APPENDIX 16

Economic Assessment

Chain Valley Colliery Consolidation Project Economic Assessment

Final Report

Prepared for

Delta Coal

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August 2022

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EXECUTIVE SUMMARY

The Chain Valley Colliery Consolidation Project (the Project) aims to consolidate the existing Chain Valley Colliery (CVC) development consent and Mannering Colliery (MC) project approval and provide for ongoing coal production from the Delta Coal assets through to 2029.

This Economic Assessment has been prepared for Delta Coal in accordance with the Secretary's Environmental Assessment Requirements (SEARs), 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 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.
  - environmental and social impacts on the local community.

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

Cost Benefit Analysis

A CBA of the Project indicated that it would have net production benefits to NSW of $89M, 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 $89M, 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 has already been incorporated into the estimate of net production benefits. Expert technical investigations indicate no material impacts are envisaged in relation to surface water, air quality, ecology, Aboriginal heritage, historic heritage, road transport, visual impacts, public infrastructure, or loss of surplus to other industries. Impacts that were quantified included greenhouse gas generation and opportunity cost of groundwater. However, these costs are minor compared to the estimated net production benefits of the Project. Noise impacts will remain consistent with the existing approved operations however the extended life of operations will mean noise impacts will continue for an additional 2 years. The economic costs associated with this extended period of operations is not quantified however they are also expected to be minor compared to the estimated net production benefits.

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 $71M, present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of $85M when potential employment benefits are excluded

and $155M when potential employment benefits are included.[1] Consequently, relative to the "without Project" scenario the Project 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 $85M when potential employment benefits are excluded and $155M when potential employment benefits are included, for the Project not to have net benefits to NSW.

The key driver of the net benefits to NSW is revenue (reflecting production levels and the Australian dollar value of coal). The estimate of net benefits to NSW is less sensitive to assumptions about the opportunity costs of land and capital, development costs, operating costs, decommissioning and rehabilitation costs, residual value of land and capital, and environmental costs not already included in the estimation of net production benefits.

Local Effects Analysis

The Project will provide an average annual operational workforce of 297 per year over the life of the Project, with 68% (202) sourced from the local region of the Central Coast and Lake Macquarie LGAs. Under the strict LEA assumptions of full regional employment i.e. in the absence of the Project these people would be employed elsewhere in the local area, the Project provides an increase in regional wages equivalent of $10M which is equivalent to 101 net mining jobs.

Non labour expenditure in the local area is estimated at $38M per annum.

The main potential residual impacts to the local area after mitigation, compensation and offsets relate to the extended duration of noise impacts on adjoining residents due to the extension of the life of mining operations.

Supplementary Local Effects Analysis

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

Using this approach, the Project operation is estimated to make up to the following contribution to the regional economy:

- $263M in annual direct and indirect regional output or business turnover.
- $140M in annual direct and indirect regional value-added.
- $50M in annual direct and indirect household income.
- 627 direct and indirect jobs.

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

[1] This estimate of net social benefits of the Project is considered to be conservative. The NSW Government (2015) *Guidelines for economic assessment of mining and coal seam gas proposals*, also allows for potential benefits to suppliers which remain unquantified in this analysis. Also, because of the vertically integrated nature of Great Southern Energy Pty Ltd there may be additional economic benefits of the Project to Vales Point Power Station and electricity consumers. These potential benefits are outside the scope of this assessment and have not been quantified.

1 INTRODUCTION

1.1 Introduction

Gillespie Economics has been engaged by Great Southern Energy Pty Ltd (trading as Delta Coal) to complete an Economic Assessment for the Chain Valley Colliery Consolidation Project (the Project). The purpose of the Economic Assessment is to form part of a Development Application being prepared by Umwelt (Australia) Pty Ltd to support an application for State significant development consent under 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 (DPIE) for the Project that relate to economics i.e:
  - a detailed assessment of the likely economic impacts of the development, in accordance with the *Guidelines for the economic assessment of mining and coal seam gas proposals 2015*, paying particular attention to:
    - the significance of the coal resource;
    - the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and
    - the demand on local infrastructure and services.

- 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*.[2]

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

To meet the above requirements two 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.
  - environmental and social impacts on the local community.[3]

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

1.3 Report Outline

Section 2 outlines the scope of the Project, 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.

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

2 PROJECT DESCRIPTION

2.1 Project Overview

Chain Valley Colliery (CVC) and Mannering Colliery (MC) are underground coal mines located on the southern shore of Lake Macquarie, NSW. The operations are located approximately 60 kilometres (km) south of Newcastle, within the Lake Macquarie and Central Coast local government areas (LGAs).

The CVC and MC operations are owned and operated by Delta Coal. In April 2019, Delta Coal acquired Lake Coal's CVC and MC assets. Existing operations are undertaken in accordance with CVC's Development Consent SSD-5465 (as modified), and MC's Major Project Approval MP 06_0311 (as modified), both issued under the EP&A Act.

The CVC and MC Pit Top facilities (pit tops) are located at Mannering Park with approved underground mining areas within the Lake Macquarie and Central Coast LGAs. Delta Coal operates CVC and MC as an integrated operation providing access to the underground mining areas from both pit tops. Existing operations are currently approved to carry out mining operations to 31 December 2027.

Sunset Power International Pty Ltd, trading as Delta Electricity, own and operate the Vales Point Power Station (VPPS) located at Mannering Park on the southern extent of Lake Macquarie adjacent to the CVC and MC pit tops. VPPS is a coal fired power station which commenced operations in the 1960s and has historically been supplied with coal from local and regional coal mines including CVC and MC. Coal is transported to the VPPS via rail, road, or overland conveyor.

The owners of both Delta Coal and Delta Electricity are seeking to maximise the use of the Delta Coal assets to supply coal to the VPPS.

The Project would consolidate the existing operations at CVC and MC under a single development consent under the EP&A Act. The Project would also provide for:

- Extension of Life of mine to 2029 (additional 2 years), aligning with nominal closure of the Vales Point Power Station (VPPS) and removal of coal resources from approved mining areas only.
- Retention of approval for continued operation of both the CVC and MC pit tops.
- Handling of up to 2.8 Mtpa ROM Coal from MC (increase from 2.1 Mtpa) and retaining 1.5 Mtpa at CVC with overall cap of 2.8 Mtpa.
- Consistent application of secondary extraction currently approved under CVC development consent under the Lake Macquarie within the approved MC mining area.

2.2 Project Description

The consolidation of the CVC and MC operations would enable the continuation of mining within existing approved areas.

Under the Project, all mining under land areas will be limited to bord and pillar mining methods which would be designed to be long term stable with negligible (maximum 20mm) subsidence impacts. Secondary extraction would be limited to the approved MC and CVC areas under Lake Macquarie where subsidence impacts are unlikely to have a significant impact on surface features or sensitive marine sea grass areas. Subsidence impacts to sea grass beds will also be limited to a maximum of 20mm vertical subsidence consistent with existing CVC Consent limits.

Delta Coal would retain the ability to bring coal to the surface at either CVC or MC pit top retaining the current approved processing rate at CVC of 1.5 Mtpa, increasing the processing rate at MC to 2.8 Mtpa while applying an overall production cap of 2.8 Mtpa coal to the combined operations.

The existing infrastructure at CVC and MC will continue to be utilised, with minor upgrades to surface facilities proposed (as required) to support extended life of mine and the increase to ROM throughput. Coal handling infrastructure recently demolished at CVC will also be replaced if required.

All ROM coal transferred to the VPPS would be via conveyor from MC and via road from CVC, consistent with the existing CVC consent conditions. The ability to haul up to 600,000 tpa of coal from CVC to the Port of Newcastle by road from the CVC pit top would be retained. Road haulage would be via the approved road haulage route and subject to the same movement restrictions as the existing CVC Consent.

The Project would extend the life of mining operations at CVC and MC by two years to the end of 2029. No change is proposed to the operational workforce levels across the two operations of up to 390 full-time equivalent (FTE) employees.

Table 2.1 provides a comparison of the Project with existing approved operations.

Table 2.1 Overview of Existing Operations and Consolidation Project

Project Component	CVC Approved Operations (assumes Mod 4 approved)	MC Approved Operations	Consolidation Project
Project Area	Refer to **Figure 2.1**	Refer to **Figure 2.1**	Consolidated Project boundary to align with adjustments to align with Delta Coal mining tenement boundaries - refer to **Figure 2.1**
Mine life	Mining operations are approved until 31 December 2027	Mining operations are approved until 31 December 2027	Mining operations approved to 31 December 2029
Annual Coal Extraction	Extraction of up to 2.1 Mtpa of ROM coal	Extraction of up to 1.1 Mtpa of ROM coal	Extraction of up to 2.8 Mtpa total from existing mining areas
Annual Surface Handling	Up to 1.5 Mtpa ROM coal (all production at CVC beyond the 1.5 Mtpa ROM coal surface cap to be sent to VPPS via MC).	Up to 2.1 Mtpa ROM coal	Handling of up to 2.8 Mtpa ROM Coal from MC and 1.5 Mtpa at CVC with overall cap of 2.8 Mtpa
Resource	Fassifern seam	Fassifern and Great Northern seam	Great Northern seam and Fassifern seam
Mining Method	Continuous miner (bord and pillar and pillar extraction) and miniwall mining methods Pillar extraction and miniwall mining only under lake and subject to 20 mm vertical subsidence limits on seagrass beds and foreshore areas	First workings only, including use of a herringbone bord and pillar configuration	No change to approved mining methods First workings only under land areas, foreshore and seagrass beds. Pillar extraction and miniwall mining limited to Fassifern Seam mining areas under Lake Macquarie
Underground Mining Areas	Refer to **Figure 2.1**, consistent with Appendix 2 CVC Consent	Refer to **Figure 2.1**, consistent with Appendix 2 of MC Consent	Consolidate the existing approved CVC and MC consent boundaries

Project Component	CVC Approved Operations (assumes Mod 4 approved)	MC Approved Operations	Consolidation Project
Subsidence Commitments	Zone A – Maximum of 20mm (includes High Water Mark Subsidence Barrier and Seagrass Protection Barrier) Zone B - Maximum 780mm	Maximum of 20mm subsidence	Zone A – Maximum of 20mm subsidence Zone B – Maximum 780mm
Mine Infrastructure	Personnel-and-material drifts, ROM coal conveyor drift to MC Upcast and downcast ventilation shaft and fans Coal handling facilities for breaking, crushing, sizing and storing product coal Administration and workshop facilities Water management infrastructure	Coal crushing facility Upcast and downcast ventilation shaft and fans Coal handling facilities for breaking, crushing, sizing and storing product coal Overland conveyor (from MC pit top are to VPPS) Underground link road to CVC Administration and workshop facilities Water management infrastructure	Continued use of existing infrastructure. Minor upgrades to surface facilities proposed to support extended LOM and the increase to ROM throughput (including water management structures).
Coal Processing	Screening and ROM coal crushing, no coal rejects are generated.	Screening and ROM coal crushing, no coal rejects are generated.	Screening and ROM coal crushing, no coal rejects are generated. ROM coal to be brought to the surface at CVC or MC
Product Coal Handling and Transportation	Product coal from CVC Pit Top to VPPS via truck on private roads only (up to 1.5Mtpa) Transport product coal to MC via the existing underground linkage up 2.1 Mtpa, for subsequent delivery to VPPS via conveyor. A maximum of 660,000 tpa* of product coal per annum on public roads to Port Waratah Coal Services (PWCS) for export. A maximum of 180,000 tpa* of product coal per annum on public roads to domestic customers (other than VPPS)	N/A Up to 2.1 Mtpa ROM Coal via overland conveyor to VPPS.	Up to 1.5 Mtpa coal transport from CVC Pit Top to VPPS via internal haul road and sections of privately owned Construction Road Up to 2.8 Mtpa product coal transport from MC to VPPS via overland conveyor A maximum of 660,000 tpa* of product coal per annum on public roads to Port Waratah Coal Services (PWCS) for export. A maximum of 180,000 tpa* of product coal per annum on public roads to domestic customers (other than VPPS)
Hours of Operation	24 hours per day, 7 days per week	24 hours per day, 7 days per week	No change
Site Access	Existing road access via Construction Road off Ruttleys Road	Existing road access directly from Ruttleys Road	No change to existing arrangements for both pit top areas.

Project Component	CVC Approved Operations (assumes Mod 4 approved)	MC Approved Operations	Consolidation Project
Rehabilitation	Surface infrastructure will be decommissioned and the site rehabilitated following mine closure	Surface infrastructure will be decommissioned and the site rehabilitated following mine closure	No change
Workforce (Operations)	Up to approximately 330 FTE personnel at CVC and within an overall CVC/MC workforce of approximately 390		No change
Workforce (Construction)	N/A	N/A	Managed within approved operational workforce limits.
Water Discharge Requirements	Licensed daily discharge of up to 12.161 ML/day (EPL)	Licensed daily discharge of up to 4 ML/day (EPL)	No change
Water Supply and Demand	Potable water utilised for surface facilities and underground operations (160 ML per annum) supplied by Central Coast Council from potable water supply mains	Potable water utilised for surface facilities and underground operations supplied by Central Coast Council via metered pipeline	Potable water utilised for surface facilities and underground operations supplied by Central Coast Council via metered pipeline.
Exploration	Exploration activities subject to Exploration Activities and Minor Surface Infrastructure Management Plan	Exploration activities subject to Exploration Activities and Minor Surface Infrastructure Management Plan	No change

*Subject to CVC Pit Top handling liming of 1.5Mtpa ROM coal and overall operational limit of 2.8 Mtpa ROM coal

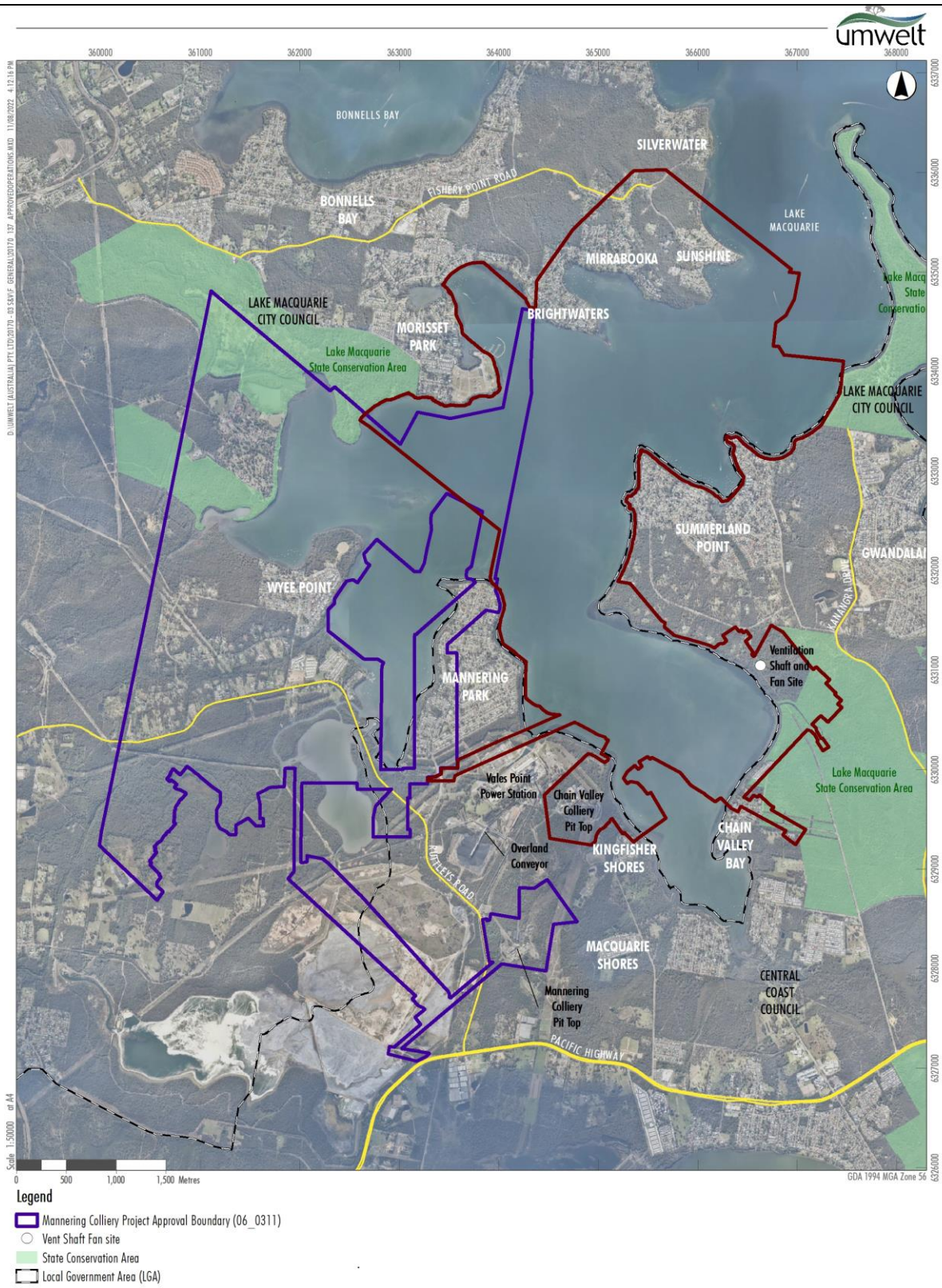


Figure 2.1 Approved Operations

Image Source: Nearmap (May 2019). Data Source: Delta Coal

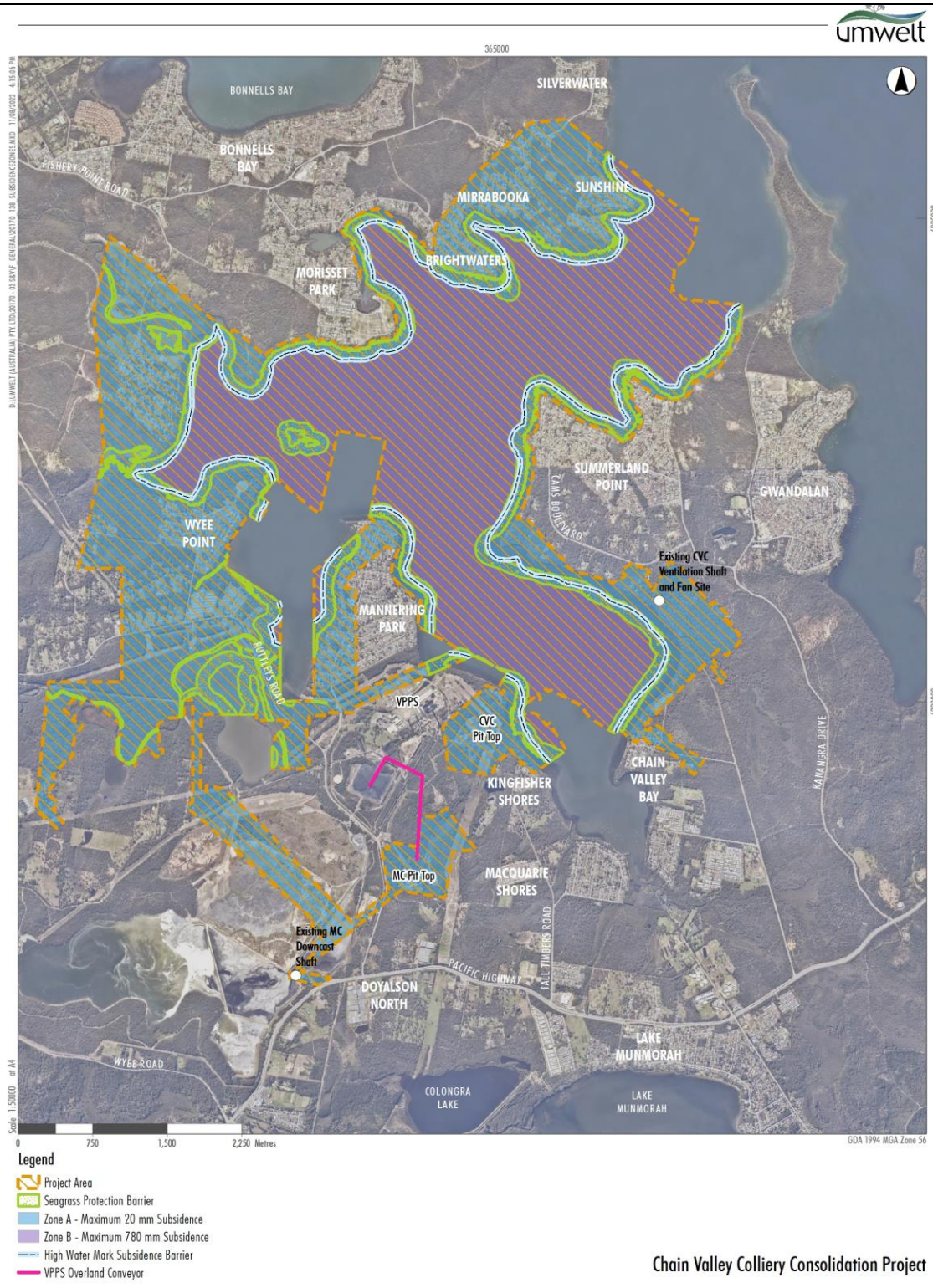


Figure 2.2 Chain Valley Colliery Consolidation Project

Image Source: Nearmap (May 2019). Data Source: Delta Coal

2.3 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, Delta Coal will continue to engage with, and, where possible, 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. Examples of these benefits include:

- Extended employment opportunities for the existing workforce and local employees.
- Extended opportunities for local businesses to supply services to Delta Coal.
- Delta Coal will actively engage with the local community and affected individuals and groups and address any complaints and feedback on mining operations.
- Continued investment in the Delta Coal Community fund.

2.4 Significance of the Resource

Due to the current constraints on life of mine at CVC and MC, current mine planning indicates that it would be uneconomic to continue operations at CVC and MC beyond 2025 due to capital expenses associated with accessing resources in the Western part of the approved reserves. This is primarily due to not being able to recoup capital costs associated with development works during the shorter period of approved operations. However, the two-year extension of approved life of operations (to the end of 2029) and the ability to undertake selected secondary extraction in the proposed extended Zone B area enables sufficient resources to be extracted to justify the cost of capital works associated with accessing this area.

The Project would provide for an additional 5.6 million tonnes (Mt) of mineable coal reserves from within the existing approved resource extraction area providing for the continuation of mining until December 2029. This improved resource extraction from within existing approved mining areas aligns the LOM for the CVC and MC operations with the current operational requirements of the VPPS. The Project will also provide improved coal supply security to the VPPS. This is achieved with negligible additional environmental impacts relative to the planned operations due to the proposed mining methods.

Delta Coal currently has approval to supply coal for both domestic and export markets with most of the approved production at CVC, and all the approved production from MC, transferred to VPPS. Due to proximity to VPPS and common ownership, all the coal produced at CVC and MC is currently supplied to the VPPS. Coal resource from the Fassifern and Great Northern seams mined at CVC and MC is known to have a low sulphur content, making it a preferable supply for power generation. Coal sourced from other operations would be less suited to the design specifications of the VPPS operations which were specifically designed around the use of coal from the Wallarah, Great Northern and Fassifern coal seams. The use of externally sourced coal would require additional rail movements between mines in NSW and the VPPS rail handling facilities. This would also expose the VPPS to cost fluctuations and potential supply uncertainty in the event of supply chain disruptions.

Delta Coal is seeking to ensure the continuity of coal supply for the VPPS which will reduce reliance on external parties and supply chains. The Project will allow for the extension of the LOM for the combined CVC and MC operations to align with the current projected requirements of the VPPS.

The improved operational efficiencies associated with the management of the CVC and MC operations as a single operation with flexibility in production rates between the two pit tops significantly reduces

supply risks for VPPS. The ability to source coal from the CVC and MC mining areas also reduces VPPS reliance on externally sourced coal and associated exposure to price fluctuations.

2.5 Key Assumptions

The Economic Assessment was based on year-by-year financial and employment data provided by Delta Coal. This year-by-year data 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 (2022) values. Estimates of net production benefits are not equivalent to estimates of pre-tax financial net present value of the Project due to differences in timing, exclusion of royalties as a cost and inclusion of opportunity cost of land and capital equipment. The source of the assumptions and description of both Project Case and Base Case are set out in detail in Section 4.

Table 2.2 Key Assumptions Underpinning the Economic Assessment

Item	Assumption
Current Approvals Timeframe	To 31 December 2027
Cessation of production under Current Approvals	2025
Project Timeframe	To 31 December 2029
Cessation of Production under Project	2029
Incremental Production (relative to base case)	9.49 Mt
Opportunity cost of land in 2025	$0.1M
Opportunity cost of capital equipment in 2025	$75M
Capital costs over Project life	$45M
Average annual operating costs 2026 to 2029	$115M
Royalties over Project life	$54M
Life of Analysis	8 years
Workforce	Average annual operational workforce - 297
Coal Price	AUD80/t
Residual value of land	$0.1M
Residual value of capital	$34M

2.6 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 so as 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 and its impacts (as summarised in Section 4.4.2) 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 (Boardman et al. 2001). However, in practice most analysts define society at the national level based on the notion that the citizens of a country share a common constitution that sets out fundamental values and rules for making collective choices and that the citizens of other countries have their own constitutions that make them distinct societies (Boardman et al. 2001).

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

With respect to the application of CBA in relation to coal mining and coal seam gas proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW. 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 NSW.

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 Identification of the Base Case

CBA should compare the state of the world with the proposed project against the state of the world without the project. The base case is the projection of costs and benefits 'without' the project. In a mining context, the base case would include the costs and benefits of any mining that would be undertaken in accordance with any existing approval. Where no mining is approved it is the continued use of the subject land for other land uses.

3.2.4 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 2.1 and includes mining and domestic delivery, as well as all mitigation, offset and compensation measures. However, because of the vertically integrated nature of the proponent this definition of the Project scope may understate the economic benefits of the Project to VPPS and electricity consumers.[4]

3.2.5 Net Production Benefits

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

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

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

3.2.6 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.

[4] Vertical integration can result in cost savings for VPPS and hence allow electricity generation at a lower cost than would otherwise be the case. The benefits of this for VPPS and electricity consumers may not be reflected in the estimate of the net benefits of the Project as defined (i.e. focused on ongoing coal production).

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

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.
- 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.

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.

3.2.7 Consideration of Net Social Benefits

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

In combining these considerations, it should be noted that the estimates of net production benefits of a project generally includes accounting for costs aimed at mitigating, offsetting, or compensating for the main environmental, social, and cultural impacts. This includes the costs of purchasing properties adversely affected by noise and dust, providing mitigation measures for properties moderately impacted by noise and dust or experiencing visual impacts, the costs of providing ecological offsets, the cost of purchasing groundwater and surface water entitlements in the water market and the costs of public infrastructure impacts. Including these costs in the capital and operating costs of a project effectively

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

3.2.8 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.
- 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.

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

3.2.9 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.

3.2.10 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 Delta 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 the LEA, the locality is defined as the Local Government Area(s)[7] (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:

[7] In this case the Central Coast and Lake Macquarie LGAs have been chosen to represent the locality. This is the region that will primarily be the source of labour and non-labour inputs to the Project.

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

3.3.2 Direct Effects Relating to Local Employment

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

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.[9]

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

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

- existing local residents employed by a project are already employed in the region i.e. they are not unemployed or coming from new participants in the labour force.
- jobs vacancies in the region created by those filling the positions in a project remain unfilled for the duration of the project i.e. it essentially assumes that the regional economy and the wider Australian economy is at full employment. Refer to Attachment 3 for a discussion of the 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. As well as being supported in the NSW Government Guidelines (2015) *Economic assessment of mining and coal seam gas proposals*, IO

[8] Employment filled by those migrating into a region to live are excluded as are jobs filled by those who reside outside the region.
[9] Wages paid to those migrating into a region to live are excluded as a wage benefit to the region.

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.

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.
- 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 reports 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.
- 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.

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.
- 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

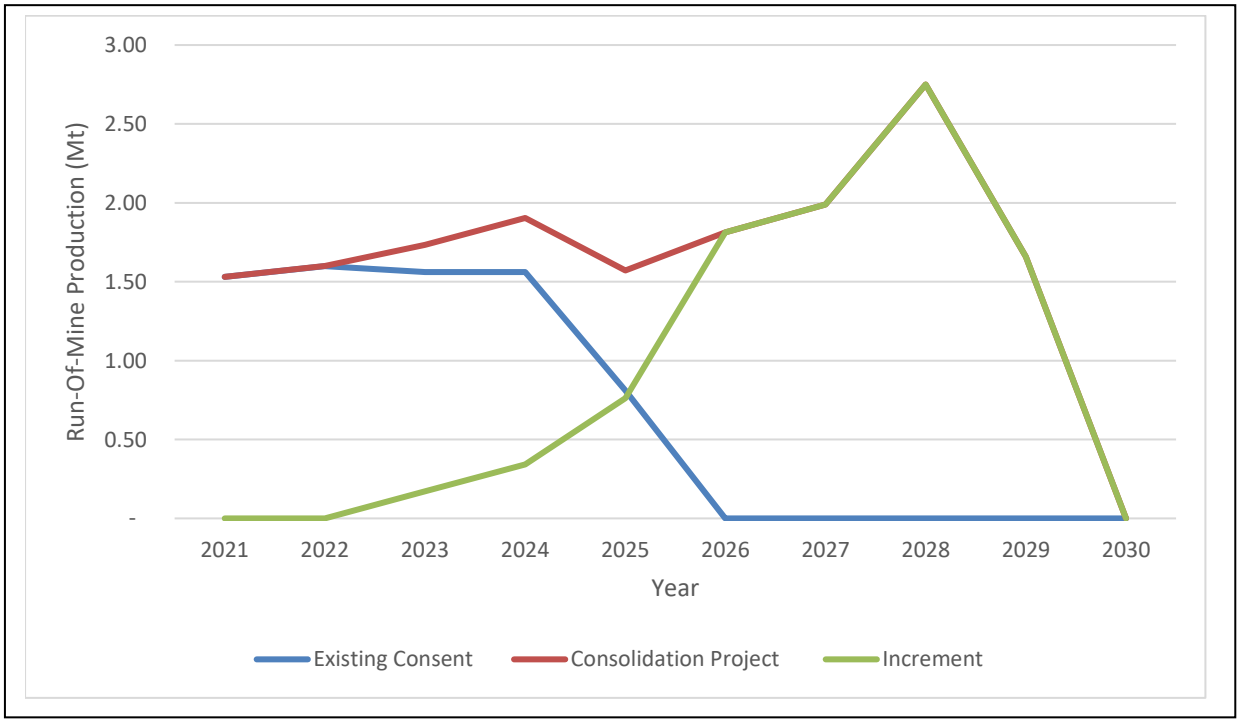
This Section reports on a CBA of the Project based on financial, technical, and environmental advice provided by Delta Coal and its specialist consultants.

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 mining in accordance with existing approvals at CVC and MC. For both mines, approval is until 31 December 2027. However, due to the shorter approval timeframe for approved operations, life-of-mine planning indicates commercially viable extraction options only extend to 2025. The additional coal resources present within the currently approved mining area, are only considered to be viable if the approved operational period of CVC is extended. The Project is as outlined in Section 2 and would enable continuation of production until 2029. The indicative production profile "with" the Project, compared to "without" the Project is provided in Figure 4.1.

Figure 4.1 Incremental Production from the Project



CBA is primarily concerned with the evaluation of a Project relative to the counterfactual of the "without Project" scenario. Where there are alternatives to a project, these can also be evaluated using CBA. However, alternatives need to be feasible to the proponent and to this end several alternatives to the Project were considered by Delta Coal in the development of the current Project.

The Project assessed in the EIS and evaluated in the CBA is considered by Delta Coal to be a feasible alternative for minimising environmental, cultural, and social impacts whilst maximising resource recovery and operational efficiency. It is therefore this alternative that is proposed by Delta Coal 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 in 2025 • Opportunity cost of land in 2025 • Development costs including labour, capital equipment, sustaining capital, and any acquisition costs for impacted properties and biodiversity offsets[1] • Operating costs, including administration, mining, processing, transportation, labour and mitigation, offsetting and compensation measures • Incremental rehabilitation and decommissioning costs	• Value of coal • 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 • 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 any 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 2022 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%.

The analysis period is 8 years, coinciding with the proposed Project life until 2029. Any impacts that occur after this period are included in the final year of the analysis as a terminal value.

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

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

4.4.1 Production Costs and Benefits[11]

Production Costs

Opportunity Cost of Land and Capital

At the cessation of existing mining in 2025 it is estimated that land and capital would have a residual value of $0.1M and $75M, respectively. There is an opportunity cost of carrying this land and equipment forward into the Project rather than sale.

Development Cost of the Project

The development costs of the Project include upgrades to surface facilities to support extended LOM and ROM throughput increases, including water management, increased temporary stockpile areas, haul road upgrades and underground development work to access the western parts of the approved mining area. These incremental capital costs over the life of the Project are estimated by Delta Coal at in the order of $45M. 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, processing, transport, environmental management, and monitoring. Annual incremental operating costs of the Project (excluding royalties) will ramp up from 2022 to an average annual operating cost of $115M between 2026 and 2029.

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

While royalties are a cost to Delta Coal, they are part of the overall producer surplus benefit of the Project that is paid to and then redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Project. Nevertheless, it should be noted that the Project would generate total royalties over its life in the order of $54M, or $36M in present value terms (at 7% discount rate). This royalty calculation is based on the assumed coal price identified below, deductions for crushing and screening, and other levies, and the application of a royalty rate of 7.2% to coal revenue (after deductions).

Decommissioning and Rehabilitation Costs

Rehabilitation would be progressive over the life of the Project with final decommissioning and rehabilitation occurring in the final years of the Project. Rehabilitation costs for the Project would be largely identical to those of the existing approved operations with the incremental costs of rehabilitation and decommissioning estimated at $0.8M. Notwithstanding, it should be noted that Delta Coal is required to pay a rehabilitation security deposit to the Resources Regulator NSW. Since decommissioning and rehabilitation costs would occur mainly towards the end of the Project life and are effectively the same as for existing approved operations, the deferral of these costs means that discounting reduces their significance to the outcome of the CBA.

Production Benefits

Value of Coal

The main economic benefit of the Project is the market value of the coal that is produced. This reflects the production and processing profile, the coal quality, assumed benchmark coal price which is generally quoted in USD and the USD/AUD exchange rate, and a discount or premium to the benchmark coal price for the coal quality. Coal prices are also generally quoted in terms of being free on board and hence coal prices at the mine gate would reflect a discount for avoided rail and port charges.

The NSW Department of Regional NSW – Mining, Exploration and Geoscience (2020) in its assessment of Chain Valley Colliery – Modification 4, assumed an AUD coal price of $80/t. This coal price has been assumed for this analysis but is likely to be conservative given current and forecast thermal coal prices.[12] Sensitivity testing around this assumption in provided in Section 4.7.

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land (excluding environmental offsets) are estimated to have an undiscounted residual value of $34M and $0.1M, respectively.

4.4.2 Environmental, Social and Cultural Costs and Benefits

The environmental, social, and cultural impacts of the Project are assessed in the Specialists Assessment Reports and the EIS. This Section considers these impacts from an economic perspective.

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

[12] Even market prices are unlikely to reflect the value of the coal to VPPS from vertical integration.

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 Assessment identified that the Project would result in no change to the flow regime in Swindles Creek relative to the approved operations. Consequently, no surface water entitlements are expected to be required because of the Project. In addition, there will be no material change in water quality of discharges relative to existing operations is expected. There will also be no predicted impacts on water flows, downstream water users and no change to cumulative impacts.

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

Groundwater

The Groundwater Assessment found that:

- Groundwater inflows to the combined CVC and MC mine workings are predicted to be consistent with approved conditions and average approximately 6.7 ML/day. Should there be any secondary extraction within the Fassifern Seam at MC, this may result in a minor and temporary increase in groundwater inflow to approximately 7.6 ML/day (2,774 ML/year). This peak inflow is well below the current combined groundwater licence allocation held by Delta of 4,893 ML/year. No high priority GDEs listed in the relevant WSPs occur within the Project area.
- Proposed mining is predicted to not impact GDEs within the Project Area, including high potential terrestrial GDE's in the vicinity of the Project Area.
- Mining within the Fassifern Seam is predicted to result in some groundwater depressurisation, predominately within and Permian strata, and it is not predicted that the Consolidation Project will not result in drawdown of greater than 2 m at any registered bore. Overall, the level of impact to the water table, water pressure and groundwater quality is considered to be less than meet the Level 1 minimal impact considerations under the NSW Aquifer Interference Policy and are therefore considered to be acceptable.
- The Project is not predicted to have any material impacts on post mining groundwater recovery relative to approved operations.

While the existing combined groundwater licence for CVC/MC is sufficient to cover the take from the Sydney Basin North Coast Groundwater Source there is an opportunity cost associated with holding WALs for an additional time period and for the incremental groundwater inflows. This is because these WALs would not need to be held without the Project.

The required WALs for existing inflows to the combined CVC and MC mine workings of 6.7ML/day i.e. 2,446 ML will need to be carried forward together with the maximum incremental groundwater inflows of 329ML. Assuming a market value of $2,000/ML this is equivalent to an opportunity cost of $5.5M in 2026.

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 Impact Statement 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). Odour concentrations were also assessed.

The results of the modelling show that the predicted concentrations and deposition rates for incremental particulate matter (TSP, PM10, PM2.5 and dust deposition) and odour are below the applicable impact assessment criteria and Voluntary Land Acquisition and Mitigation Policy (VLAMP) mitigation and acquisition criteria at all assessment locations for both Project scenarios. Cumulative impacts were assessed by combining modelled impacts with recorded ambient background levels. The cumulative results showed that compliance with applicable NSW EPA impact assessment criteria and the VLAMP mitigation and acquisition criteria is predicted at all assessment locations for all pollutants and averaging periods.

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

Noise and Vibration

The impact of the Continuation Project noise and vibration on nearby properties can potentially be valued using the property value method, where the change in property value 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 Impact Assessment found that with minimal changes to the existing approved operations at CVC and MC, noise associated with the Project will not increase/change compared to the approved site noise. Furthermore, the implementation of feasible and reasonable mitigation measures is predicted to result in a reduction in the number of privately-owned residential properties categorised as experiencing significant, moderate, or marginal residual noise impacts from the sites compared to existing approved operations. Notwithstanding, with an extension of the life of operations, residual noise impacts will continue for several years relative to the base case of cessation of operations in 2025.

It is noted however that the operation of the VPPS remains the dominant noise source in the locality and will remain the dominant noise source during the extended period of operations. While the CVC and MC operations contribute to the noise impacts experienced at residences, the VPPS is likely to be the dominant factor in any valuation of properties or economic valuation of the loss of social amenity due to noise impacts in so far as noise impacts are concerned.

Due to the difficulties in disaggregating the effects of noise impacts from the VPPS and the CVC and MC operations, noise impacts have not been quantified in the CBA.

Ecology and Biodiversity

Any impacted vegetation, and associated fauna, because of 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 offsets.

The project does not include any surface disturbance and will not result in any direct or indirect impacts to identified biodiversity values.

As the project will not result any direct impacts to native vegetation or habitat for threatened species or GDEs, offsets are not required.

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

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 Project does not propose any impacts outside of the approved CVC and MC consent boundaries. The impacts within the Project Area associated with MC and CVC are all approved under the existing separate approvals and are subject to an approved HMP. The impacts, once the operations are consolidated, will be consistent with those approved and covered by the HMP. 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 Historic Heritage Assessment determined that none of the listed or potential (unlisted) heritage items within or within the vicinity of the Project Area will be subject to any impacts, either physical or visual, because of 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. defensive expenditure approach.

A Traffic Impact Assessment (TIA) was prepared by GHD (GHD, 2020) to support the CVC Modification 4. This report has also been utilised to support the EIS, given there is no change associated with the Project that would result in further traffic impacts relative to the approved operations. Additionally, the assessment timeframe associated with the GHD 2020 report covers the proposed extended mine life to 2030.

The Traffic Impact Assessment (GHD, 2020) concluded that the approved operations would have a negligible impact on the adjoining road network and the intersection modelling analysis indicated in the 2030 horizon year all intersections are expected to operate with a good Level of Service.

Consequently, there are no 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.

No specific visual impact assessment was undertaken for the EIS because there is no proposed change to infrastructure and hence no change to visual impacts because of the Project.

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

Greenhouse Gas Generation

The Project will generate in the order of an additional 2.2 Million tonnes (t) of Scope 1 and Scope 2 emissions over the life of the Project.[13]

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. These shadow prices represent the 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 $62,000 and $260,000 dollars (present value), with an average value of $145,000. The cost of greenhouse gas emissions to NSW is estimated at between $20,000 and $83,000 dollars (present value), with an average value of $46,000.

Market Benefits to Workers

The Project will provide continuation of employment for 297 workers from 2026 to 2029.

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 in the mining sector earn higher wages than in other sectors because they have higher productivity, primarily driven by the highly capital-intensive nature of the mining sector. 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 who would otherwise be 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

[13] It should be noted that greenhouse gas generation associated with Scope 3 emissions are 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.

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)[14] if it were assumed that 10% of the direct workforce of the Project[15] (30 out of a total of 297 jobs) would otherwise be unemployed for three years from 2026 to 2028 (i.e. from when mining would cease under the base case), and that the reservation wage for these people was $50,048[16] compared to a mining wage of $133,000, then the market employment benefit in terms of income would be $5M 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 4.3 Potential Economic Benefits to Workers ($M)

	Discount Rate		
% Unemployed for 3 years	**4%**	**7%**	**10%**
Scenario 1 - 5% UE	$2.9	$2.5	$2.1
Scenario 2 - 10% UE	$5.8	$4.9	$4.2
Scenario 3 - 15% UE	$8.7	$7.4	$6.3
Wage premium benefit for Rest of Employment			
Scenario 1 - 5% UE	$45.5	$38.4	$32.6
Scenario 2 - 10% UE	$43.1	$36.4	$30.9
Scenario 3 - 15% UE	$40.7	$34.4	$29.1
Total Wage Benefit			
Scenario 1 - 5% UE	$48.4	$40.9	$34.7
Scenario 2 - 10% UE	$48.9	$41.3	$35.0
Scenario 3 - 15% UE	$49.4	$41.7	$35.4

[14] Streeting and Hamilton (1991) *An Economic Analysis of the Forests of South-Eastern Australia*, Resource Assessment Commission, Research Paper Number 5.
[15] All sourced from NSW.
[16] 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).

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[17]) gives an indication of a potential average reservation wage. Further, assuming 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 $36M present value, at a 7% discount rate. Values at alternate discount rates and percentages of already employed people are provided in the Table 4.3.

Based on these assumptions the potential market-based benefits of employment are in the order of $41M present value at 7% discount rate. As identified above, standard CBA generally excludes these potential benefits, while the NSW Government (2015) Guidelines are explicit in their allowance of positive worker benefits and recognises that such benefits can represent a major proponent of the overall benefits for a project. For this analysis, the CBA results are reported both with and without these potential employment benefits.

Non-market Value of Employment

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 who feel sympathy for the unemployed. As identified by Portney (1994), the concept of existence values should be interpreted more broadly than just relating to environmental resources and may also apply to the employment of others. Refer to Attachment 7 for further discussion on non-market values of employment.

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

The Project will provide an average annual incremental 297 direct jobs from 2026 to 2029. Using the more conservative Bulli Seam Operation employment value gives an estimated $29M 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. Consequently, the results have conservatively been reported "with" and "without" employment benefits.

Economic Benefits to Existing Landholders

Payments by the proponent for the purchase of land, that exceed the opportunity cost of the land, are an economic benefit to the landholder. Land required for the Project is already owned by the proponent and has been for some time. The market value of land owned by Delta Coal is included in the CBA as an opportunity cost.

[17] Mean NSW employee income 2018 - (ABS Regional Statistics).

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 (Sinden and Thampapillai, 1995). 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. Consequently, no net infrastructure costs to government are envisaged because of the Project.

Loss of Surplus to Other Industries

No loss of surplus to other industries is envisaged because of the Project.

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 4.4.

The Project is estimated to have global net production benefits of $102M (present value at 7% discount rate), relative to the base case.

The proponent, Delta Coal, is wholly owned by Delta Electricity Pty Ltd (ABN 66 620 205 263) which is registered and based in NSW. Consequently, the global net production benefits are also the Australian net production benefits.

The net production benefits can be further apportioned to NSW by assuming that all royalties accrue to NSW, all residual net production benefits accrue to NSW 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 $89M (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 wage benefits, nonmarket benefits of employment 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 4.4 - 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	$57
Capital costs	$29
Operating cost (ex-royalties), including rehabilitation and decommissioning	$335
Rehabilitation and decommissioning costs	$1
Sub-total	**$422**
Benefits	
Revenue	$505
Residual value of land	$0
Residual value of capital equipment	$20
Sub-total	***$525***
Global Net Production Benefits	**$102**
Royalties to NSW Govt	$36
Company Tax	$20
Residual Net Production Benefits	$47
Global Net Production Benefits	**$102**
Royalties to NSW Govt	$36
Company Tax	$20
Residual Net Production Benefits	$47
Australian Net Production Benefits	**$102**
Royalties to NSW Govt	$36
Company Tax	$6
Residual Net Production Benefits	$47
NSW Net Production Benefits	**$89**

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 4.5 summarises the results of the consideration of externalities in Section 4.4.2.

Table 4.5 – Externality Impacts of the Project ($M Present Values at 7% Discount Rate)

Benefits	Australia	NSW
Wage benefits to employment	$41	$41
Nonmarket benefits of employment	$29	$29
Economic benefits to existing landholders	Not applicable	Not applicable
Economic benefits to suppliers	Unquantified	Unquantified
Sub-total	**$71**	**$71**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.1	$0.05
Surface water	No material impact*	
Groundwater	$4	
Air quality	No material impact*	
Noise and vibration	Unquantified	
Ecology and Biodiversity	No material impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Road transport	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
Loss of surplus to other industries	No material impact*	

* 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.
All employees obtaining wage benefits are assumed to reside in NSW.
All nonmarket benefits of employment accrue to NSW as the estimate is based on a WTP study where only NSW households were surveyed.

From Section 4.4.2, it is evident that the main potential impacts of the Project are internalised into the production costs through Project design as well as mitigation, offset and compensation measures. Other costs not already included in the production costs of the Project are associated with opportunity cost of WALs, GHG costs, and noise impacts associated with an extension of the mine life. Although from Table 4.5, it is evident that the opportunity costs of WALs and GHG costs to Australia and NSW are very small.

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 would obtain net benefits from the project.

The results from Table 4.4 and Table 4.5 are combined in Table 4.6 to estimate the net social benefits of the Project to Australia and NSW, relative to the base case.

Table 4.6 – Net Social Benefits of the Project ($M Present Value @ 7% Discount Rate)

Benefits	Australia	NSW
Net Production Benefits		
Royalties to Government	$36	$36
Company Tax	$20	$6
Residual Net Production Benefits	$47	$47
Sub-total	***$102***	***$89***
Other Benefits		
Wage benefits to employment	$41	$41
Nonmarket benefits of employment	$29	$29
Economic benefits to existing landholders	Not applicable	Not applicable
Economic benefits to suppliers	Unquantified	Unquantified
Sub-total	***$71***	***$71***
Total Benefits	**$173**	**$159**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.1	$0.05
Surface water	No material impact*	
Groundwater	$4	
Air quality	No material impact*	
Noise and vibration	Unquantified	
Ecology and Biodiversity	No material impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Road transport	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
Loss of surplus to other industries	No material impact*	
Sub-total	***$4***	***$4***
Net Social Benefits with Employment Benefits	**$169**	**$155**
Net Social Benefits without Employment Benefits	**$98**	**$85**

* 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 material residual impacts occur, and all impacts are borne by the proponent.

Overall, the Project is estimated to have net social benefits to both Australia and NSW relative to the base case, and hence is desirable and justified from an economic efficiency perspective. The net social benefits to Australia are estimated at $98M when potential employment benefits are excluded and $169M when employment benefits are included. The net social benefits to NSW are estimated at $85M when potential employment benefits are excluded and $155M when employment benefits are included.[18]

[18] This estimate of net social benefits of the Project is considered to be conservative. The NSW Government (2015) *Guidelines for economic assessment of mining and coal seam gas proposals*, also allows for potential benefits to suppliers which remain unquantified in this analysis. Also, because of vertically integrated nature of Great Southern Energy Pty Ltd there may be

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 e.g. noise impacts, would need to be valued at greater than the above estimates of net social benefits for the Project to be questionable from an Australian and NSW economic efficiency perspective.

4.6 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 4.7.

Table 4.7 - 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	$36
Company tax	NSW Government and NSW households	$6
Residual net production benefits	Owners of Delta Coal	$47
Additional benefits		
Wage benefits to employment	Regional and NSW employees of Delta Coal	$41
Nonmarket benefits of employment		$29
Economic benefits to existing landholders	Local landholders who sell land required the Project	Not applicable
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	$0.05
Surface water	Delta via WAL purchases	No material impact*
Groundwater	Delta via WAL purchases	$4
Air quality	Adjoining landholders	No material impact*
Noise and vibration	Adjoining landholders	Unquantified
Ecology and biodiversity	Local and NSW households	No material impact*
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impact*
Historic heritage	Local and NSW households	No material impact*
Road transport	Local residents	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	No material impact*

* 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 material 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.

additional economic benefits of the Project to VPPS and electricity consumers. These potential benefits are outside the scope of this assessment and have not been quantified

4.7 Risk and Sensitivity Analysis

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

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

The NSW DPE 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 Delta 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 Delta is required to pay a rehabilitation security deposit to the NSW Department of Regional NSW – Resources Regulator (DRNSW-RR) as the holder of a mining authority under the *Mining Act 1992*. This security deposit is held by DRNSW-RR to ensure that the legal obligations in relation to rehabilitation and safety of the site can be met following mine closure. If rehabilitation obligations are not met to the satisfaction of the Minister, then the security funds would be used by DRNSW-RR to meet the relevant requirements.

The provision of biodiversity offsets can be associated with several risks. However, no additional biodiversity values will be impacted by the Project and hence no risks regarding biodiversity and offsets arise.

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 worst case scenarios 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 4.8 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[19].

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/coal price.
- residual value of land.
- residual value of capital.
- GHG costs.
- groundwater costs.

Results are reported in Tables 4.8. What this analysis indicates is that CBA is most sensitive to changes in revenue (reflecting the value of coal in AUD) and to a lesser extent, operating costs. This is because changes in revenue directly impact royalties and residual net production benefits which are the main

[19] 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.

component of net production benefits to NSW. Changes in revenue also impact company tax estimates, 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.

While the analysis is most sensitive to a reduction in revenue. The sensitivity analysis was undertaken for a sustained 20% reduction in what can already be considered a very conservative estimate of coal price.

The sensitivity analysis indicated that the CBA results are not sensitive to changes in the opportunity costs of land and capital, development costs, operating costs, decommissioning and rehabilitation costs, residual value of land and capital, capital costs, or environmental costs that have not already been internalised into production costs, such as GHG and groundwater opportunity 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.

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

Table 4.8 - NSW CBA Sensitivity Testing ($M Present Value @ Various Discount Rates)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$104	$85	$70
INCREASE – 20%			
Opportunity cost of land	$104	$85	$70
Opportunity cost of capital	$93	$76	$62
Capital costs	$98	$80	$66
Operating costs	$67	$53	$42
Decommissioning and rehabilitation costs	$103	$85	$70
Revenue	$200	$166	$139
Residual value of land	$104	$85	$70
Residual value of capital	$107	$88	$72
Greenhouse gas costs	$104	$85	$70
Groundwater costs	$103	$84	$69

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE – 20%			
Opportunity cost of land	$104	$85	$70
Opportunity cost of capital	$114	$94	$78
Capital costs	$109	$89	$74
Operating costs	$140	$117	$97
Decommissioning and rehabilitation costs	$104	$85	$70
Revenue	$7	$3	$0
Residual value of land	$104	$85	$70
Residual value of capital	$100	$82	$67
Greenhouse gas costs	$104	$85	$70
Groundwater costs	$104	$85	$70

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 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 Project Area extends across the Lake Macquarie and Central Coast LGAs, with the CVC and MC Pit Tops located in the Central Coast LGA, and in proximity to the Lake Macquarie LGA. This is also the area in which most employees from the Project reside. Consequently, the local area is defined as the combined LGAs of Central Coast and Lake Macquarie.

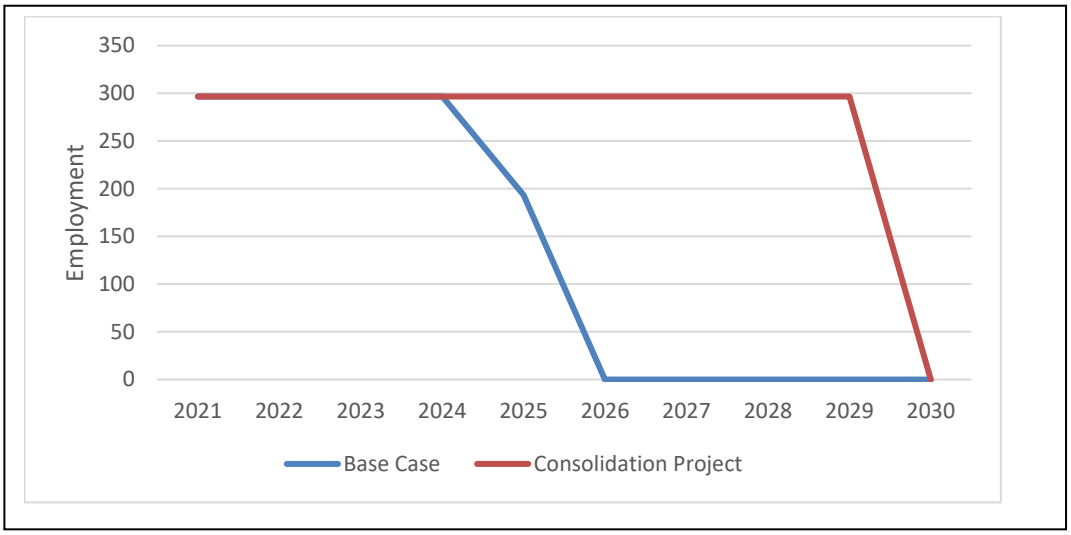
5.2 Direct Effects Related to Employment

The Project will provide an average annual operational workforce of 297 per year over the life of the Project, with 68%[20] sourced from the local region.

Incremental employment from the Project is illustrated in Figure 5.1.

[20] ABS statistics indicated that 68% of those working in coal mining in the Central Coast/Lake Macquarie LGAs (combined) also live in this area.

Figure 5.1 – Incremental Direct Employment from the Project



Assuming that those that already reside in the local area would otherwise be employed in an average job in the local area and that job vacancies created by these people filling the mining positions remain unfilled (i.e. no job chain effects), the incremental disposable wages accruing to the region from Project is $9.6 per annum. This is equivalent to 101 direct full time equivalent (FTE) mining jobs. This is a minimum estimate as it assumes full employment in the local area and hence the jobs from which people come to fill the mining jobs remain vacant.

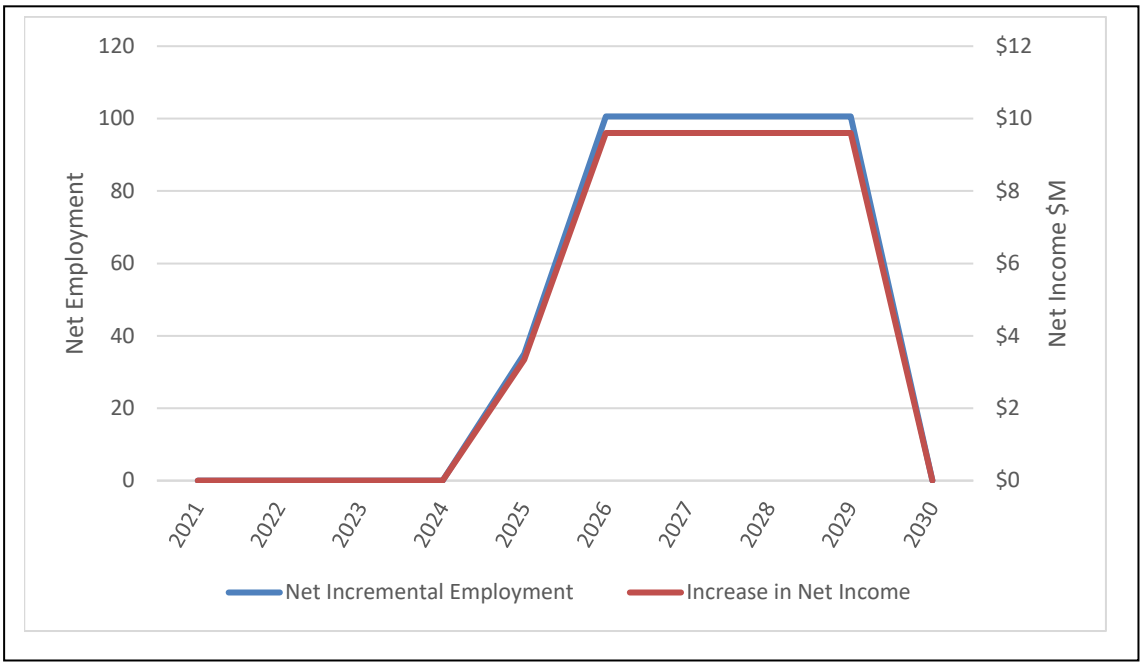
Table 5.1 Analysis of Net Income Increase and FTE Job Increase

	Operations
a) Direct employment during operations phase	297
Number that already reside in the region	202
b) Average net income in construction and mining	$95,453
c) Average net income in other industries*	$47,856
d) Average increase in net income per job (b-c)	$47,597
e) Increase in net income per year due to direct employment	$ 9,602,686
f) FTE (e/b)	101

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

Local area effects ramp up to this level of impact from 2024 and ramp down from this level of impact in 2029. Refer to Figure 5.2.

Figure 5.2 – Incremental Net Employment and Net Income



5.3 Direct Effects Related to Non-Labour Expenditure

The total annual non-labour expenditure (operating costs of the Project after subtraction of wages to employees) between 2026 and 2029 is in the order of $76M per annum.

However, not all this expenditure will accrue to the local area. From the location quotient analysis and allocation of margins and taxes undertaken by Gillespie Economics for Section 6, $38M pa of non-labour Project expenditure is estimated to accrue to the regional economy.

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 study by Lawrence Consulting (2021) for the NSW Minerals Council confirms the existence of substantial flow-on effects from mining operations in all mining regions of NSW.

Recognised methods for assessing second round and flow-on effects such as IO analysis (but also CGE analysis), do not utilise direct effects of employment and income effects as calculated above in accordance with the NSW 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 contributes 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 Other Effects

5.5.1 Contraction in Other Sectors

There will be no substantive contraction in other sectors of the economy because of the Project.

5.5.2 Displaced Activities

No economic activities will be directly displaced by the Project.

5.5.3 Wage Impacts

In the short run, increased regional demand for labour as a result of the Project (relative to the "without Project" scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the region and the availability and mobility of labour from outside the region. However, the incremental direct employment and income impacts of the Project operation, as estimated in Section 6, are small relative to the size 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 12% 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.

5.5.4 Housing Impacts

The Project will enable continuation of employment for those already employed by Delta Coal. Hence there will be no increased demand for housing. In the absence of the Project, a proportion of those who become unemployed may migrate out of the region in search of alternative employment, resulting in some decreased demand for housing, all other things being equal. However, this is likely to be immaterial relative to the continued population growth of the region.

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

The main potential residual impacts to the local area after mitigation, compensation and offsets relate to noise on adjoining residents because of the extension of the life of mining operations.

5.7 Summary of Local Effects

A summary of local effects of the Project is provided in Table 5.2.

Table 5.2 Summary of Local Effects 2026-2029

	Project Direct	**Project Direct: Local**	**Net Direct Effect**
Operation (Average Annual)			
Employment	297	202	101
Net income (M)			$10
Net non-labour expenditure (M)	$38 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**	
Continuation of existing residual noise impacts for additional years	Adjoining landholders	Unquantified but difficult to disaggregate from noise impacts from VPPS which are the dominant noise source in the area, and this will continue for the life of the Consolidation Project	

6 SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 Introduction

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

6.2 Structure of the Local Area Economy

For the analysis, the local area economy is defined as comprising the Central Coast and Lake Macquarie LGAs. This is the region where the Project is located, and most of the Project operational workforce resides.

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 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 $0M worth of output to the agriculture, forestry, and fishing sector of the regional economy, $121M worth of output to the mining sector of the regional economy etc. It also sells $5M of output directly to households and exports $2,581M 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 $3,030M worth of output, it purchases $0M of inputs from the agriculture, forestry and fishing sector of the regional economy, $121M of inputs from the mining sector of the regional economy etc. It also imports $569M of inputs from outside the region, generates $1,610M in other value added, employs 1,818 people, and pays $269M in wages and salaries.

Output for the regional economy is estimated at $89,794M. Value-added for the regional economy is estimated at $25,775M, comprising $12,587M to households as wages and salaries and $13,188M in OVA.

The total employment working in the regional economy was 160,026 jobs.

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

Figures 6.3 to 6.5 provide a more expansive sectoral distribution of gross regional output, employment, household income, value-added, exports and imports, and can be used to provide some more detail in

the description of the economic structure of the regional economy. From these figures, it is evident that in terms of gross regional output, ownership of dwellings, construction trade services, utilities, coal mining and retail trade other mining, food manufacturing and construction trade services are the most significant sectors (Figure 6.3). In terms of value-added, Ownership of dwellings, coal mining, retail trade, community care services, health services and education services are the most significant sectors (Figure 6.3). The retail trade, health, education, community care and accommodation/restaurants sectors are the most significant sector in terms of regional employment (Figure 6.4) while the community care, health, education, accommodation/restaurants, and construction trade services are the most significant sectors in terms of income (Figure 6.4). Major importing sectors are utilities, food manufacturing, metal manufacturing, coal mining, investment and insurance and construction trade services. Major exporting sectors area coal mining metal manufacturing, and food manufacturing sectors (Figure 6.5).

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	13	0	98	0	5	40	3	9	169	106	(26)	1	251
Mining	0	121	84	202	29	4	11	5	455	5	(11)	2,581	3,030
Manuf.	8	68	351	31	645	231	79	146	1,559	701	532	1,998	4,790
Utilities	4	23	80	440	41	66	105	106	865	297	1,388	426	2,977
Building	8	64	45	89	1,898	76	497	139	2,815	36	3,625	33	6,509
Trade/Accom	7	58	157	35	188	177	179	232	1,032	3,448	277	591	5,349
Bus.Srvcs	19	190	425	312	550	884	2,364	985	5,729	6,720	1,184	940	14,572
Public/Pers Srvcs	2	57	50	31	86	54	267	304	851	2,877	5,634	158	9,520
TOTAL	61	582	1,290	1,140	3,442	1,532	3,503	1,927	13,477	14,190	12,604	6,729	46,999
Household Income	38	269	887	256	1,351	2,006	2,606	5,173	12,587	-	-	-	12,587
OVA	84	1,610	433	645	559	942	6,020	1,001	11,295	1,471	416	7	13,188
Imports	67	569	2,180	936	1,156	869	2,444	1,419	9,641	6,029	1,190	161	17,020
TOTAL	251	3,030	4,790	2,977	6,509	5,349	14,572	9,520	46,999	21,690	14,209	6,896	89,794
Employment	1,111	1,818	10,922	1,788	14,277	40,595	26,664	62,851	160,026				

Figure 6.1
Summary of Aggregated Sectors: Regional Economy (2018-19)

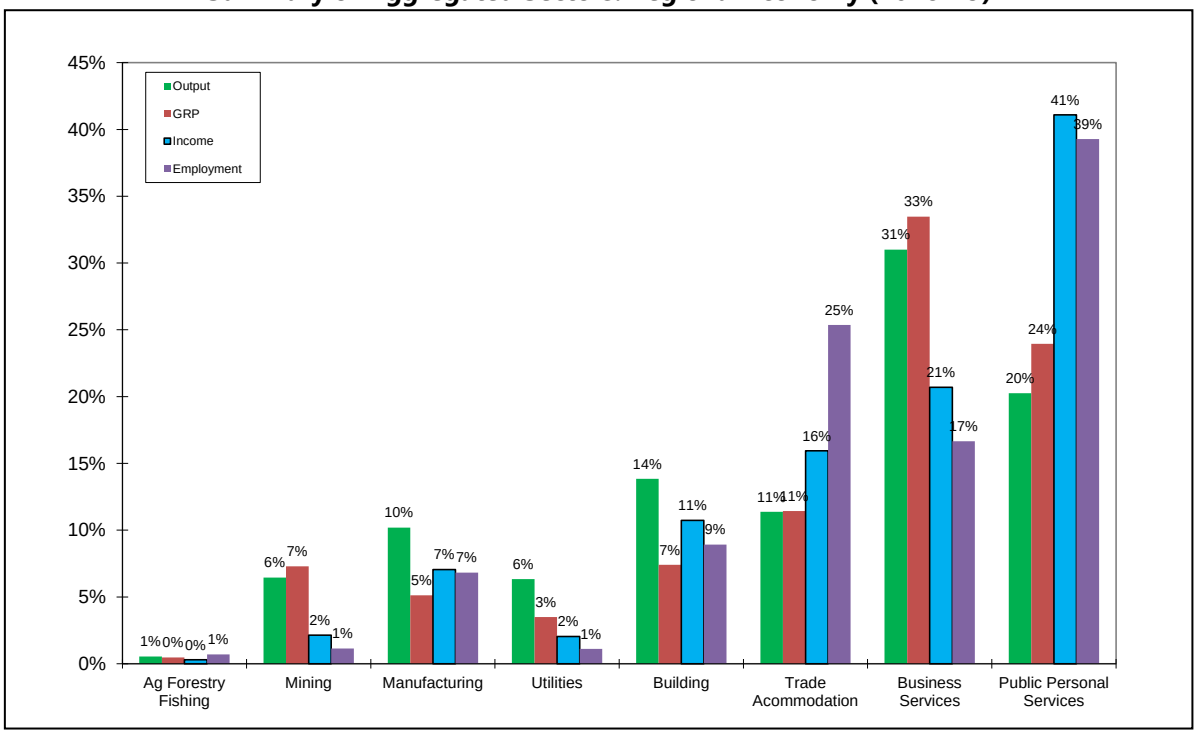


Figure 6.2
Summary of Aggregated Sectors: NSW Economy (2018-19)

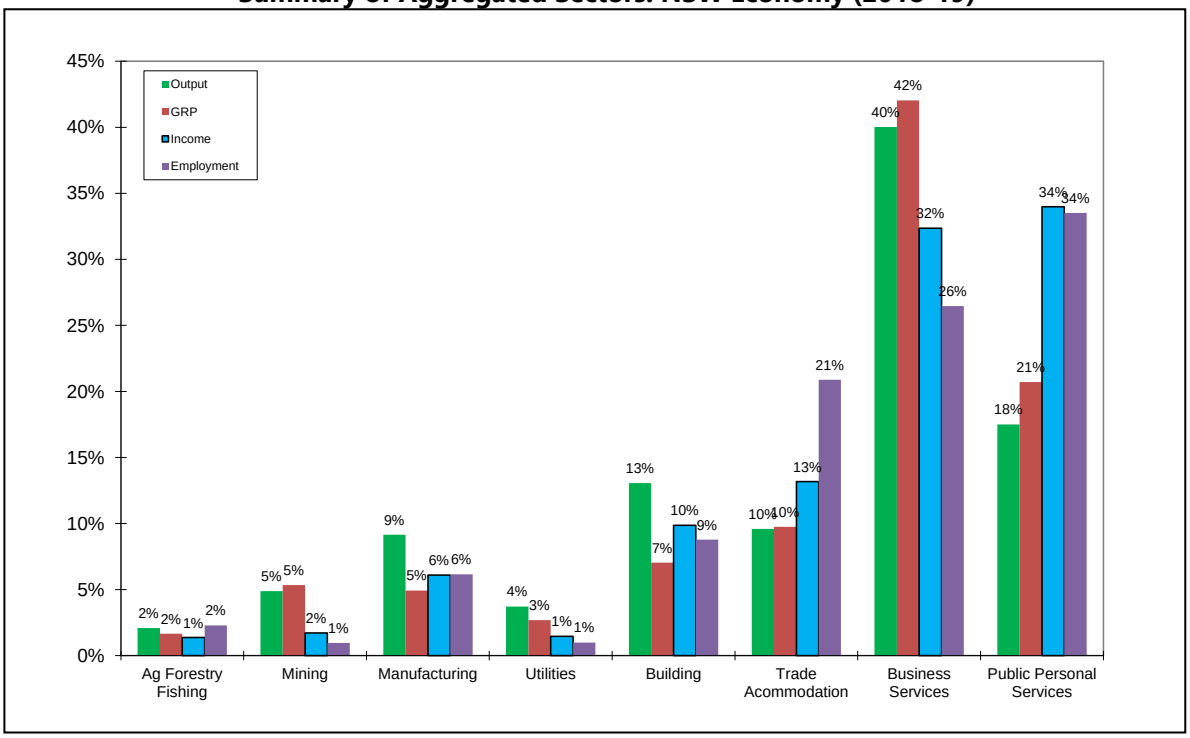


Figure 6.3 Sectoral Distribution of Gross Regional Output and Value Added ($M)

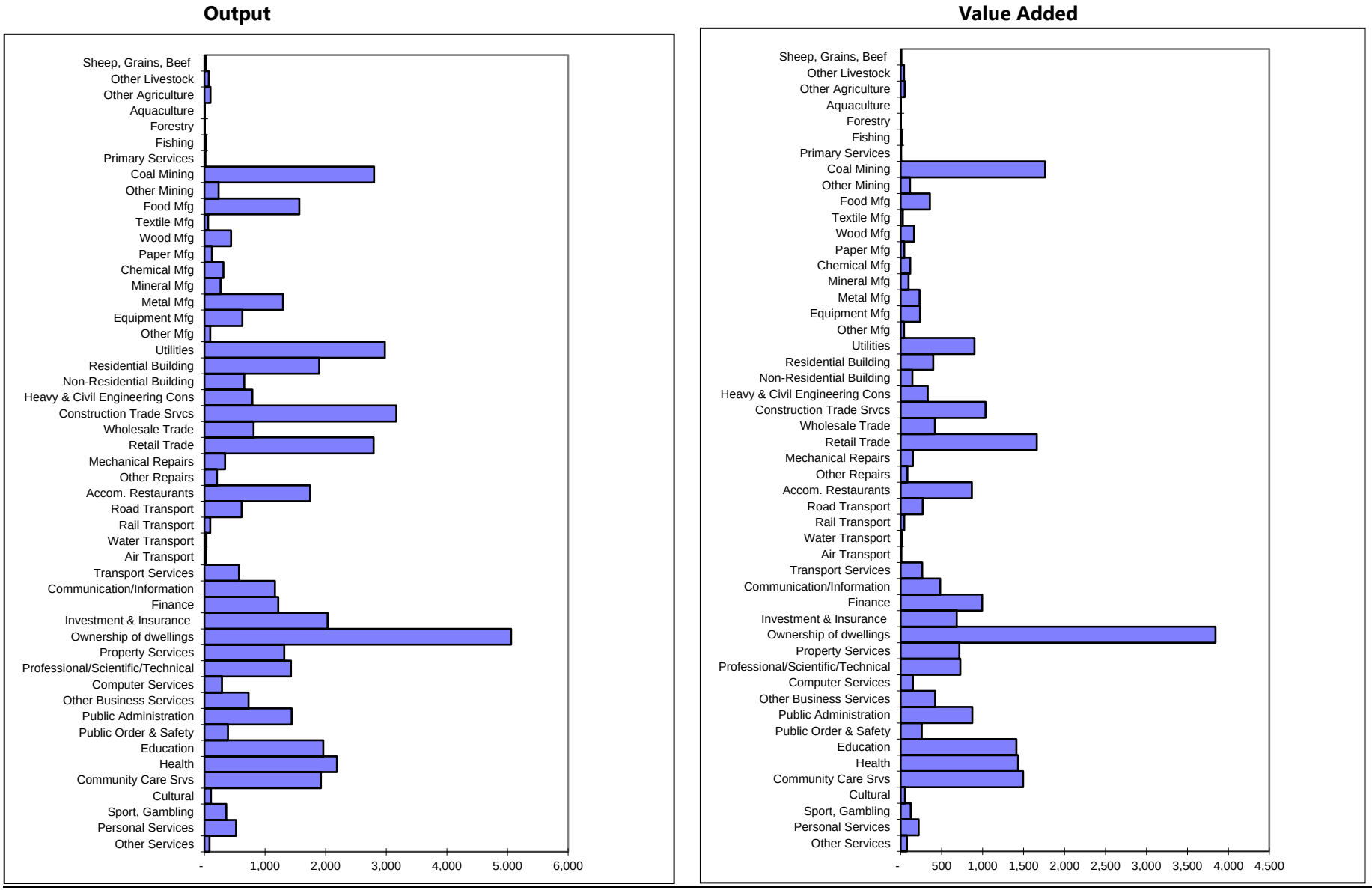


Figure 6.4 Sectoral Distribution of Income ($M) and Employment (No.)

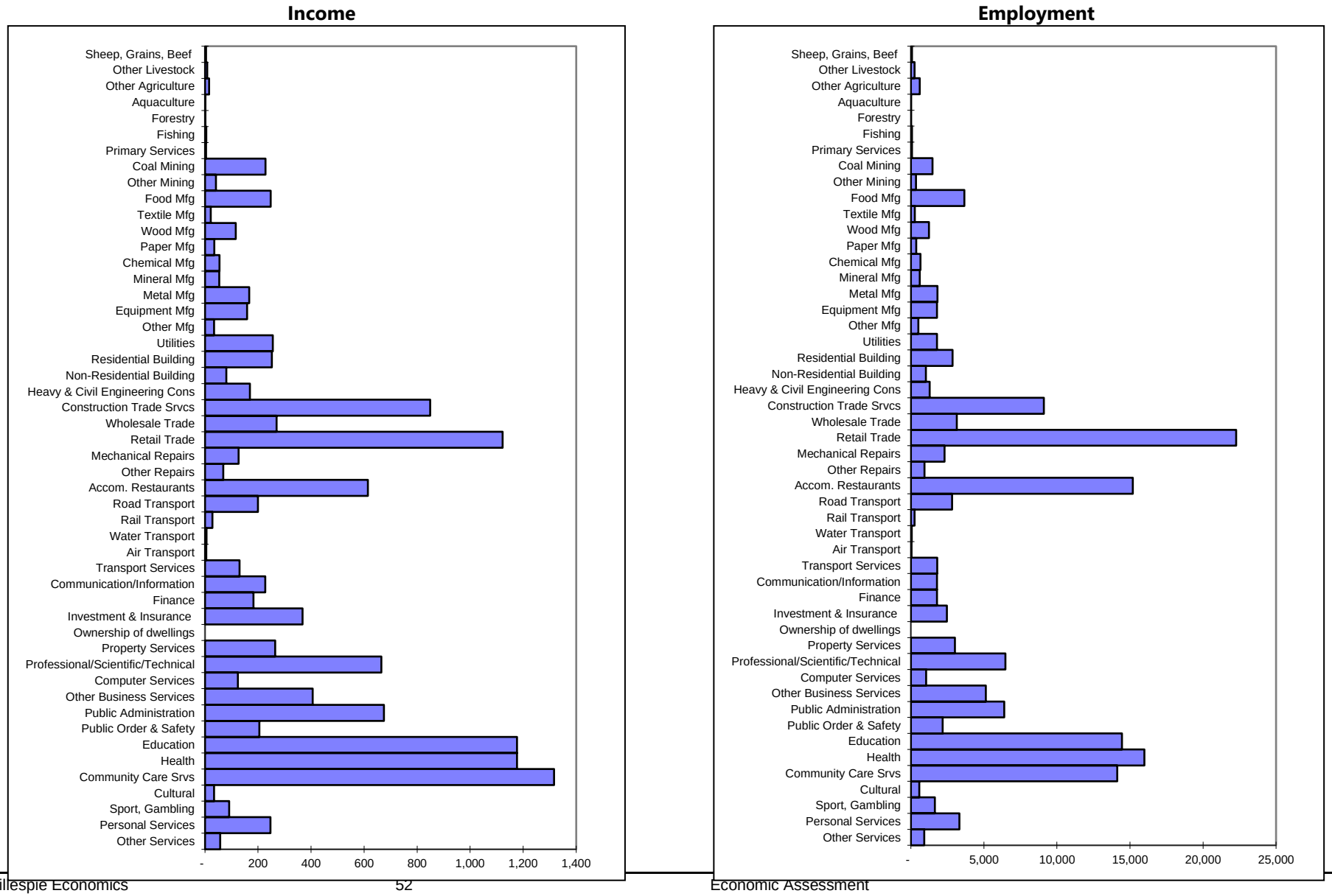


Figure 6.5 Sectoral Distribution of Imports and Exports ($M)

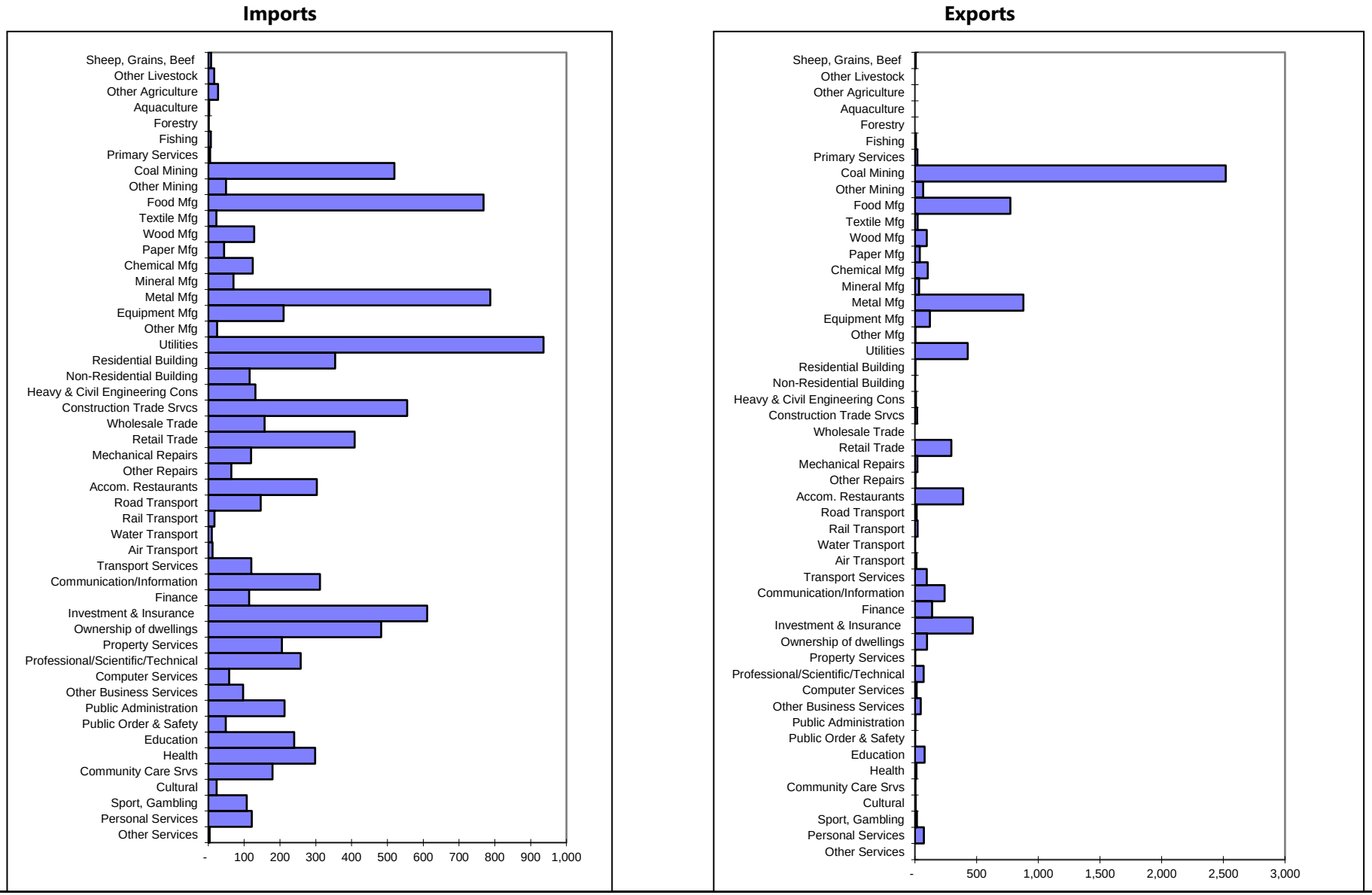
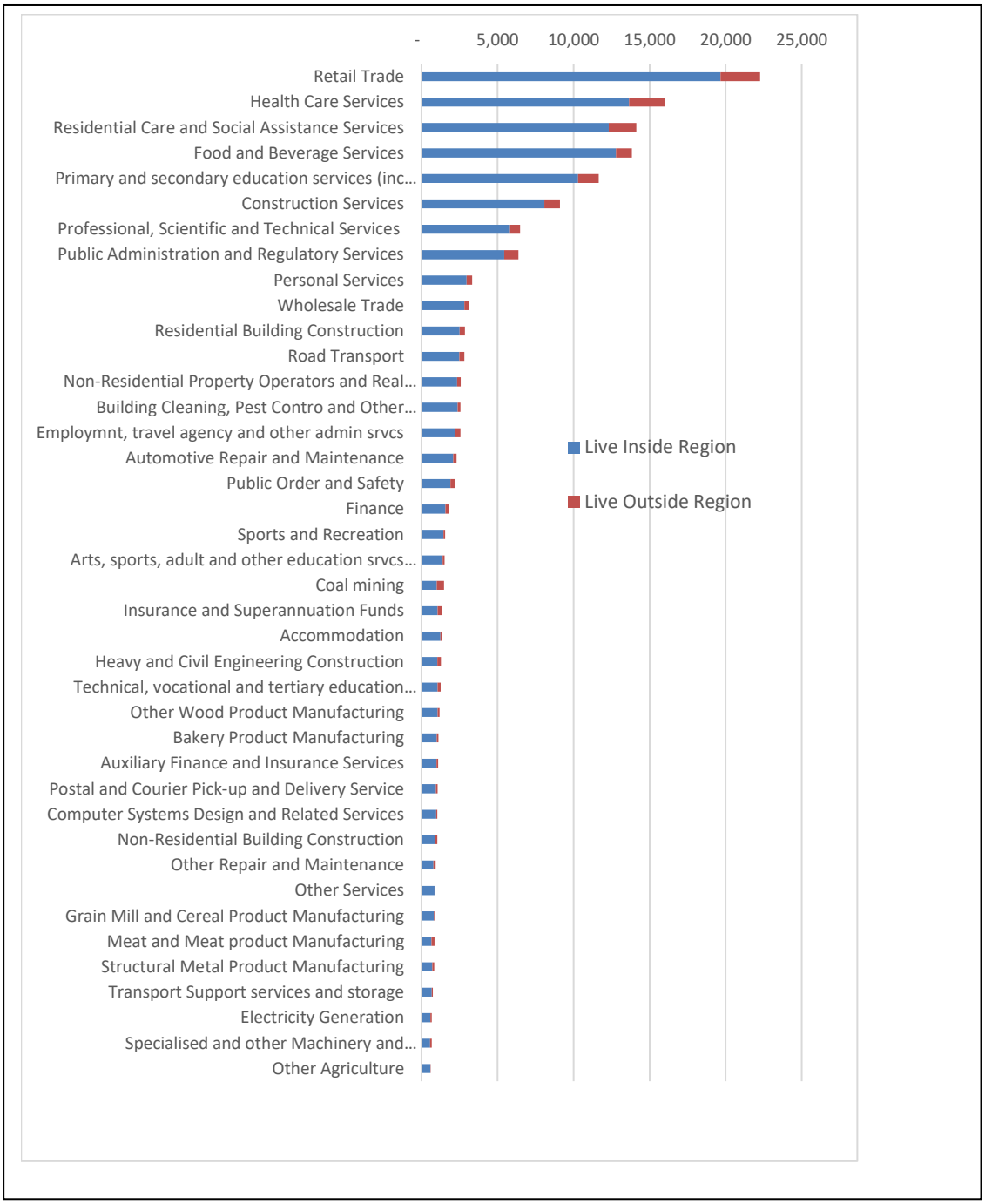


Figure 6.6 shows the top 40 individual industry sectors by employment number for the region. The five most significant employment providers in the region are the retail trade sector, health care services sector, residential care and social assistance services sector, food and beverage services sector and primary and secondary education services sector. In the top 40 individual industry sectors by employment, 12% of the workforce resides outside the region.

Figure 6.6 Main Employment Sectors (Input-output Sector Classification) 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 quarrying operation. All other things being equal, the economic activity arising from a project will depend on:

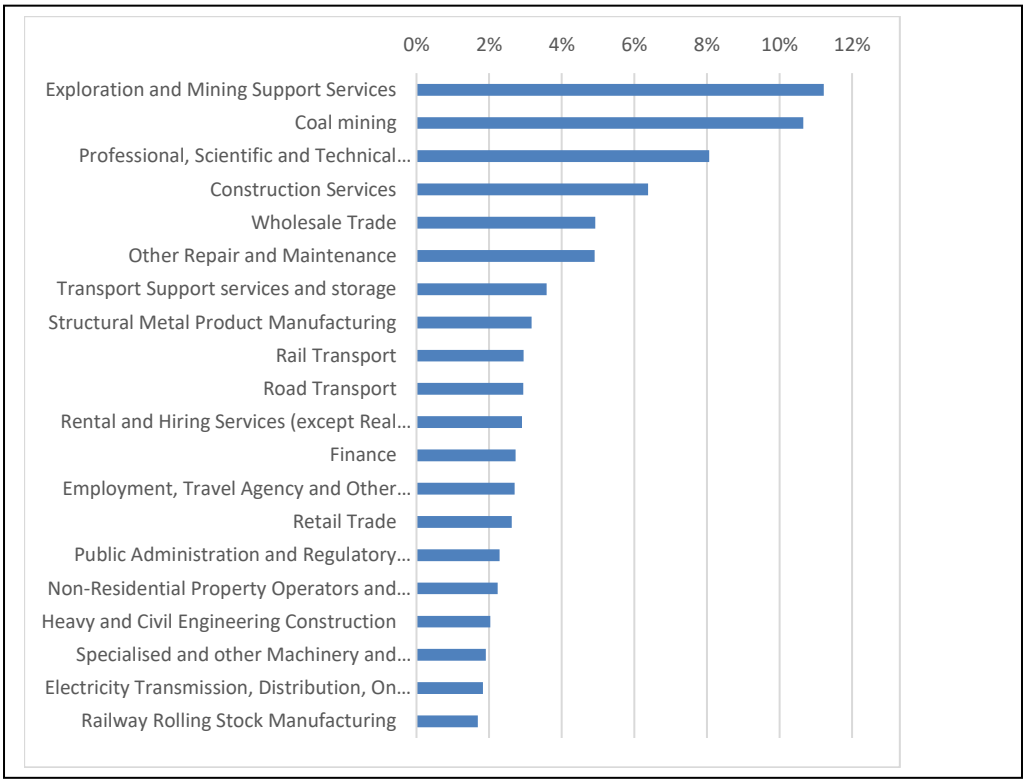
- the expenditure profile in the regional economy that is associated with the project.
- the expenditure profile and residential location of the workforce.
- the size of the regional economy and the ability of local businesses to supply inputs to production demanded by mine proponents and the workforce.

6.3.2 Mining Operation Expenditure

The Project is a continuation of an existing development. Some indication of the main sectors of the regional economy that may directly benefit from the Project operation can be obtained by examining the regional expenditure pattern of the Coal Mining sector in regional IO table. This has been developed based on the expenditure pattern of the Coal Mining sector in the National IO table and the application of NSW and then regional location quotients[21] to assess the ability of sectors in the regional economy to supply the goods and services demanded. Based on this approach, the main sectors in the regional economy to benefit from direct operational expenditure are shown in Figure 6.7. The main sectors benefitting are exploration and mining support services, coal mining, professional, scientific, and technical services, construction services, wholesale trade, and other repair and maintenance.

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

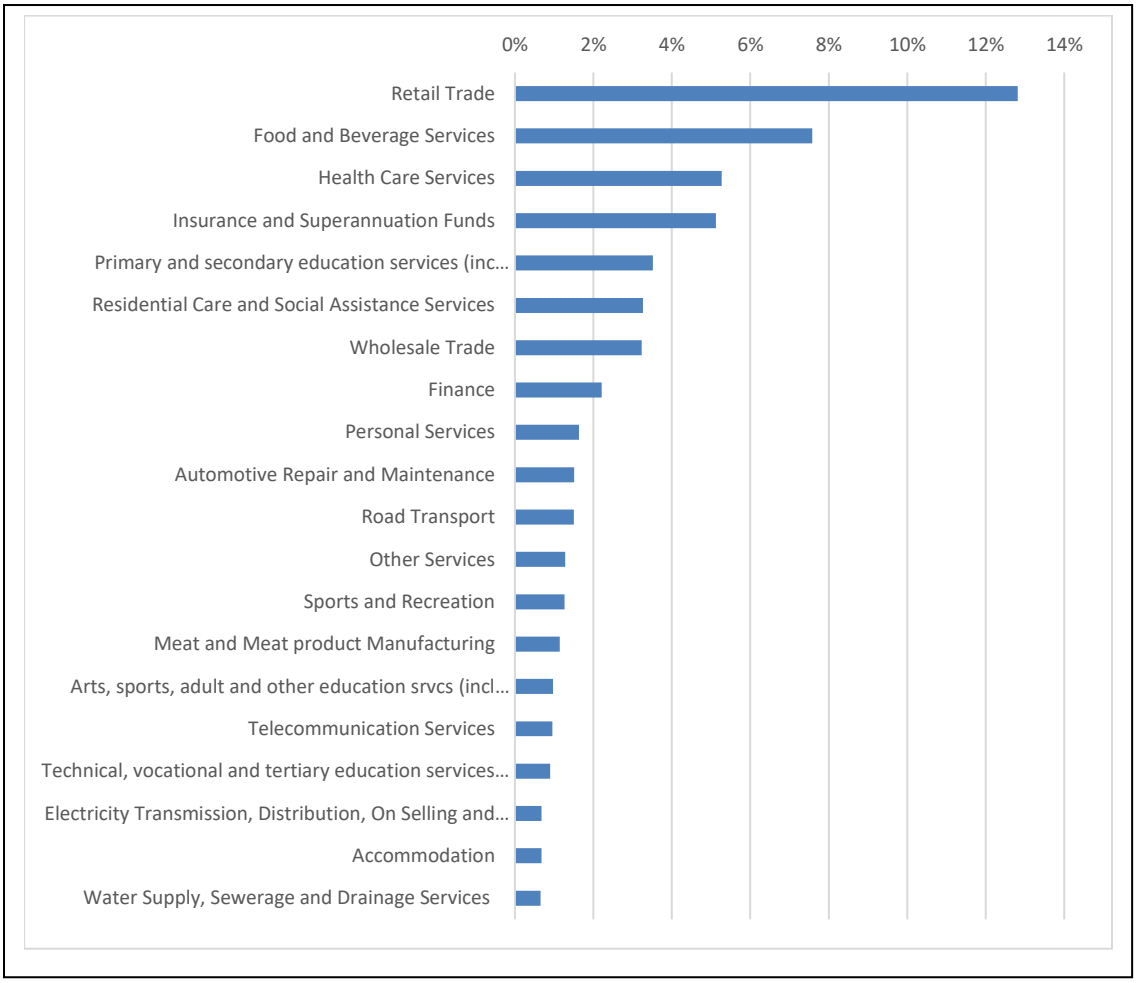
Figure 6.7
Percentage of Operational Expenditure in the Region by Sector (Input-output Sector Classification)



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 for 297 people. Sixty eight percent are estimated to live in the region. An indication of the main sectors of the regional economy that may benefit from employee expenditure can be obtained by examining the expenditure pattern of the household sector in the National IO table adjusted to the region using location quotients. Based on this approach the main sectors in the regional economy to benefit from direct expenditure of wages in the regional economy are shown in Figure 6.8. The main sectors benefitting from workforce expenditure are retail trade, food and beverage services, health care services, insurance and superannuation funds, and primary and secondary education services.

Figure 6.8 - Percentage of Employee Expenditure in the Region by Sector (Input-output Sector Classification)



6.4 Regional Impact of the Project Operation

Introduction

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

For the analysis of the Project, a Project sector was inserted into the regional IO table[22] reflecting average annual incremental production levels for the Project from 2026 to 2029. The revenue, expenditure and employment data for this new sector was obtained from financial information provided by Delta Coal. For this new sector:

- the estimated average annual gross 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 expenditure was initially allocated across the relevant *intermediate sectors* in the economy and *imports* based on ratios in the regional input-output table.

[22] Inflated to 2021

- the difference between total revenue and total costs (excluding royalties) was allocated to the *other value-added* row.
- direct employment in the Project was allocated to the *employment* row.

Impacts

The total and disaggregated average annual impacts of the Project on the regional economy in terms of output, value-added, income and employment (in 2021 dollars) are shown in Table 6.2.

Table 6.2 Annual Regional Economic Impacts of the Project

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	164	55	43	98	263
Type 11A Ratio	1.00	0.34	0.26	0.60	1.60
VALUE ADDED ($M)	88	26	25	51	140
Type 11A Ratio	1.00	0.29	0.29	0.58	1.58
INCOME ($M)	27	14	10	23	50
Type 11A Ratio	1.00	0.51	0.37	0.88	1.88
EMPL. (No.)	297	173	157	330	627
Type 11A Ratio	1.00	0.58	0.53	1.11	2.11

Note: Totals may have minor discrepancies due to rounding.

The Project is estimated to make up to the following contribution to the regional economy (Table 6.3):

- $263M in annual direct and indirect regional output or business turnover.
- $140M in annual direct and indirect regional value-added.
- $50M in annual direct and indirect household income.
- 627 direct and indirect jobs.

Multipliers

Type 11A ratio multipliers for the Project range from 1.58 for value-added up to 2.11 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 because 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 several different sectors of the regional economy. The sectors most impacted by output, value-added and income flow-ons are likely to be:

- Construction Services.
- Professional, Scientific and Technical Services.
- Retail Trade.
- Wholesale Trade.
- Exploration and Mining Support Services.
- Coal Mining.
- Food and Beverage Services.

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 6.3).

Table 6.3 Sectoral Distribution of Total Regional Employment Impacts of the Project

Sector	Average Direct Effects	Production Induced	Consumption Induced	Total
Impact sector	297	0	0	297
Primary	0	0	2	3
Mining	0	11	0	11
Manufacturing	0	17	7	25
Utilities	0	2	1	3
Wholesale/Retail	0	21	40	61
Accommodation, cafes, restaurants	0	10	25	35
Building/Construction	0	17	4	21
Transport	0	16	5	21
Services	0	80	72	151
Total	**297**	**173**	**157**	**627**

Note: Totals may have minor discrepancies due to rounding.

Table 6.3 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, manufacturing, building/construction, and transport* sectors, while consumption induced flow-on employment would be mainly in the *services, wholesale/retail trade and accommodation/cafes/restaurants* sectors.

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 (relative to without the Project). 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 because of an 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 is at full employment during the Project life and is a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is unlikely to be at full employment for the duration of the Project and is an open economy with access to external labour resources. Consequently, 'crowding out' of economic activity in other sectors because 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 four 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 several interrelated factors at the time, including:

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

Ignoring all other influences, the impact of Project cessation on the regional economy would depend on whether the workers and their families affected would leave the area. If it is assumed that some or all of the workers remain in the region, then the impacts of Project cessation would not be as severe compared to a greater number leaving the region. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption, the regional economic impacts of Project cessation would approximate the direct and production-induced effects in Table 6.2. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Table 6.2.

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

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

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

7 CONCLUSIONS

Cost Benefit Analysis

A CBA of the Project indicated that it would have net production benefits to NSW of $89M, 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 $89M, 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 has already been incorporated into the estimate of net production benefits. Expert technical investigations indicate no material impacts are envisaged in relation to surface water, air quality, ecology, Aboriginal heritage, historic heritage, road transport, visual impacts, public infrastructure, or loss of surplus to other industries. Impacts that were quantified included greenhouse gas generation and opportunity cost of groundwater. However, these costs are minor compared to the estimated net production benefits of the Project. Noise impacts relating to a continuation of mine life remained unquantified.

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 $71M, present value at 7% discount rate. Overall, the Project is estimated to have net social benefits to NSW of $85M when potential employment benefits are excluded and $155M when potential employment benefits are included. Consequently, relative to the "without Project" scenario the Project 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 $85M when potential employment benefits are excluded and $155M when potential employment benefits are included, for the Project to be questionable from a NSW economic efficiency perspective.

Local Effects Analysis

The Project will provide an average annual operational workforce of 297 per year over the life of the Project, with 68% (202) sourced from the local region of the Central Coast and Lake Macquarie LGAs. Under the strict LEA assumptions of full regional employment i.e. in the absence of the Project these people would be employed elsewhere in the local area, the Project provide an increase in regional wages equivalent of $10M which is equivalent to 101 net mining jobs.

Non labour expenditure in the local area is estimated at $38M per annum.

The main potential residual impacts to the local area after mitigation, compensation and offsets relate to noise on adjoining residents, because of the extension of the life of mining operations.

Supplementary Local Effects Analysis

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

Using this approach, the Project operation is estimated to make up to the following contribution to the regional economy:

- $263M in annual direct and indirect regional output or business turnover.
- $140M in annual direct and indirect regional value-added.
- $50M in annual direct and indirect household income.
- 627 direct and indirect jobs.

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

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ATTACHMENT 1 – LEGISLATIVE CONTEXT FOR ECONOMIC ANALYSIS IN EIA

Environmental Planning and Assessment Act 1979 and Environmental Planning and Assessment Regulation 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"*.
  - 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).
    - 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.
  - environmental and social impacts on the local community.

Secretary's Environmental Assessment Requirements

- The Project SEARs include a requirement for:
  - a detailed assessment of the likely economic impacts of the development, in accordance with the *Guidelines for the economic assessment of mining and coal seam gas proposals 2015*, paying particular attention to:
    - the significance of the coal resource.

- the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates.
- the demand on 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 because 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[23].

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.

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

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

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

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

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

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

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

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

Table 1 - Incremental Income when Immigrating Workforce is Included

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

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

effect, "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 – 114 sectors based on current National IO tables.
- Data specific to a project's 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 several indicators of economic activity – output, income, value-added[24] 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.

[24] 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.

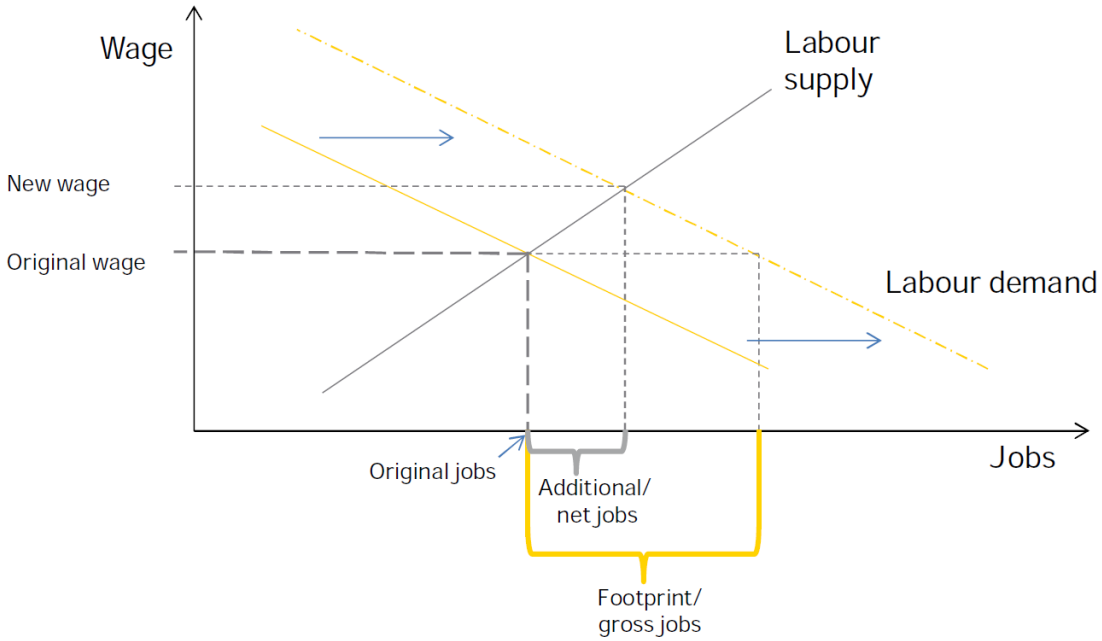
Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.
- CGE modelling can be dynamic or comparative static[25] 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 several 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.

[25] 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[26]. 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:

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

- US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*.
- 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).

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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).
  - 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)[27]. 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.

[27] 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 encompasses property value impacts due to noise. No significant impacts identified.
Moderate	Defensive expenditure	Noise mitigation costs included in capital costs of project.
Significant air quality impacts	Property valuation method	Cost of acquiring properties encompasses property value impacts due to air quality impacts. However, no properties impacted by exceedances.
Use of surface water	Market value of water	Cost of Water Access Licences reflects marginal value product of water. No 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 can be included in capital costs. Assumes that offsets levels are sufficient to compensate the community for values lost. This is a requirement of Govt. Policy. No offsets required for the Project
Road transport impacts	Defensive expenditure	Cost of road investment required because of the Project can be included in capital costs of project. No road impacts of the Project that required defensive expenditure
Aboriginal heritage	Defensive expenditure or Stated Preference techniques	No impacts on Aboriginal heritage identified
Historic heritage	Benefit transfer	Can be valued from national choice modelling study. No impacts identified.
Visual	Defensive expenditure	Costs of mitigation measures included in the economic analysis. No impacts identified.

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 benefit 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 during 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[28]). The shadow price of labour is lower than the actual wage and has the effect of increasing the magnitude of the producer surplus benefit of a project. The analysis included consideration of the magnitude of these additional benefits under a number of scenarios but conservatively excludes them from the core analysis. Ceteris paribus these estimates are conservative since they ignore any consideration of search and retraining costs, scarring, stigma and physical and mental health effects of unemployment (Haveman and Weimer 2015).

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

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

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

- As identified by Portney (1994[29]), 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).

[28] Boardman, A., Greenberg, D., Vining, A. and Weimer, D. (2001) *Cost-benefit analysis: concepts and practice*, Prentice Hall, New Jersey.
[29] Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.

- 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[30]). This is consistent with the observed behaviour of altruism (Freeman III 2003[31]).

- 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

[30] 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.
[31] 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.

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.
- 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.