risks would be mitigated through offset ratio requirements in the provision of offsets or estimation of biodiversity credits, and commitment to the offset actions (including payment for credits) prior to the commencement of works under approval. The biodiversity offset package, with an appropriate offset ratio to account for ecological risks would be developed in consultation with the Biodiversity Conservation Division of DPIE and would be committed to prior to the commencement of the Project.

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

The net present value of the Project to NSW (presented in Table 4.10) is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a CBA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie 2002) to determine the effect on the NPV[15].

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

- opportunity cost of land;
- opportunity cost of capital
- operating costs;
- capital costs;
- revenue;
- residual value of land;

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

- residual value of capital;
- GHG costs; and
- groundwater costs.

Results are reported in Tables 4.10. What this analysis indicates is that CBA is most sensitive to changes in revenue (reflecting production levels, the value of metals in USD and the USD/ AUD exchange rate) and to a lesser extent, operating costs. This is because changes in revenue directly impact royalties which is the main component of net production benefits to NSW. Changes in revenue also impact company tax estimates and residual net production benefits, only a component of which accrues to NSW. Changes in operating costs do not impact royalties but do impact the estimates of company tax and residual net production benefits.

The sensitivity analysis indicated that the CBA results are not sensitive to changes in opportunity costs, capital costs, residual values or environmental costs that have not already been internalised into production costs, such as GHG and groundwater costs. Since mitigation, offset and compensation costs are a small component of the capital and operating costs of the Project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

The Project has net social benefits to NSW under all scenarios apart from a sustained 20% reductions in revenues/prices.

Table 4.10 - NSW CBA Sensitivity Testing ($M Present Value @ Various Discount Rates) (Excluding Employment Benefits)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$97	$69	$49
INCREASE – 20%			
Opportunity cost of land	$97	$69	$49
Opportunity cost of capital	$97	$69	$49
Operating costs	$20	$10	$2
Capital costs	$83	$57	$38
Revenue	$214	$159	$120
Residual value of land	$97	$69	$49
Residual value of capital	$97	$69	$49
Greenhouse gas costs	$97	$69	$49
Groundwater costs	$97	$69	$49

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE – 20%			
Opportunity cost of land	$97	$69	$49
Opportunity cost of capital	$98	$69	$49
Operating costs	$176	$130	$97
Capital costs	$112	$82	$60
Revenue	-$13	-$16	-$19
Residual value of land	$97	$69	$49
Residual value of capital	$97	$69	$49
Greenhouse gas costs	$97	$69	$49
Groundwater costs	$97	$69	$49

5 LOCAL EFFECTS ANALYSIS

5.1 Introduction

The CBA in Section 4 is concerned with whether the incremental benefits of the Project exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' the Project compared to 'without' it. This section and Section 6 examine local effects using two different methods – LEA and IO analysis. Refer to Attachment 3 for a comparison of LEA and IO.

LEA assumes there is no additional employment provided to the local area by the Project i.e. the local area economy is at full employment and additional employment simply displaces employment from where it would otherwise be employed. In economics parlance, it assumes a perfectly inelastic local area labour supply curve. The LEA method does however allow from some disposable wage increase as a result of the Project i.e. the difference between wages in mining and other sectors, for those employed by the Project. Even though it assumes no additional employment as a result of the Project i.e. a perfectly inelastic labour supply curve, it converts the estimated increase in wages into an employment number by dividing the increase in wages by the typical mining wage.

IO analysis assumes a perfectly elastic labour supply curve for the regional economy and therefore all jobs provided by the Project are additional to the local area. Even if people are employed from other sectors, there is sufficient labour available to the region either already residing inside the region or available from outside the region (commuting or migrating) for all jobs to be filled.

The Local Area is defined as the LGA of Cobar, within which the Project is located and is the region considered likely to be the main source of labour and non-labour inputs for the Project.

5.2 Direct Effects Related to Employment of Existing Residents Only

The Project will provide:

- an average annual construction workforce of 100 during the peak year of construction, with 10% assumed to already reside in the local area; and
- an average annual operational workforce of 200 per year over the life of the Project, with 15% sourced from the local region.

Assuming that future employees residing in the local area would otherwise be employed in the local area and that job vacancies created by these people filling the construction and mining positions remain unfilled, the incremental disposable wages accruing to the region is $0.08M during construction and $1.1M during Project operations. This is equivalent to 1 direct full time equivalent (FTE) job during the construction and 12 direct FTE jobs per annum during operations.

Table 5.1 - Analysis of Net Income Increase and FTE Job Increase

	Construction	Operations
a) Direct employment during project	100	200
Number that already reside in the region	10	30
b) Average net income in construction and mining	$63,243	$93,833
c) Average net income in other industries*	$55,704	$55,704
d) Average increase in net income per job (b-c)	$7,539	$38,129
e) Increase in net income per year due to direct employment	$75,391	$1,143,872
f) FTE (e/b)	1	12

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

5.3 Direct Effects Related to Non-labour Expenditure

Stimulus to the local area from the Project comes from both income expenditure and non-labour expenditure (operating costs of the Project after subtraction of wages). Average annual non-labour operating expenditure associated with the Project operation is $93M. However, not all this expenditure will accrue to the local area. From a 2018-19 input-output table of the local area economy developed by Gillespie Economics for this analysis, approximately 33% (i.e. $31M pa of non-labour expenditure) is estimated to accrue to the local area.

5.4 Second Round and Flow-on Effects

The expenditure by employees, who reside in the region, and non-labour expenditure that is captured by the local area, provides flow-on economic activity to the local economy.

A recent study by Lawrence Consulting (2021) for the NSW Minerals Council confirms the existence of substantial flow-on effects from mining operations in the Far West region of NSW.

Recognised methods for assessing second round and flow-on effects such as input-output (IO) analysis (but also computable general equilibrium analysis), do not utilise direct effects of employment and income effects as calculated above in accordance with the Economic Guidelines (NSW Government, 2015). Instead, they use the total employment working in the region, with total wages (rather than net additional wages to existing employed people) divided between those who live in the region and those who reside outside the region. Multiplier effects arising from labour and non-labour expenditure are evaluated in terms of how this expenditure contribute to the local area economy in terms of direct and indirect output, value-added, income and employment. This type of assessment is reported in the section 6.

5.5 Effects on Other Industries and Infrastructure

5.5.1 Regional Economic Impacts of Displaced Agriculture

Agricultural activities displaced by the Project relate to herding of feral goats, a low economic value activity. The small area of land impacted, and the low economic value of the activity means that there will be insignificant regional economic impacts on agricultural activity.

5.5.2 Wage Impacts

In the short run, increased regional demand for labour because of the Project (relative to the “without Project” scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the region and the availability and mobility of labour from outside the region. The incremental direct employment (of residents) and income impacts (of residents) of the Project operation, represent less than 2% of employment and income of the regional economy. The contribution is smaller using the LEA approach above. As shown in Figure 6.6, the main employment sectors in the regional economy have on average 11% of their labour residing outside the region, reflecting the mobility of labour. Wage impacts are therefore not likely to be significant. Where upward pressure on regional wages occurs, it represents an economic transfer between employers and owners of skills and would attract skilled labour to the region leading to downward pressure on wages.

5.5.3 Housing Impacts

Eighty-five percent of the direct operational labour force for the Project will be sourced from outside the region. This workforce will reside in the accommodation village and return to their homes outside the

region when off shift. Consequently, there is not likely to be any impact on housing demand and hence prices in the region.

5.5.4 Demand on Local Infrastructure and Services

Demand for local infrastructure and services arises from the production process as well as demands of the workforce and their families. Production demands on local infrastructure mainly relates to the use of local roads. The Project costs assume road maintenance payments to local Councils and an upgrade of Burthong Road.

The Project will allow for a continuation and slight increase in the levels of employment it currently provides at Hera Mine. It will also continue to provide an accommodation camp for workers. Consequently, the Project will not provide any significant additional consumer demand for local infrastructure beyond current levels.

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

Externalities that potentially accrue to the local area are summarised in Table 5.2.

Table 5.2 – Main Potential Environmental and Social Impacts on the Local Community

ENVIRONMENTAL, SOCIAL AND CULTURAL COSTS	INCIDENCE OF COSTS AND BENEFITS	COMMENT
Agricultural impacts	Farmers whose land is required for the Project	Impacted farmers compensated. No material residual impact
Surface water	Local surface water users	No surface water WALs required for the Project and no material impacts on surface water
Groundwater	Local groundwater users	Hera Resources bear the opportunity cost of holding WALs and the cost of make good agreements for any water users impacted by drawdown
Air quality impacts	Adjoining landholders	No properties impacted by exceedances. No material impact
Noise impacts	Adjoining landholders	No properties impacted by exceedances. No material impact.
Ecology and biodiversity	Local and NSW households	Some loss of non-use values but offset by provision of biodiversity offsets. No net loss requirement.
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts
Historic heritage impacts	Local and NSW households	No material impacts.
Transport and traffic	Local residents	Road upgrade and maintenance costs borne by Hera Resources. No material residual impacts.
Visual amenity	Adjoining landholders	No material impacts.

5.8 Summary of Local Effects

A summary of local effects of the Project is provided in Table 5.3.

Table 5.3 - Summary of Local Effects

	Project Direct	Project Direct: Local	Net Direct Effect
Construction (Peak Year)			
Employment	100	10	1
Net income (M)			$0.08
Operation (Average Annual)			
Employment	200	30	12
Net income (M)			$1.1
Net non-labour expenditure (M)	$33 Mpa		
Second round and flow-on effects	Refer to Section 6		
Contraction in other sectors	No material impact		
Displaced activities	No material impact		
Wage impacts	No material impact		
Housing impacts	No material impact		
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**	
Agricultural impacts	Farmers whose land is required for the Project	Impacted farmers compensated. No material residual impact	
Surface water	Local surface water users	No surface water WALs required for the Project and no material impacts on surface water	
Groundwater	Local groundwater users	Hera Resources bear the opportunity cost of holding WALs and the cost of make good agreements for any water users impacted by drawdown	
Air quality impacts	Adjoining landholders	No properties impacted by exceedances. No material impact	
Noise impacts	Adjoining landholders	No properties impacted by exceedances. No material impact.	
Ecology and biodiversity	Local and NSW households	Some loss of non-use values but offset by provision of biodiversity offsets. No net loss requirement.	
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impacts	
Historic heritage impacts	Local and NSW households	No material impacts.	
Transport and traffic	Local residents	Road upgrade and maintenance costs borne by Hera Resources. No material residual impacts.	
Visual amenity	Adjoining landholders	No material impacts.	

6 SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 Introduction

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

6.2 Structure of the Local Economy

For the analysis, the local economy is defined as comprising the Cobar LGA. This is the region where the Project is located, and the majority of the Project operational workforce is expected to reside during their shifts.

A 2018-19 IO table of the regional economy was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 8), using a 2018-19 IO table of the Australian economy (ABS Cat. 5209.0.55.001 Australian National Accounts: Input-Output Tables – 2018-19) as the parent table and 2016 Census employment by industry data for NSW and the region. The 114 sector IO table of the regional economy was aggregated to 50 sectors and 8 sectors for the purpose of describing the economy.

A highly aggregated 2018-19 IO table for the regional economy is provided in Table 6.1. The rows of this table indicate how the gross regional output of an industry is allocated as sales to other industries, to households, to exports and other final demands (OFD - which includes stock changes, capital expenditure and government expenditure). For example, the mining sector in the region sells $30M worth of output to the mining sector, $5M worth of output to the manufacturing sector of the regional economy etc. It also $855M worth of output from the region.

The corresponding column shows the sources of inputs to produce that gross regional output. These include purchases of intermediate inputs from other industries, the use of labour (household income), the returns to capital or other value-added (OVA - which includes gross operating surplus and net indirect taxes and subsidies) and goods and services imported from outside the region. The number of people employed in each industry is also indicated in the final row. For the mining sector to produce $970M worth of output, it purchases $3M of inputs from the agriculture, forestry, and fishing sector of the regional economy, $30M of inputs from the mining sector of the regional economy etc. It also imports $458M of inputs from outside the region, generates $149M in other value added, employs 774 people, and pays $137M in wages and salaries.

Output for the regional economy is estimated at $2,398M. Value-added for the regional economy is estimated at $438M, comprising $217M to households as wages and salaries and $221M in OVA.

The total employment in the regional economy was 1,954 jobs.

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

Figures 6.3 to 6.5 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in the description of the economic structure of the regional economy. From these figures, the significance of the aggregated Other Mining Sector (mainly comprising Non-Ferrous Metal Ore Mining) to the regional economy for output, value-added, income and employment, is evident. The second most significant aggregated sector is Sheep, Grains, Beef (mainly comprising Sheep Farming and Beef Cattle Farming).

Table 6.1 - Aggregated Transactions Table: Regional Economy 2018-19 ($M)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Trade/ Accom	Bus. Srvcs	Public/ Pers. Srvcs	*TOTAL*	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	7	3	0	0	0	0	0	0	10	0	15	39	64
Mining	0	30	5	0	0	0	0	0	35	0	80	855	970
Manuf.	0	13	0	0	0	0	0	0	13	1	(6)	17	24
Utilities	0	16	1	6	0	0	0	0	24	2	(6)	4	24
Building	1	39	0	0	3	0	1	1	44	0	(17)	(0)	27
Trade/Accom	1	18	0	0	0	0	0	1	21	24	(8)	(8)	28
Bus.Srvcs	3	51	0	1	1	2	3	3	63	25	(17)	(20)	50
Public/Pers Srvcs	0	56	0	0	0	0	1	2	59	17	(7)	(7)	62
TOTAL	12	225	6	7	4	3	5	6	269	68	35	878	1,251
Household Income	12	137	2	2	6	11	10	36	217	-	-	-	217
OVA	14	149	1	7	2	4	21	4	202	17	1	1	221
Imports	26	458	15	7	14	10	14	17	562	123	3	21	709
TOTAL	64	970	24	24	27	28	50	62	1,251	207	39	900	2,398
Employment	229	774	21	18	62	271	133	447	1,954				

Figure 6.1 - Summary of Aggregated Sectors: Regional Economy (2018)

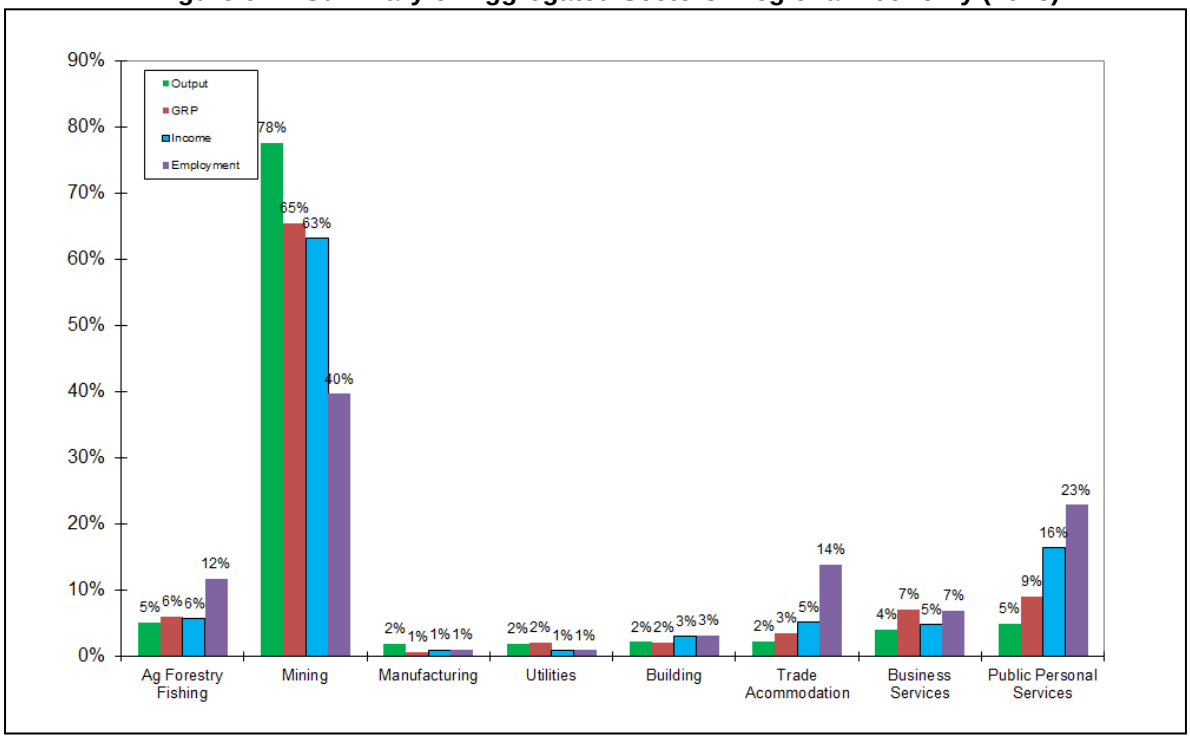


Figure 6.2 - Summary of Aggregated Sectors: NSW Economy (2018)

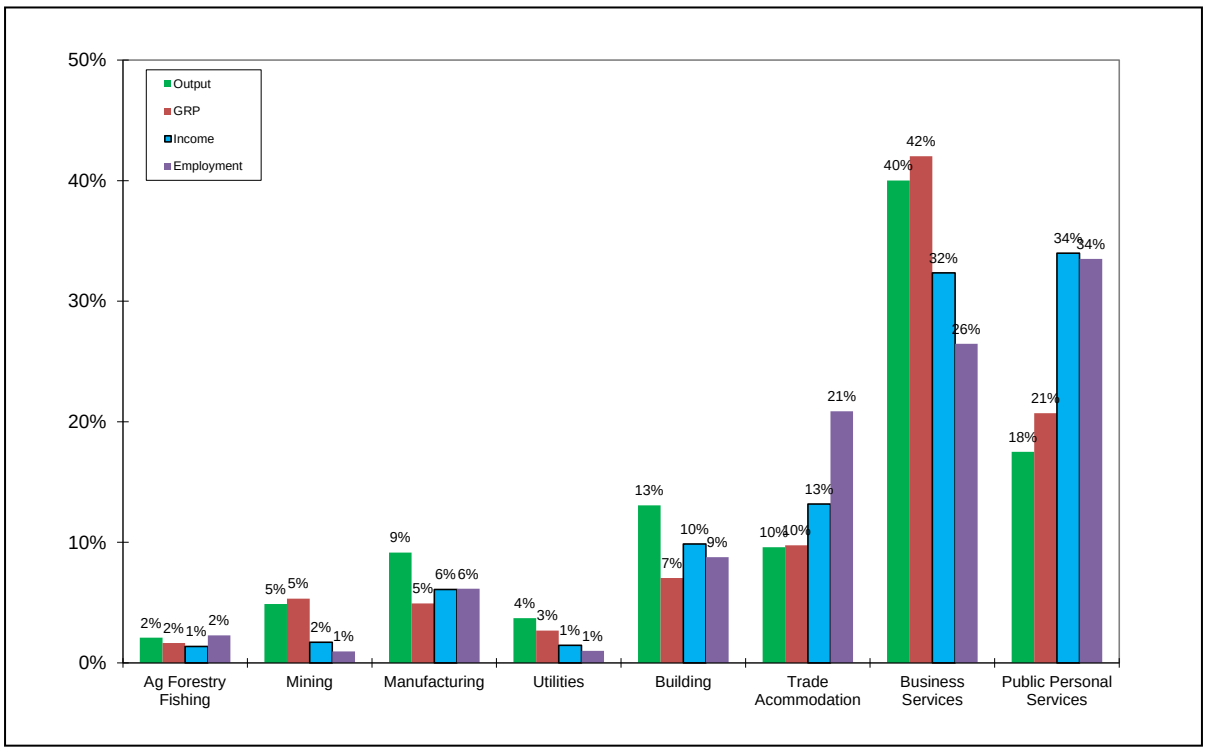


Figure 6.3 - Sectoral Distribution of Gross Regional Output and Value Added ($M)

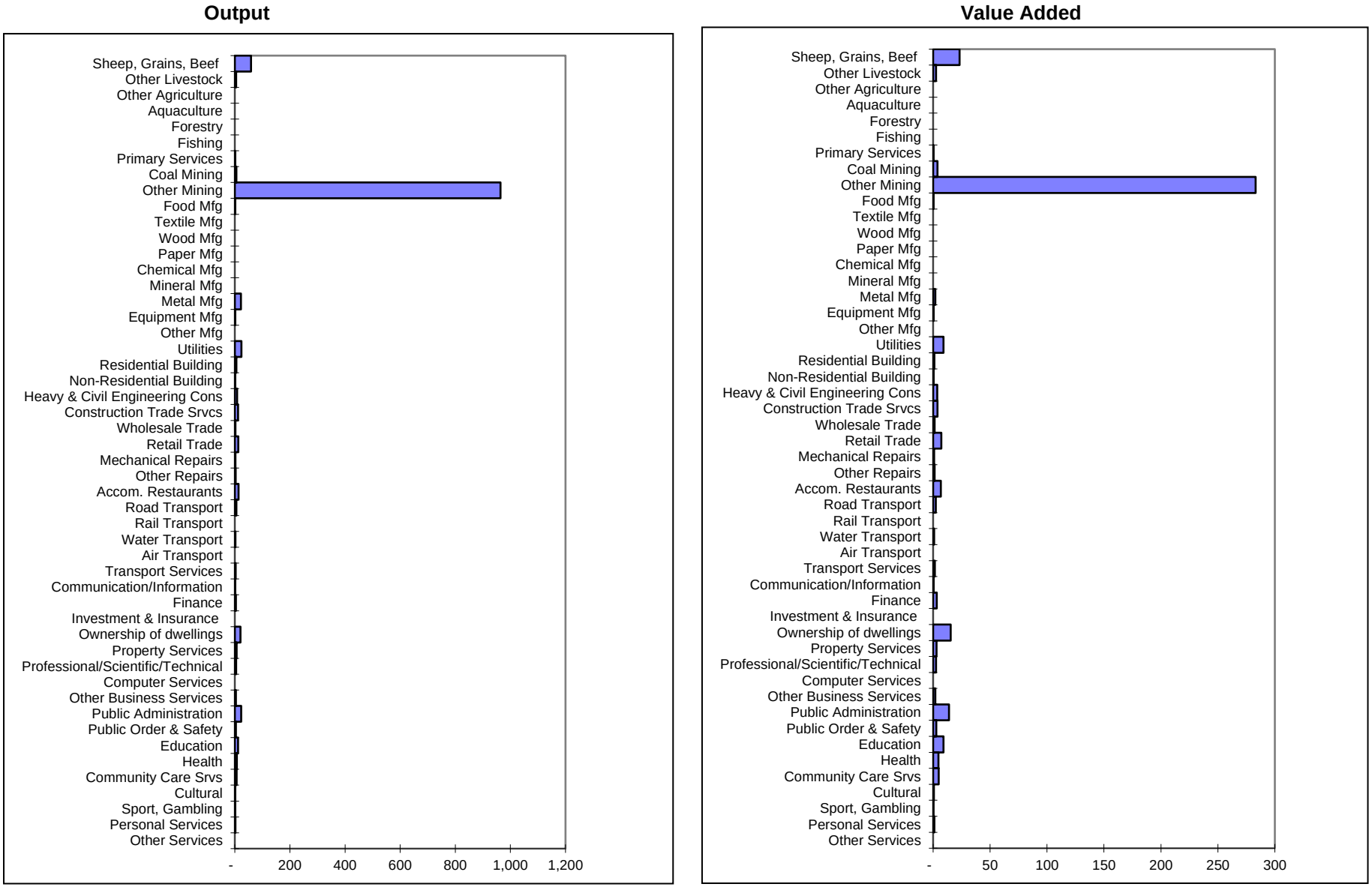


Figure 6.4 - Sectoral Distribution of Income ($M) and Employment (No.)

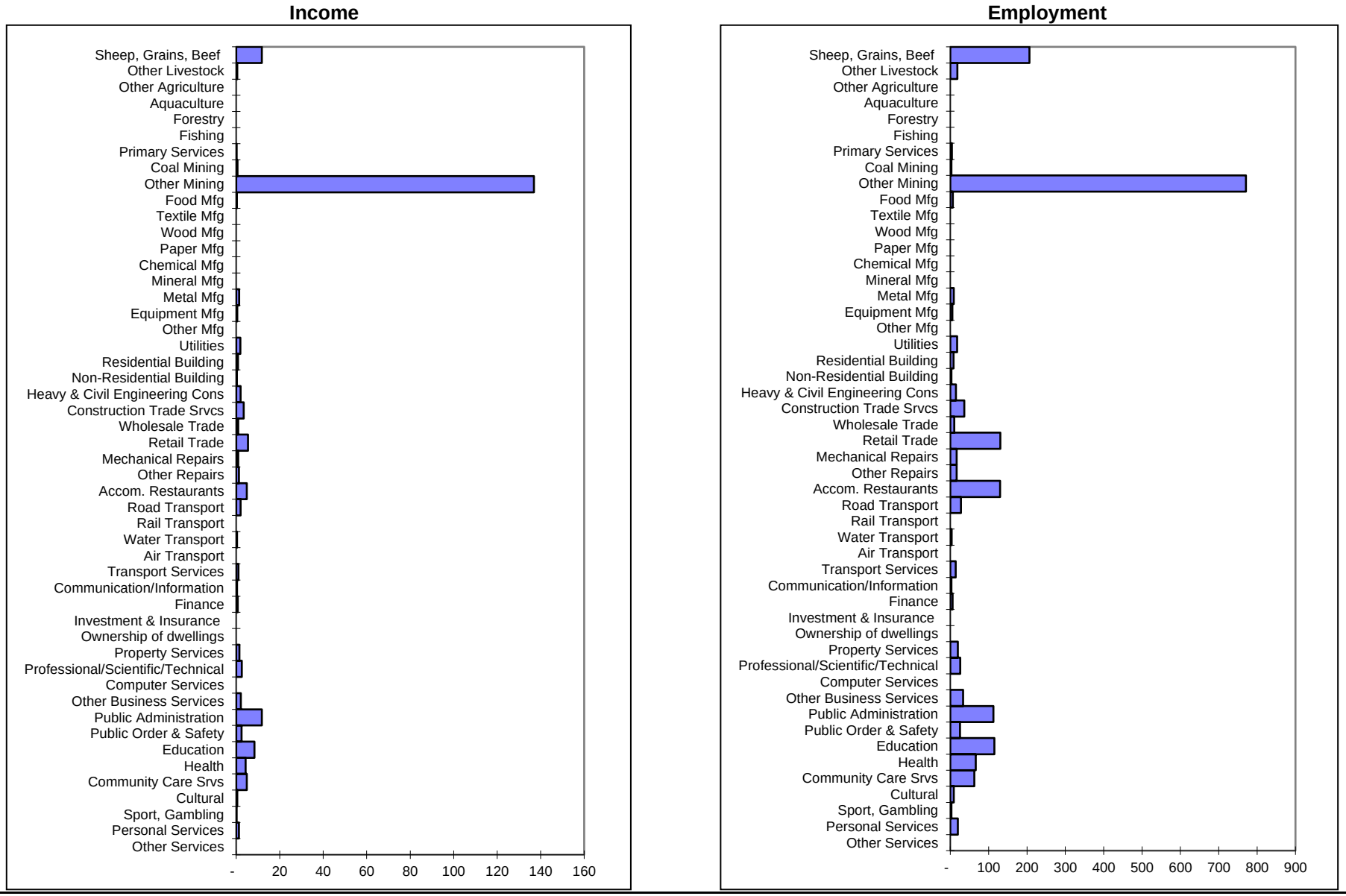


Figure 6.5 - Sectoral Distribution of Imports and Exports ($M)

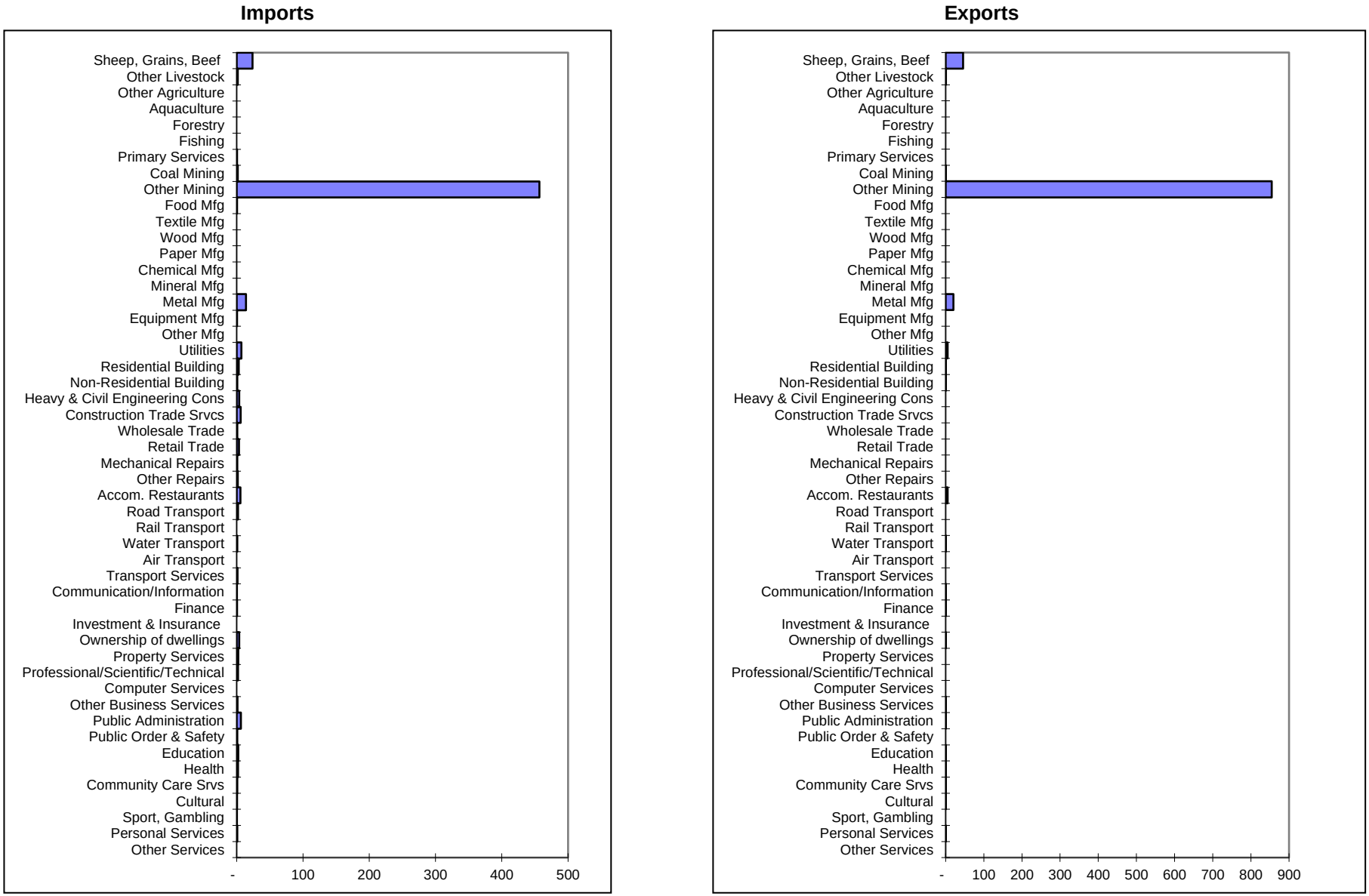
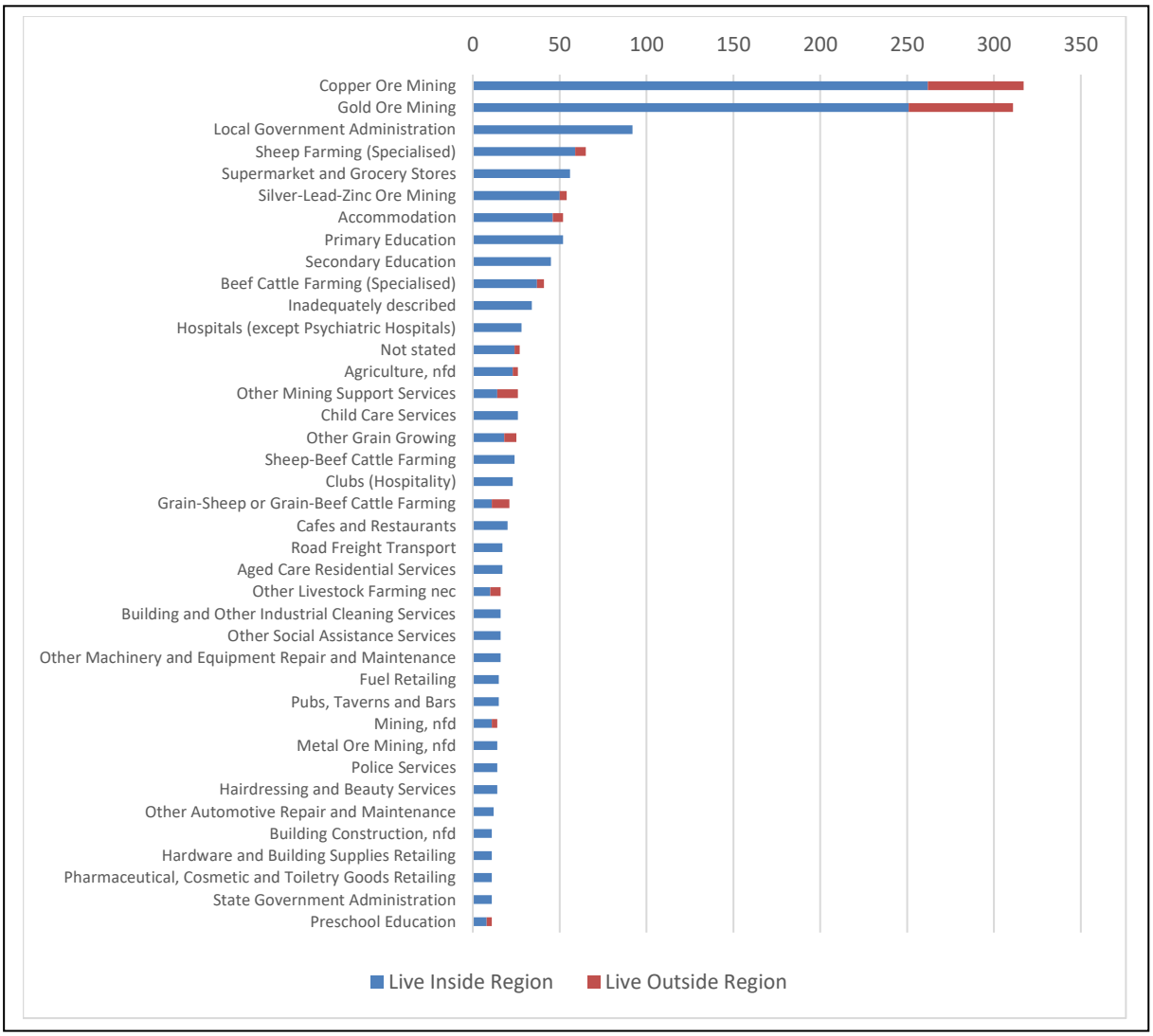


Figure 6.6 shows the top 40 individual industry sectors (4-digit ANSZIC sectors) by employment number for the region. The five most significant employment providers in the region are the Copper Ore Mining Sector, Gold Ore Mining Sector, Local Government Administration Sector, Sheep Farming (Specialised), and Supermarket and Grocery Stores. In the top 40 individual industry sectors by employment, 11% of the workforce resides outside the region.

Figure 6.6 - Main Employment Sectors (4-digit ANSZIC) in the Region (Job Numbers)



Source: Generated from ABS 2016 census 4-digit employment by industry by place of usual residence data.

6.3 Expenditure During Mining Operation

6.3.1 Introduction

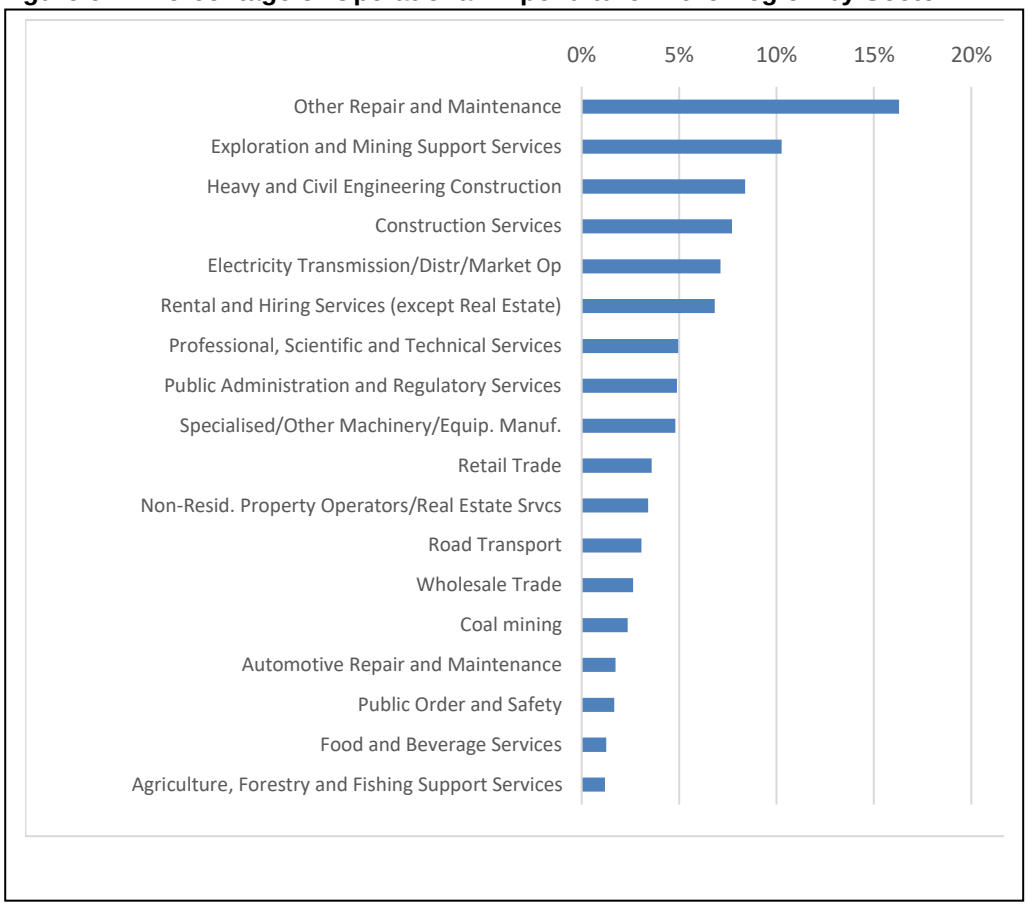
Mining projects provide direct economic activity to regional economies i.e. the output, value-added, income and employment associated with the mining operation. All other things being equal, the flow-on economic activity arising from a project will depend on:

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

6.3.2 Mining Operation Expenditure

Some indication of the main sectors of the regional economy that may directly benefit from the Project operation can be obtained by examining the regional expenditure pattern of the Non Ferrous Metal Ore Mining sector in regional IO table. This has been developed based on the expenditure pattern of the Non-Ferrous Metal Ore Mining in a National IO table and the application of NSW and then regional location quotients[16] to assess the ability of sectors in the regional economy to supply the goods and services demanded. Based on this approach, the main sectors in the regional economy to potentially benefit from direct operational expenditure are shown in Figure 6.7. The main sectors potentially benefitting are Other Repairs and Maintenance, Exploration and Mining Support Services, Heavy and Civil Engineering Construction and Construction Services.

Figure 6.7 - Percentage of Operational Expenditure in the Region by Sector



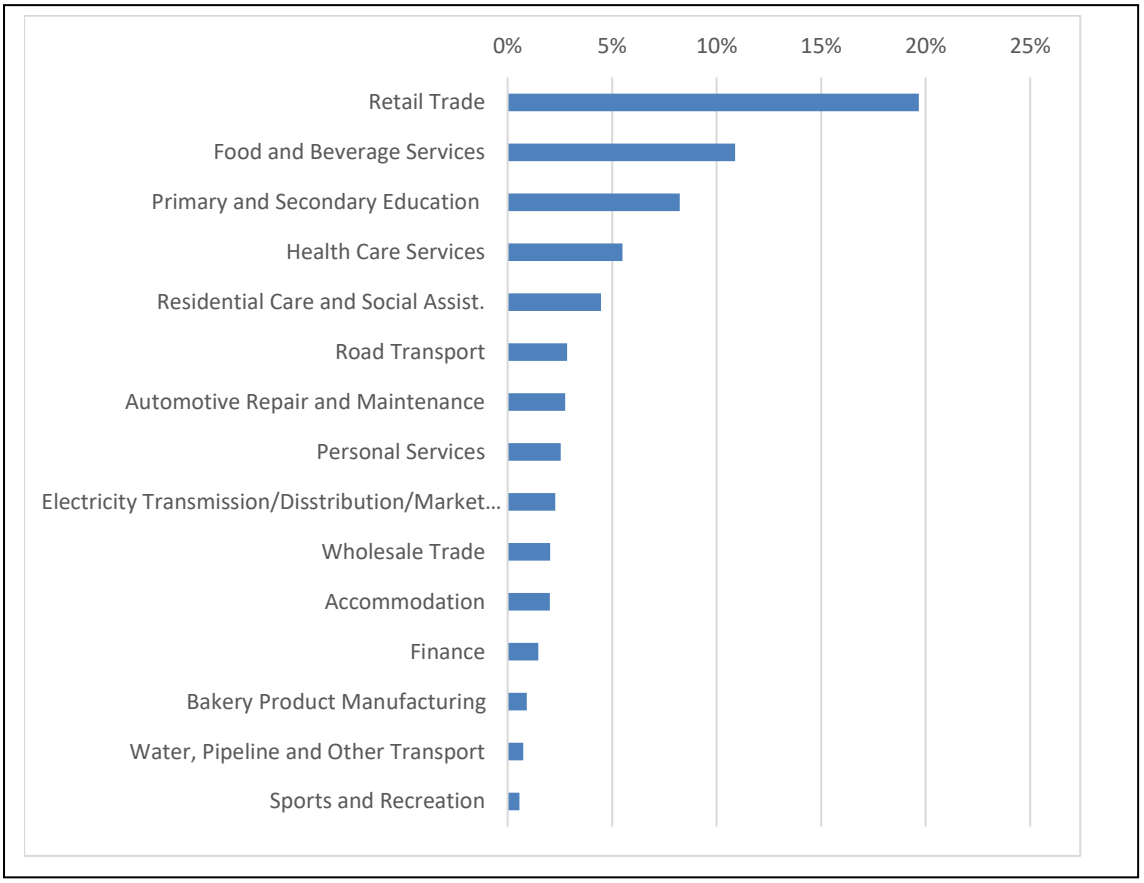
6.3.3 Mine Employee Expenditure

Economic activity in the region will also arise from the expenditure of the Project's workforce in the region. It is estimated that the Project will provide direct regional operation employment of 200 people. Fifteen percent are estimated to live in the region with the remainder being drive-in-drive-out workers. This latter group is assumed to have no (or very little) spending in the regional economy. Only employees that live the regional will provide wage expenditure in the region. An indication of the main sectors of the regional economy that may benefit from resident employee expenditure can be obtained by examining

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

the expenditure pattern of the household sector in the National IO table adjusted to the region using location quotients. Based on this approach the main sectors in the regional economy to potentially benefit from direct expenditure of wages in the regional economy are shown in Figure 6.8. The main sectors potentially benefitting from workforce expenditure are retail trade, food and beverage services, primary and secondary education services, and health care services.

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



6.4 Regional Impact of the Project

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

6.4.1 Construction Phase

Introduction

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

- the non-*residential building construction sector* which includes businesses involved in industrial building construction;
- the *heavy and civil engineering construction sector* which includes businesses involved in mine site construction services;
- the *construction services sector* which includes businesses involved in mine site preparation services, plumbing, electrical, and other trades; and

- the *specialised and other machinery and equipment manufacturing sector* which includes the manufacturing of mining machinery and equipment.

Given the largely specialist nature of capital equipment and the relatively small size of the regional economy, for the purpose of this analysis an assumption is made that all such purchases and the leasing of machinery are made outside the regional economy.

Impact on Regional Economy

The Project construction workforce is estimated at 100 for approximately 12 to 18 months. Reference to the input-output coefficients for the region shows that approximately $55M of capital expenditure would be required in the *heavy and civil engineering construction sector* to support 100 jobs across the *non-residential building sector*, the *heavy and civil engineering construction sector* and *construction services sector.* With an estimated 10% of construction workers sourced from the region, 90% of potential consumption induced flow-on impacts will leak from the region. The direct and indirect regional economic impact of this level of expenditure in the regional economy is reported in Table 6.2.

Table 6.2 - Economic Impacts of Construction on the Regional Economy (Year 1)

	Direct	Production induced	Consumption induced	Total Flow on*	TOTAL EFFECT*
OUTPUT ($M)	55	10	1	10	65
Type 11A Ratio	1.00	0.17	0.01	0.19	1.19
VALUE ADDED ($M)	24	3	0	3	27
Type 11A Ratio	1.00	0.11	0.02	0.13	1.13
INCOME ($M)	14 (1.4)	2	0	2	16
Type 11A Ratio	1.00	0.15	0.02	0.16	1.16
EMPL. (No.)	100 (10)	26	4	30	130
Type 11A Ratio	1.00	0.26	0.04	0.30	1.30

Notes: Totals may have minor discrepancies due to rounding.

The table summarises the direct and indirect level of economic activity generated in the region. For direct income and employment effects the number in brackets relate to individuals permanently residing in the region.

That is, total annual impact of the peak year of construction on the regional economy is estimated at:

- $65M in annual direct and indirect regional output or business turnover;
- $27M in annual direct and indirect regional value added;
- $16M in annual direct and indirect household income; and
- 130 direct and indirect jobs.

Multipliers

Multipliers are summary measures used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry (ABS, 1995). There are many types of multipliers that can be generated from input-output analysis (refer to Attachment 5). Type 11A ratio multipliers summarise the total impact on all industries in an economy in relation to the initial own sector effect e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc.

The Type 11A ratio multipliers for the construction phase of the Project are reported in the above table.

Main Sectors Affected

The input-output analysis indicates that construction is most likely to directly impact the heavy and civil engineering construction sector, non-residential building construction sector and construction services sector. The sectors most impacted by output, value-added, income and employment flow-ons are likely to be professional, scientific and technical services, rental and hiring services (except Real Estate), retail trade, road transport and food and beverage services.

6.4.2 Operation Phase

Impact on the Regional Economy

Introduction

For the analysis of the Project, a Project sector was inserted into the regional IO table[17] reflecting average annual production levels for the Project, during years of mining operation. The revenue, expenditure and employment data for this new sector was obtained from financial information provided by Hera Resources. For this new sector:

- the estimated gross annual revenue of the Project was allocated to the o*utput* row;
- the estimated wage bill of employees residing in the region was allocated to the *household wages* row with the remainder allocated to a secondary household wages row that does not get incorporated into flow-on effects;
- non-wage local expenditure was initially allocated across the relevant *intermediate sectors* in the economy and *imports* based on ratios in the regional input-output table for the Non Ferrous Metal Ore Mining Sector;
- the difference between total revenue and total costs was allocated to the *other value-added* row*;* and
- direct employment in the Project was allocated to the *employment* row.

Impacts

The total and disaggregated annual impacts of the average operation of the Project on the regional economy in terms of output, value-added, income and employment (in 2021 dollars) are shown in Table 6.3.

Table 6.3 - Annual Regional Economic Impacts of the Project Operation

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	171	37	6	43	214
Type 11A Ratio	1.00	0.21	0.04	0.25	1.25
VALUE ADDED ($M)	78	16	4	20	98
Type 11A Ratio	1.00	0.21	0.05	0.26	1.26
INCOME ($M)	28 (4)	11	2	13	41
Type 11A Ratio	1.00	0.40	0.07	0.47	1.47
EMPL. (No.)	200 (30)	121	29	150	350
Type 11A Ratio	1.00	0.60	0.15	0.75	1.75

Note: Totals may have minor discrepancies due to rounding.

Impacts analysis is based on where activity occurs. For direct income and employment effects the number in brackets relate to individuals permanently residing in the region.

[17] Inflated to 2021

The Project is estimated to make up to the following average annual contribution to the regional economy for a period of 13 years (Table 6.4):

- $214M in annual direct and indirect regional output or business turnover;
- $98M in annual direct and indirect regional value-added;
- $41M in annual direct and indirect household income; and
- 350 direct and indirect FTE jobs.

Multipliers

Type 11A ratio multipliers for the Project range from 1.25 for output up to 1.75 for employment.

Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to relatively high ratio multipliers for employment. A lower ratio multiplier for income (compared to employment) also generally occurs as a result of comparatively higher wage levels in the mining sectors compared to incomes in the sectors that would experience flow-on effects from the Project.

Capital intensive mining projects also typically have a relatively low ratio multiplier for value-added, reflecting the relatively high direct value-added for the Project compared to that in flow-on sectors. The low output ratio multiplier largely reflects the high direct output value of the Project compared to the sectors that experience flow-on effects from the Project.

Main Sectors Affected

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

- Other Repair and Maintenance Sector;
- Electricity Transmission, Distribution, On Selling and Electricity Market Operations Sector;
- Exploration and Mining Support Services Sector;
- Construction Services;
- Heavy and Civil Engineering Construction Sector;
- Rental and Hiring Services (except Real Estate) Sector;
- Retail Trade Sector;
- Professional, Scientific and Technical Services Sector;
- Exploration and Mining Support Services Sector.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment opportunities would be generated by the Project operation (Table 6.5).

Table 6.4 - Sectoral Distribution of Total Regional Employment (FTE) Impacts of the Project

Sector	Average Direct Effects	Production Induced	Consumption Induced	Total
Impact Sector	200	0	0	200
Primary	0	2	0	2
Mining	0	6	0	6
Manufacturing	0	6	0	7
Utilities	0	2	0	2
Wholesale/Retail	0	14	9	23
Accommodation, cafes, restaurants	0	5	6	11
Building/Construction	0	14	0	14
Transport	0	8	1	9
Services	0	67	11	78
Total	200	121	29	354

Note: Totals may have minor discrepancies due to rounding.

Table 6.4 indicates that direct, production-induced and consumption-induced employment impacts of the Project on the regional economy are likely to have different distributions across sectors. Production-induced flow-on employment would occur mainly in the *services*, *wholesale/retail, and building/construction* sectors, while consumption induced flow-on employment would be mainly in the *services, wholesale/retail trade, building/construction and accommodation/cafes/restaurants* sectors (Table 6.4).

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

6.5 Potential Contraction in Other Sectors

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

'Crowding out' would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is an open economy with access to external labour resources. Furthermore, the Project will essentially provide a substitute source of employment for those currently employed at the Hera Mine. Consequently, 'crowding out' of economic activity in other sectors as a result of the Project would not be expected to be significant.

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

6.6 Mine Cessation

As outlined in Section 6.4, the Project would provide direct and indirect economic activity in the regional economy for approximately 16 years. Conversely, the cessation of the mining operations in the future would result in a contraction in regional economic activity.

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

- the movements of workers;
- alternative development opportunities; and
- economic structure and trends in the regional economy at the time.

Ignoring all other influences, the impact of Project cessation on the regional economy would depend on whether the resident workers (and their families) affected would leave the area. If it is assumed that some or all of the workers remain in the region, then the impacts of Project cessation would not be as severe compared to a greater number leaving the region. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption, the regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table 6.4. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 6.4.

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

Ultimately, the significance of the economic impacts of cessation of the Project would depend on the economic structure and trends in the regional economy at the time. For example, if the Project cessation takes place in a declining economy, the impacts might be significant. Alternatively, if Project cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Project may have little impact.

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

7 CONCLUSIONS

A CBA of the Project indicated that it would have net production benefits to NSW of $70M, present value at 7% discount rate. Provided the residual environmental, social and cultural impacts of the Project that accrue to NSW are considered to be valued at less than $70M, the Project can be considered to provide an improvement in economic efficiency and hence relative to the “without Project” scenario is justified on economic grounds.

Adverse uncompensated environmental, social, and cultural impacts of the Project have been minimised through project design and mitigation, offset and compensation measures. The cost of implementing these measures have already been incorporated into the estimate of net production benefits, including the cost of using land resources, provision of biodiversity offsets and road maintenance and upgrades. Expert technical investigations indicate no material impacts are envisaged in relation to air quality, noise, surface water, visual amenity, Aboriginal Heritage, Historic Heritage, public infrastructure or loss of surplus to other industries. Impacts that were quantified included greenhouse gas generation and groundwater WALs. However, these costs are minor compared to the estimated net production benefits of the Project.

There may also be some market and non-market benefits of employment provided by the Project which are estimated to be in the order of $96M, present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of between $69M (without employment benefits) to $165M (with employment benefits), present value at 7% discount rate and hence relative to the “without Project” scenario is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $69M and $165M (present value) for the Project to be questionable from a NSW economic efficiency perspective.

The key driver of the net social benefits to NSW is revenue (reflecting production levels, the value of gold in USD and the AUD/USD exchange rate) and to a lesser extent, operating costs. The estimates are less sensitive to assumptions about land opportunity costs, capital costs, residual values, or environmental costs that have not already been internalised into production costs, such as GHG and groundwater costs.

The Project has net social benefits to NSW under all sensitivity testing scenarios apart from a sustained 20% reductions in revenues/prices.

Local Effects Analysis

The Project will provide 100 direct construction jobs and a minimum of 200 direct operational jobs. Under the strict LEA assumptions of full regional employment and no in-migration of labour, the Project provide an increase in regional wages equivalent to 1 job during construction and 12 jobs during operation.

Local externality impacts are not considered material.

Supplementary Local Effects Analysis using Input-Output Analysis

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

Using this approach, the total annual impact of peak year of construction on the regional economy is estimated at up to:

- $65M in annual direct and indirect regional output or business turnover;
- $27M in annual direct and indirect regional value added;
- $16M in annual direct and indirect household income; and
- 130 direct and indirect jobs.

The Project operation is estimated to make up to the following contribution to the regional economy:

- $214M in annual direct and indirect regional output or business turnover;
- $98M in annual direct and indirect regional value-added;
- $41M in annual direct and indirect household income; and
- 350 direct and indirect FTE jobs

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

8 REFERENCES

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

Australia Bureau of Statistics (2016) *Census of Population and Housing.*

Bartik, T. (2012) Including Jobs in Benefit-Cost Analysis, *Annual Review of Resource Economics*, 2012, 4:55–73.

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

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

Bureau of Transport Economics (1999) *Facts and furphies in Benefit Cost Analysis: transport*, Commonwealth of Australia.

Department of Employment (2015) Small Area Labour Markets, December Quarter 2019, http://employment.gov.au/small-area-labour-markets-publication.

Dinc, M. (2015) *Introduction to Regional Economic Development: Major Theories and Basic Analytical Tools*, Edward Elgar Publishers.

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

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

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

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

Haveman, R. and Weimer, D. (2015) Public Policy Induced Changes in Employment: Valuation Issues for Benefit-Cost Analysis, *Journal of Benefit Cost Analysis*, 6(1), p. 112-153.

James, D. and Gillespie, R. (2002) *Guidelines for Economic Effects and Evaluation in EIA*. Prepared for NSW Department of Urban Affairs and Planning.

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

Lawrence Consulting (2021) *NSW Mining Industry Expenditure Impact Survey 2019/20*, prepared for the NSW Minerals Council.

NSW Government (2012) *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals*.

NSW Government (2014) *Voluntary Land Acquisition and Mitigation Policy: For State Significant Mining, Petroleum and Extractive Industry Developments*.

NSW Government (2015) *Guideline for the economic assessment of mining and coal seam gas proposals*

NSW Government (2015b) *Guideline for the economic assessment of mining and coal seam gas proposals: Draft for consultation.*

NSW Government (2018) *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals.*

NSW Treasury (2007) *NSW Government Guidelines for Economic Appraisal.*

NSW Treasury (2017) NSW Government Guide to Cost Benefit Analysis.

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

Productivity Commission (2006) *Waste Management*, Productivity Commission Inquiry Report No. 38, Commonwealth of Australia

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

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

ATTACHMENT 1 – LEGISLATIVE CONTEXT FOR ECONOMIC ANALYSIS IN EIA

Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 2000

- The basis for economic analysis under the *Environmental Planning and Assessment* (EP&A) *Act 1979* emanates from:
  - the definition of the term "environment" in the EP&A Act which is broad and includes the social and **economic** environment, as well as the biophysical environment;
  - the "objects" of the EP&A Act which includes *"to promote the social and **economic welfare** of the community"*; and
  - Clause 7(1)(f) of Schedule 2 of the EP&A Regulations which requires environmental assessment to provide "*the reasons **justifying** the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, **economic** and social considerations…"*
  - *Section 4.15 of the EP&A Act requires the following two matters to be taken into consideration by the consent authority in determining a development application:*
    - the public interest (taken as the collective public interest of households in NSW); and
    - the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.
- Objects of promoting economic welfare and requirements to justify a project having regard to economic considerations are consistent with the use of CBA. A note to Clause 7 (1) (f) states that "A cost benefit analysis may be submitted or referred to in the reasons justifying the carrying out of the development, activity or infrastructure."
- A cost benefit analysis is consistent with the consideration of the public interest, although the limitation of public interest to NSW households requires consideration of the costs and benefits to NSW households, whereas CBA would normally be undertaken at the National level.
- Elements of CBA can provide information on the economic impacts in the locality, although CBA should not be undertaken at the local level. This can be supplemented by other forms of analysis to examine economic impacts in the locality such as the consideration of:
  - effects relating to local employment;
  - effects relating to non-labour project expenditure; and
  - environmental and social impacts on the local community.

Secretary's Environmental Assessment Requirements

- The Project SEARs include a requirement for:
  - 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;
- the demand for the provision of local infrastructure and services; and
- consideration of the need for a Voluntary Planning Agreement in relation to the demand for the provision of local infrastructure and services.

Other Economic Guidelines

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

- In 2018 the NSW Government prepared *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals.* This provides supporting information on how to conduct a CBA of mining and coal seam gas proposals.

- NSW Treasury (2017) *NSW Government Guide to Cost-Benefit Analysis*, provides guidance for Government agencies on how to undertake CBA of significant spending proposals, including proposed capital works, projects and new programs across all public sector agencies. However, many of the principles have broader application.

ATTACHMENT 2 – INTRODUCTION TO ECONOMIC METHODS

Cost Benefit Analysis

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

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

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

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

Economic Activity Analysis

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

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

- While economic activity measures from IO analysis and CGE modelling e.g. direct and indirect output, value-added and income, are generally not measures of benefits and costs relevant to a CBA this information can be of interest to decision-makers[18].

Economic Analysis and Decision-Making

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

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

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

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

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the mine site then all these jobs are counted in IO analysis as a direct effect i.e. direct employment in the region, because the jobs are located in the region. A similar approach is taken for wages. However, when the assessment of flow-on impacts is undertaken only the spending of the income of employees living in the region is included since it is only wages expenditure of those living in the region that flows through the regional economy. Similarly, if new jobs are taken by people who migrate into the region then the spending of this income in the regional economy is included in the impact assessment. In IO analysis, the income of those residing outside the region is excluded from the impact assessment as most of their income will be taken home after shift and spent where they live or elsewhere.

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

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

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

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

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

Table 1 - Incremental Income when Immigrating Workforce is Included

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

Even for those already living in the region who are already employed, the incremental income estimated using the guideline will substantially understate additional regional income effects. This is because new jobs in a region create a chain of job opportunities (referred to in the literature as the "trickle down" effect, "job chain" or "occupational upgrading"- see Persky et al, 2004 What are jobs worth?, Employment Research Vol. 11 , p. 3).

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

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

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

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

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

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

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

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- Data specific to a projects revenue, expenditure and employment profile can be inserted into an IO table and analysed.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added[19] and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a CBA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption *"that there is a ghost pool of highly skilled yet unemployed people"* in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

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

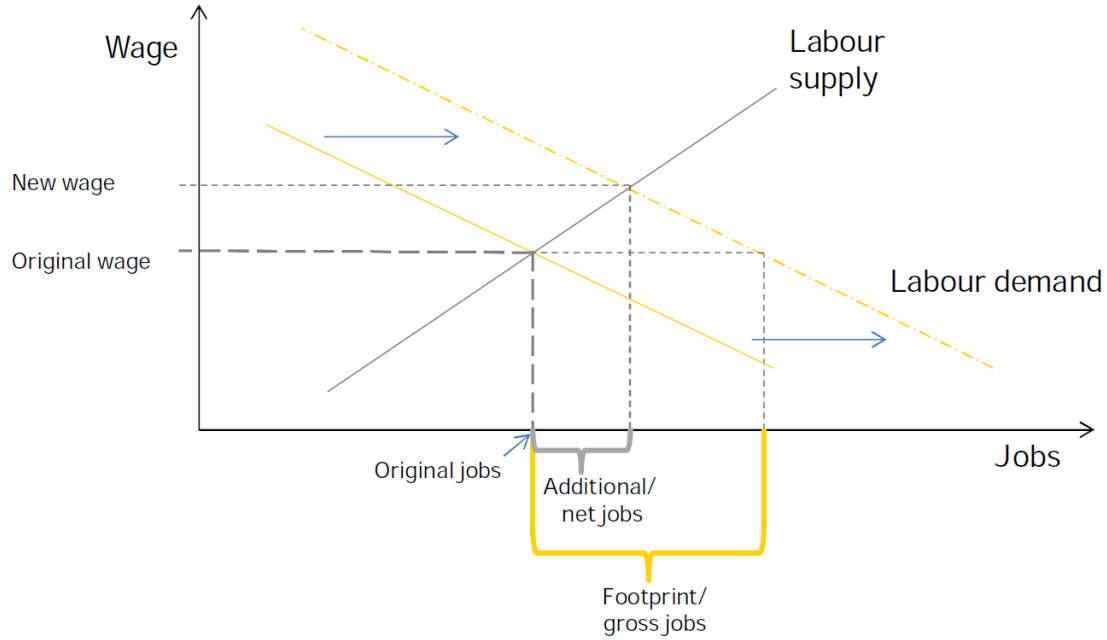
[19] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

- CGE modelling can be dynamic or comparative static[20] and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- Modelling of the impact of a project uses the production function of the model for that sector, rather than project specific production function.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a CBA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a CBA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some 'crowding out' of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- 'Crowding out' of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

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

Comparison of IO Analysis and CGE Modelling

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



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

- Figure A4.1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity[21]. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and "crowding out" across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

Guidelines

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

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

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

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

Government Applications of IO Analysis

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

Criticisms Misrepresented

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

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

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

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

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

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

Reviews of IO

- CIE (2015, p.28) *Peer review of economic assessment: Bylong Coal project,* identified that:

"The IO methodology is reasonable but should be considered an upper bound of the regional effects."

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

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

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

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

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

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

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

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

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

Components of the conventional output multiplier are as follows:

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

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

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

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

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

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

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

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

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

A description of the different ratio multipliers is given below.

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

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

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

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

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

REFERENCES

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

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

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

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

ATTACHMENT 6 – CBA AND ASSESSMENT OF EXTERNALITIES

Consideration of Externalities in the Economic Assessment

Introduction

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

Threshold Value Analysis

- The first approach used to consider the environmental impacts of the Project was the threshold value method.
- Threshold value analysis is a recognised approach to CBA where it is not possible or pragmatic to attempt to value potential external impacts.
- Threshold value analysis was developed by Krutilla and Fisher (1975)[22]. It is specifically referred to as an appropriate approach in the DP&I's (2002) *Draft Guideline for Economic Effects and Evaluation in EIA* and is a widely recognised approach.
- Threshold value analysis avoids the sometimes contentious matter of physically quantifying environmental impacts and then placing dollar values on them.
- Threshold value analysis leaves the trade-off between quantified economic benefits and unquantified environmental costs for the decision-maker.
- In the Economic Assessment of the Project, the estimated net production benefits provide a threshold value or reference value against which the relative value of the residual environmental, social and cultural impacts of the Project, after mitigation, offset and compensation, may be assessed. The threshold value indicates the price that the community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the 'no development' option.

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

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

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

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

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

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

Impact	Potential Valuation Method	Comment
Greenhouse gas emissions	Damage cost method	Estimate of global social damage cost of carbon from literature and govt policy, adjusted to Australian and NSW damage cost.
Agricultural impacts	Property valuation method	Foregone agricultural production is reflected in land values. So opportunity costs of land reflect, among other things, foregone agriculture.
Noise impacts		
Significant	Property valuation method	Cost of acquiring properties or compensating landholders encompasses property value impacts due to noise. No significant impacts identified.
Moderate	Defensive expenditure	Compensation to impacted landholders included in capital costs of project.
Significant air quality impacts	Property valuation method	Cost of acquiring properties encompasses property value impacts due to air quality impacts. However, no properties impacted by exceedances.
Use of surface water	Market value of water	Cost of Water Access Licences reflects marginal value product of water. No surface WALs required.
Use of groundwater	Market value of water	Cost of Water Access Licences reflects marginal value product of water. Included in CBA
Groundwater drawdown	Defensive expenditure	No material impacts on private bores predicted.
Water discharges		Regulated under the Protection of Environment Operations Act 1997.
Flora and fauna	Replacement cost	Capital and operating costs of offsets included in capital costs. Assumes that offsets levels are sufficient to compensate the community for values lost. This is a requirement of Govt. Policy.
Road transport impacts	Defensive expenditure	Cost of road investment and maintenance costs required as a result of the Project included in capital and operating costs of project.
Aboriginal heritage	Defensive expenditure or Stated Preference technicques	No Aboriginal heritage impacted by the Project
Historic heritage	Defensive expenditure or Stated Preference technicques	No Historic heritage impacted by the Project
Visual	Defensive expenditure	No visual impacts of the Project

Additional Threshold Value Analysis

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

ATTACHMENT 7 – NON-MARKET BENEFITS OF EMPLOYMENT

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

- Where labour resources used in a project would otherwise be employed at a lower wage or would be unemployed a shadow price of labour is included in the estimation of producer surplus rather than the actual wage (Boardman et al. 2005[23]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project. The analysis included consideration of the magnitude of these additional benefits under a number of scenarios and reports overall CBA results with and without the inclusion of these potential benefits. Ceteris paribus these estimates are conservative since they ignore any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

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

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

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

- As identified by Portney (1994[24]), the concept of existence values should be interpreted more broadly than just relating to environmental resources.

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

- The utility (welfare) of individuals may therefore be affected by changes in their own well-being as well as changes in the well-being of others (Rolfe and Bennett 2004[25]). This is consistent with the observed behaviour of altruism (Freeman III 2003[26]).

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

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

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

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

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

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

Table A7.1 – Existence Values for Mine Employment

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

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

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

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

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

ATTACHMENT 8 – THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

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

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

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

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

Table A8.1 - The GRIT Method

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

Source: Bayne and West (1988).

REFERENCES

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

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

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