APPENDIX N

ECONOMICS ASSESSMENT

Stockton Sand Quarry Dredging

Economic Assessment

Prepared for

Boral Resources (NSW) Pty Ltd
C/- Element Environment Pty Ltd

By

Gillespie Economics
Email: gillecon@bigpond.net.au

September 2019

TABLE OF CONTENTS

TABLES

FIGURES

BOXES

EXECUTIVE SUMMARY

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Stockton Sand Quarry (hereafter referred to as the 'site' or the 'quarry'), a long standing operation that currently extracts sand from the windblown (transgressive) sand dunes of Stockton Bight and transports up to 500,000 tonnes per annum (tpa) of sand product for use in the building, landscaping and construction markets.

Due to current and future demand for sand in the local Hunter and Sydney regions, Boral is seeking approval for continued and expanded operations at the site through a State Significant Development (SSD), development application. The proposed development (hereafter referred to as the 'Project') involves the extraction of sand from the inland vegetated dunes by front-end loader/excavator to a depth of 4 metres (m) Australian Height Datum (AHD) in stage 1 and subsequent dredging to 15 m below sea level (-15 m AHD). The Project would seek to permit a site wide increase on the dispatch limit to 750,000 tpa (i.e. the windblown sand extraction area and the Project operations combined) up until 2028 after which the site wide limit would reduce to no more than 500,000 tpa. The Project would be for a period of up to 25 years.

Gillespie Economics has been engaged by Element Environment Pty Ltd (Element) on behalf of Boral Resources (NSW) Pty Ltd to complete an Economic Assessment of the Project.

This Economic Assessment relates to the preparation of each of the following types of analyses:

- A Cost Benefit Analysis (CBA) of the Project;
- A Local Effects Analysis (LEA), including using input-output (IO) analysis, for the Local Area regional economy of the combined Port Stephens, Maitland and Newcastle Local Government Areas (LGAs).

CBA

A CBA of the Project indicated that it would have net social benefits to Australia of $41 million (M), and net social benefits to NSW of $17M. Hence the Project is desirable and justified from an economic efficiency perspective. Environmental, social and cultural impacts of the Project have been minimised through Project design and mitigation, offset and compensation measures. In particular, Boral will purchase the required Water Access Licence, provide required biodiversity offsets or fund payments and establish required bushfire hazard reduction measures. The costs of these actions are included in the estimate of the net social benefits of the Project. The economic value of residual impacts are considered to be immaterial from an aggregated 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 $41M for the Project to be questionable from an Australian economic efficiency perspective, and greater than between $17M for the Project to be questionable from NSW economic efficiency perspective.

LEA

The Project will provided continued quarry employment for approximately five (four full-time and one casual) employees currently on-site and another four (two full time and two casual). The Project is also estimated to provide continued transport employment for 17 people from the Local Area, plus employment for an additional 9 people from the Local Area.

Economic activity analysis, using IO analysis, estimated that quarry production at 750,000 tonnes per annum (tpa) relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $5M in annual direct and indirect regional output or business turnover;
- $3M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 9 direct and indirect jobs.

This is a minimum incremental impact. Based on the available sand resource and likely production profiles without the Project, sand extraction will decline significantly below approved levels. Consequently, incremental impacts will likely to be closer to the levels identified in the report for 750,000 tpa and 500,000 tpa.

Transportation of quarry product at 750,000 tpa relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $4M in annual direct and indirect regional output or business turnover;
- $2M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 16 direct and indirect jobs.

This is also a minimum incremental impact given that without the Project sand extraction will decline significantly below approved levels.

1 INTRODUCTION

1.1 Introduction

Boral Resources (NSW) Pty Ltd (Boral) owns and operates the Stockton Sand Quarry (hereafter referred to as the 'site' or the 'quarry'), a long standing operation that currently extracts sand from the windblown (transgressive) sand dunes of Stockton Bight and transports up to 500,000 tonnes per annum (tpa) of sand product for use in the building, landscaping and construction markets.

Due to current and future demand for sand in the local Hunter and Sydney regions, Boral is seeking approval for continued and expanded operations at the site through a State Significant Development (SSD), development application. The proposed development (hereafter referred to as the 'Project') involves the extraction of sand from the inland vegetated dunes, initial extraction in stage 1 will be by front-end loader/excavator to a depth of 4 metres (m) Australian Height Datum (AHD) all subsequent stages will be dredged to 15 m below sea level (-15 m AHD). The Project would seek to permit a site wide increase on the dispatch limit to 750,000 tpa (i.e. the windblown sand extraction area and the Project operations combined) up until 2028 after which the site wide limit would reduce to no more than 500,000 tpa. The Project would be for a period of up to 25 years.

Gillespie Economics has been engaged by Element Environment Pty Ltd (Element) on behalf of Boral Boral to complete an Economic Assessment of the the Project. The purpose of the Economic Assessment is to form part of an Environmental Impact Statement (EIS) being prepared by Element to support an application for State Significant Development, Development Application under Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the Project.

1.2 Legislative Context and Guidelines[1]

This Economic Assessment has been carried out in accordance with:

- the amended Secretary's Environmental Assessment Requirements (SEARs), issued by the then NSW Department of Planning and Environment on 16 November 2018 that required:
  - a detailed assessment of the likely economic impacts of the development, paying particular attention to:
    - the significance of the resource;
    - the costs and benefits of the project; identifying whether the development as a whole would result in net benefits to NSW, including consideration of fluctuation in commodity markets and exchange rates; and
    - the demand on local infrastructure and services.
  - the reasons why the development should be approved having regard to biophysical, **economic** and social **impacts** of the project, including the principles of ecologically sustainable development.
- Section 4.15 (1) 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 likely impacts of that development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***; and
  - the public interest (taken as the collective public interest of households in NSW).

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

- Clause 7(1)(f) of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* which requires environmental assessments 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."*

- 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*;
  - NSW Treasury (2017) *NSW Government Guide to Cost-Benefit Analysis*

To meet the above requirements two types of analysis are needed[2]:

- 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 addresses the public interest;

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

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

Economic analysis tools of 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, often conflicting, government goals and objectives.

1.3 Report Outline

Section 2 outlines the scope of the project, as assessed in the EIS[4]. 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.

Table 1.1 lists the matters identified in the SEARs and where they are addressed in this report.

Table 1.1 Relevant matters raised in SEARs

Requirement	Section addressed
The significance of the resource	2.1

2 While specifically relevant to mining, rather than extractive industry, the following guidelines provide relevant information on how to address the public interest and economic impacts in the locality.

- 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;

NSW Treasury (2017) NSW Government Guide to Cost-Benefit Analysis also provides guidance on how to undertake a cost benefit analysis.

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

[4] The reader should refer to the EIS for more detailed qualitative consideration of the scope of the Project, Project impacts and mitigation measures.

The costs and benefits of the project; identifying whether the development as a whole would result in net benefits to NSW, including consideration of fluctuations in the commodity markets and exchange rates	4
The demand on local infrastructure and services	4.4
the reasons why the development should be approved having regard to biophysical, economic and social impacts of the project, including the principles of ecologically sustainable development	4

2 PROJECT DESCRIPTION

2.1 Economic Context and Significance of the Resource

Demand for sand is a derived demand. That is, demand for sand is dependent on there being a demand for some other product, such as concrete, cement, asphalt and construction materials, which in turn is dependent on demand for construction. With the significant increase in approved infrastructure projects in Sydney and other parts of NSW, the leading suppliers of sand are under pressure to meet this increased demand.

Supply of sand is constrained by geology and geomorphology as well as distance to the location of construction. Sand is a high bulk-low cost commodity and hence it is preferable for it to be located close to markets to minimise transport costs. A shortage in the supply of construction sand for the Sydney market has been predicted for many years as access to local onshore sources of construction sand has become increasingly difficult through resource depletion e.g. Penrith Lakes, and increasing land use constraints surrounding potential alternative sources. In the short term, demand for construction sand can be met by increasing production from existing sources, including Stockton Sand Quarry (NSW Department of Trade and Investment, 2016).

As Stockton Sand Quarry is one of Boral's few remaining natural sand quarries, Boral propose to meet part of this increased demand in natural sand by extracting sand from within the same general area as the inland extraction quarry pit approved under the 1996 development consent. The available resource from this Project is estimated at around 9 million tonnes.

2.2 Overview

Sand extraction has taken place in various locations on the site since 1976 when G. Hawkins and Sons was initially granted consent.

Boral acquired the site in 1992. Under Boral's ownership there have been two primary development consents granted, these include:

- DA 2010/94: The 'inland extraction area' (also known as pits 1 – 6) granted by Port Stephens Council in May 1996; and
- DA 140-6-2005: The 'windblown sand extraction area' (also known as the "windblown project" or pit 7) located on the transgressive dunes adjoining Stockton Beach granted by the Department of Planning in 2006.

The inland extraction operation (DA2010/94) on the vegetated dunes occurred above 5 metres AHD and ceased in 2008 and rehabilitation has been ongoing. This former extraction area is generally consistent with the Project site and is the focus of this Development Application.

The site contains an existing operation located approximately 375 m south east of the Project site, referred to as the windblown sand extraction area (or pit 7). The windblown sand extraction area is approved to operate until 2028 and dispatch up to 500,000 tpa from the site.

The Project involves the extraction of sand from within the former inland extraction area (inclusive of pits 1 – 6) from the existing ground level to a depth of 15 m below sea level (-15 m AHD). As extraction will intercept the groundwater table (at approximately 1 m AHD) the primary method of sand extraction will involve dredging.

There is an estimated 9 million tonnes of sand resource within the Project extraction area. The Project would seek to permit a site wide increase on the dispatch limit to 750,000 tpa (i.e. the windblown sand extraction area and the Project operations combined) up until 2028 after which the site wide limit would reduce to no more than 500,000 tpa. The increase in the site wide dispatch limit is sought to

permit maximum flexibility across the two projects areas (located on the same site). A concurrent administrative amendment to DA 140-5-2006 to allow for the site wide dispatch limit increase would be lodged with the Department of Planning, Industry and Environment (DPIE).

Mobile plant and equipment utilised at the site would operate across both project areas and a docket system at the weighbridge would monitor outgoing product as a site total.

The Project is to be undertaken progressively in six stages, commencing with Stage 1.

Similar to previous operations of the inland extraction area, sand extraction will involve clearing and grubbing of established vegetation from previous rehabilitation and possible screening of accumulated leaf litter and organic matter. Cleared vegetation will either be mulched or stockpiled on-site for later reuse in rehabilitation. Similarly, any stripped topsoil would be retained for use in rehabilitation efforts across the site.

Dray extraction of sand will occur only in stage 1. Dry extraction will be undertaken by front-end loader which pushes into the exposed sand face. As the sand is relatively free-flowing, material falls towards the front-end loader at the natural angle of repose.

The sand will then be screened and stockpiled before a front-end loader then loads road trucks in-pit with screened raw sand for transport off-site via the weighbridge.

Following initial extraction of sand above the water table to a depth of 4 m AHD in stage 1 only, a pond will be created large enough to float a dredge and accommodate fresh water pumping for the proposed wash plant.

The dredge will move progressively through the extraction area generally following the nominated stages. In most cases, the sand in each extraction stage is fully extracted unless constraints are encountered.

The dredge will move backwards and forwards across the active dredge pond, suctioning away the underwater sand face. The sand / water mix will be pumped directly from the dredge via a pontoon-mounted pipeline to the wash plant in the processing area. The dredge manoeuvres around the pond and its position is stabilised by wire tie ropes connected to the banks around the pond.

The dredge will then progressively extract sand in a south westerly direction in a staged process. Extraction will then move to the east and culminate with relocation of the proposed processing and stockpile area to a confined area in Stage 1 and subsequent dredging of the majority of the Stage 1 extraction area (to be known as Stage 6).

Sand will be extracted to a maximum depth of approximately 15 m below the sea level (0 m AHD).

There are minimal site establishment works required, as the Project will predominantly utilise existing infrastructure and services. New or augmented infrastructure includes:

- construction of a new entry road. The new haul road will link to the existing haul road in the south eastern extent of Stage 1 and enable continued access to the windblown sand extraction area. The road will be two way configuration (i.e. trucks moving in and out) and a separated exit road will be constructed to allow exiting vehicles to cross the weighbridge;
- a pad for the wash plant and diesel generators will be constructed as soon as practicable after vegetation removal and sand extraction in the northern portion of Stage 1; and

The existing site depot will also be reconfigured to support the Project and will include the following:

- installation of a new prefabricated office building;
- relocation of light vehicle parking;

- relocation of entry gates (inside Boral's boundary);
- relocation of onsite of storage facilities;
- replacement of workshop roofing; and
- and installation of a 30,000 L water storage tank for potential firefighting efforts.

The Project would provide employment opportunity for an additional two full time personnel and two casual employees, bringing the total employment for the quarry to six full time and three casual employees. The quarry would continue to also provide flow on employment opportunities for numerous Boral and customer truck drivers and associated service personnel.

2.3 Mitigation Measures

Boral aims to maximise the benefits of the Project to the region while minimising adverse impacts, as far as possible.

In this respect, a range of general and specific economic impact mitigation and management measures are proposed and would include:

Potential Environmental, Cultural and Social Impacts

- A range of measures to mitigate, offset and compensate for potential environmental, cultural and social impacts of the Project. A full outline of these is provided in the EIS.

Potential Workforce Impacts

- Provision of ongoing employment for the existing workforce which would be made redundant if the Project is not approved;
- Employment of regional residents preferentially where they have the required skills and experience and demonstrate a cultural fit with the organisation;
- Participating, as appropriate, in business group meetings, events or programs in the regional community.

Potential Business Impacts

- Purchasing local non-labour inputs to production preferentially where local producers can be cost and quality competitive, to support local industries.

3 ECONOMIC ASSESSMENT METHODS

3.1 Introduction

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

3.2 Cost Benefit Analysis

3.2.1 Background

Economic assessment is primarily concerned with identifying changes in aggregate wealth, from a national perspective, 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 the NSW Treasury (2017). CBA applications within the NSW EIA framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals* 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, as a result of a project, policy or program, with the present value of the aggregate costs. These benefits and costs are defined and valued based on the microeconomic underpinnings of CBA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the well-being of society and hence 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 to (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 mining and coal seam gas proposals, NSW Government (2015) guidelines define the public interest, and hence society, as the households of NSW.

CBA undertaken at a sub-national perspective requires attribution of primary costs and benefits to different geographic scales and results in a number of costs and benefits that accrue to people outside the region of analysis being excluded (Boardman *et al.* 2001). It may also result in additional costs and benefits, such as secondary net benefits, that are normally omitted from CBA, being included.

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

3.2.3 Definition of the project scope

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

Sand quarry products are intermediate goods i.e. are inputs to other production processes such as production of cement. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects (NSW Treasury, 2007). The Project definition, including mitigation measures, are summarised in Section 2.

3.2.4 Net production benefits

CBA of quarry proposals invariably involves a trade-off between:

- The net production benefits of a project; and
- The environmental, social and cultural impacts (most of which are costs of quarrying but some of which may be benefits) including economic benefits to existing landholders, economic benefits to workers, net public infrastructure costs and economic benefits to suppliers (NSW Government, 2015).

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 proponents. This is normally commercial-in-confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

3.2.5 Environmental, social and cultural impacts

The consideration of non-market impacts in CBA relies on the assessment of other experts contributing information on the biophysical impacts. The EIS 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. Only where some physical impacts are identified by other experts can economists attempt to consider the economic consequences of these impacts.

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

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

- can be readily identified, measured in physical terms and valued in monetary terms;

[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.

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

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

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 costs 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).

3.2.6 Consideration of net social benefits

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

In combining these considerations, it should be noted that the estimates of net production benefits of a project generally includes accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. This includes the costs of providing ecological offsets and the cost of purchasing groundwater and surface water entitlements in the water market. Including these costs in the capital and operating costs of a project effectively internalises the environmental, social and cultural costs of a project. To avoid double counting of impacts, only residual impacts, after mitigation, offset and compensation, require additional consideration.

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

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

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

3.2.7 Consideration of the distribution of costs and benefits

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

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

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

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

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

3.2.8 Consideration of other objectives of Government

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

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

3.2.9 Key steps in Cost Benefit Analysis

The key steps in CBA are summarised in Box 1.

Box 1: Key steps in a CBA
Step 1: Establish the base case against which to assess the potential economic, social and environmental impacts of changes due to the project.
Step 2: Define the project including all significant inputs required to achieve the project's objectives.
Step 3: Quantify the changes from the base case resulting from the project. This will focus on the incremental changes to a range of factors (for example, environmental, economic, social) resulting from the project.
Step 4: Estimate the monetary value of these changes and aggregate these values in a consistent manner to assess the outcomes. Where market prices exist, they are a starting point for valuations of both outputs and of inputs used for production. For non-market goods, as for many environmental impacts and some social impacts, the aim is to value them as they would be valued in money 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 at different geographic scales based on the financial, technical and environmental advice provided by Boral 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.

NSW Government (2015) identifies that for the purpose of a LEA the locality is defined as the Statistical Area Level 3[7] (SA3) that contains the proposed project. The relevant population group is defined as those people ordinarily resident in the locality at the time of the proposal.

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

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

[7] In this case the Port Stephens, Maitland and Newcastle LGAs have been chosen to represent the locality.

3.3.2 Direct effects relating to local employment

The *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Government 2015) identify that only employment of people ordinarily resident in the region at the time of the proposal can 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 as a result of a project is the difference between the average net income of these people in the project 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 project sector.

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 it 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 input-output (IO) analysis.

From a regional economy perspective (rather than focused on existing residents), it is also likely to understate effects since it does not take into account the income spending of those who may migrate into the region to live during the life of a 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 and for larger projects computable general equilibrium (CGE) modelling, provided the assumptions and limitations of the methods are identified.

3.3.5 Effects on other local industries

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

[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 wages benefit to the region.

- displacement of other land uses, where the project uses land that would otherwise be used for other purposes;
- where the project affects choices of external parties, particularly tourism and business travel; and
- where the 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 CBA.

3.3.7 Input-output analysis

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

IO analysis essentially involves two steps:

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

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

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

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

- ***Gross regional output*** – the gross value of business turnover;
- ***Value-added*** – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output. These costs exclude income costs;
- ***Income*** – the wages paid to employees including imputed wages for self employed and business owners; and
- ***Employment*** – the number of people employed (including self-employed, full-time and part-time).

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

Gross regional output is a measure of total revenue or turnover. All costs of production would need to be subtracted from total revenue 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 say 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 Boral and its' specialist consultants.

4.2 Identification of the Base Case and the Project

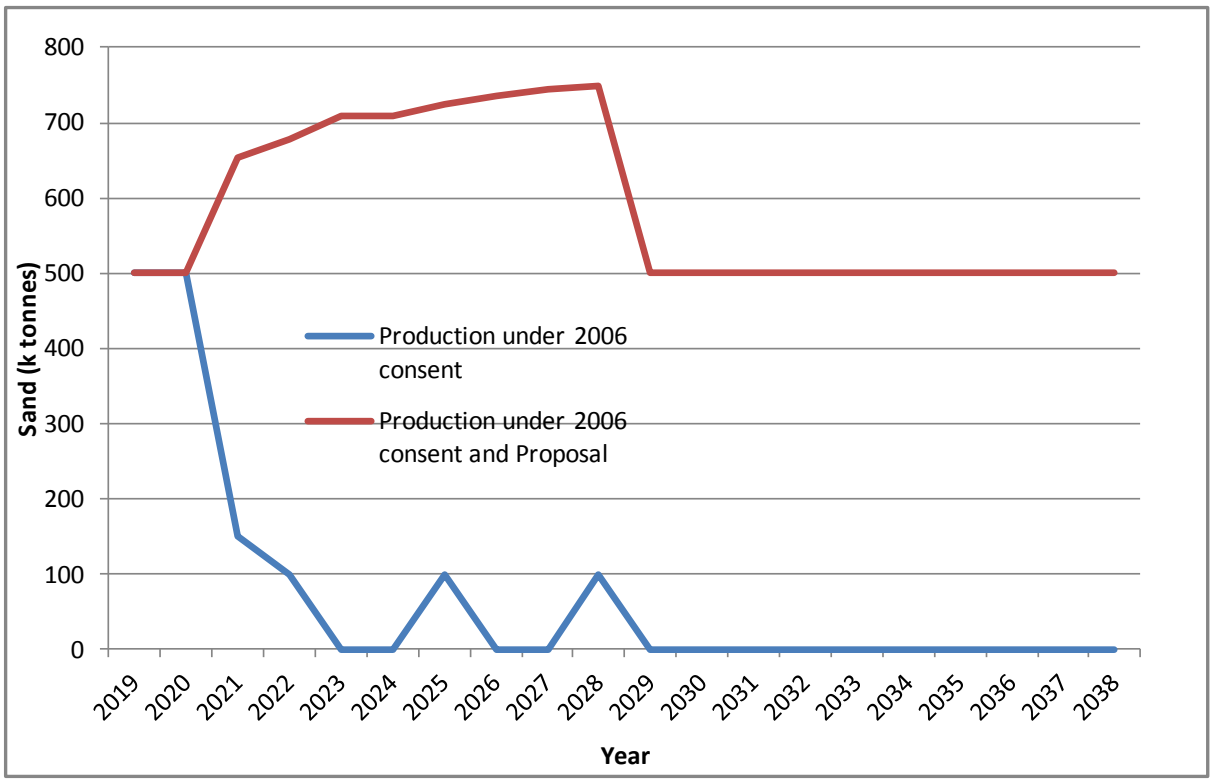
Identification of the "base case" or "without" Project scenario is required in order to facilitate the identification and estimation of the incremental economic benefits and costs of the Project.

Under the base case, Boral would operate under the current approval for a period to 2028, extracting and dry screening a total of 1.45 million tonnes (Mt) of saleable product from the transgressive windblown sand dunes adjoining the beach, with annual production up to 500,000 tpa of saleable product. On expiry of this consent some final rehabilitation of the windblown extraction area will occur.

In contrast, the Project is as described in Section 2 would seek to permit a site wide increase on the dispatch limit to 750,000 tpa (i.e. the windblown sand extraction area and the Project operations combined) up until 2028 after which the site wide limit would reduce to no more than 500,000 tpa.

An indicative comparison of the production profile "with" and "without" the extension project is provided in Figure 4.1

Figure 4.1 - Indicative Production Schedule With and Without the Project



The Project assessed in the EIS and evaluated in the CBA is considered by Boral to be the most feasible alternative required for minimising environmental, cultural and social impacts whilst maximising resource recovery, operational efficiency and ensuring ongoing employment for the existing workforce. It is therefore this option that is proposed by Boral 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 from sand extraction, producer surplus generated from ex-quarry transportation to customers, and any wage benefits to employment. The main potential economic costs relate to any environmental, social and cultural costs of quarrying and product transportation.

Table 4.1 – Potential Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits from quarrying	Opportunity costs of capital equipment in 2028 Opportunity cost of land[1] in 2028 Development costs including labour, capital equipment and any acquisition costs for impacted properties and biodiversity offsets Operating costs of quarry including labour and mitigation, offsetting and compensation measures Rehabilitation and decommissioning costs at end of the Project life	Avoided decommissioning and rehabilitation costs in 2028 Value of additional sand supply Residual value of capital equipment and land at end of Project life
Net production benefits from ex-quarry transport	Capital and operating costs	Revenues
Potential environmental, social and cultural impacts of extraction, processing and transportation, after mitigation, offsetting and compensation	Noise impacts Air quality impacts Surface water and groundwater impacts Ecological impacts Transport impacts Aboriginal heritage impacts Economic benefits to existing landholders Net public infrastructure costs Loss of surplus to other industries	Wage benefits to employment

It should be noted that the potential environmental, social and cultural costs listed in Table 4.1 are only economic costs to the extent that they affect individual and community well-being through direct use of resources by individuals or non-use. 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 Treasury (2017) and NSW Government (2015), the analysis was undertaken in real values with discounting at 7 percent (%) and sensitivity testing at 4%, 7% and 10%.

The analysis period is 25 years, coinciding with the period from the present until the end of the Project life. 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. However, even with the inclusion of these values, the estimated net social benefits 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 of quarrying[11]

Production Costs

Opportunity Cost of Land and Capital in 2028

The majority of land required for the existing consent and the Project is owned by Boral with a small area leased from the Crown for access to the quarry. Under the base case, the current consent for extraction from the transgressive windblown sand dunes adjoining the beach, would lapse in 2028 with mandated rehabilitation under the consent occurring. At this stage i.e. in 2028, the land would be essentially vegetated coastal land zoned RU2 - Rural Landscape. There is an opportunity cost in 2028 associated with the Project of continuing to use this land for sand extraction instead of its next best use. This opportunity cost is equivalent to its undeveloped land value, which according to NSWGlobe is in the order of $2.5M

Similarly, there is an opportunity cost in 2028 of continuing to use any capital equipment for the Project that has some residual market value. For the purpose of the analysis the residual value of the capital equipment in 2028 is assumed to be zero.

Development Cost of the Project

The incremental development costs of the Project are largely associated with site infrastructure and the purchase of a dredge. These costs are estimated at $6M and occur between 2020 and 2023.

Additional one-off costs of $2.5M have been included for:

- acquisition of biodiversity offsets ($2M);
- purchase of groundwater water access licences (WALs) ($0.5M); and
- provision of water tank and equipment for bushfire management ($20,000).

Capital costs and one-off costs are included in the economic analysis in the years of the Project in which they are expected to occur.

Annual Operating Costs of the Project

The annual incremental operating costs of the Project (average annual incremental operating costs of $3M) include those associated with dredging, stockpiling, progressive rehabilitation and administration and environmental monitoring. These costs include labour costs, which reflect the value of labour resources in their next best use.

Depreciation has been omitted from the estimation of operating costs since depreciation is an accounting means of allocating the cost of a capital asset over the years of its estimated useful life. The economic capital costs are included in the development costs of the Project in the years in which they occur.

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

Rehabilitation and Decommissioning Costs

At the end of the Project life, the quarry site will be decommissioned and rehabilitated at an estimated cost of $100,000. Other annual rehabilitation costs are included in the annual operating costs of the Project.

Production Benefits

Avoided Rehabilitation and Decommissioning Costs in 2028

By undertaking the Project there are no avoided or delayed rehabilitation costs associated with the existing consent. This is because the existing consent relates to extraction in a different location to that proposed for the Project. Final rehabilitation under the existing consent will occur at the end of that consent i.e. 2028, regardless of the Project.

The site has minimal infrastructure, comprising a site office with amenities, workshop and weighbridge. Minimal decommissioning costs are assumed.

Value of Sand

The main economic benefit of the Project is the market value of additional sand production. Most of the sand produced is sold internally with the remainder sold in the market. All sales are at market prices. An average unit price has been applied to the output of the quarry based on advice from Boral. It has not been reported for reasons of commercial confidentiality.

There is uncertainty around future sand prices and hence assumed values have been subjected to sensitivity testing (see Section 4.6).

Residual Value at End of the Evaluation Period

At the end of the Project, capital equipment and land (excluding offsets which are required to be protected in perpetuity) may have some residual value that could be realised by sale or alternative use.

It is assumed that rehabilitated land (not including the biodiversity offsets) has a residual value of $2.5M in accordance with its current land value, and that capital equipment has no residual value.

4.4.2 Production costs and benefits of product transport

The costs and benefits of quarrying considered in Section 4.4.1 include costs and revenues/benefits of activities up to the quarry gate. Since product transport externalities are a consideration of the EIS, economic benefits associated with transportation of quarry product to customers also needs to be considered. These net production benefits essentially relate to the net revenue that accrues to transport provider.

The annual net production benefits of product transport has been estimated based on assumed incremental sand production, an average per tonne transport cost ($15), and the percentage of total revenue that is net revenue (11%[12]).

[12] Based on the ratio of gross operating surplus to revenue for the road transport sector in the 2016-17 National Input-Output Table, adjusting for mixed income.

4.4.3 Environmental, social and cultural costs and benefits

The environmental, social and cultural impacts of the Project are assessed in the EIS. This Section considers these impacts from an economic perspective. Attachment 6 summarises the treatment of the environmental, social and cultural impacts of the Project in the CBA.

Noise

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

The Noise Impact Assessment identified that the predicted noise levels at sensitive receptors comply with the established project noise trigger levels and hence in accordance with the Noise Policy for Industry, no further noise mitigation measures or controls are warranted. It also found that the predicted relative increase in noise levels due to heavy vehicle movements are within the allowable limits outlined in the Road Noise Policy on all designate access routes.

Hence, impacts are considered to be immaterial from an aggregate economic efficiency perspective. No economic costs are included in the CBA.

Air Quality

The impact of the Project dust emissions can potentially be valued using the property value method, where the change in property value as a result of the air quality impacts are estimated, the cost of illness method where changes in health episodes as a result 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 Assessment undertook air dispersion modelling to predict the potential for offsite dust and nitrogen dioxide (NO_2) impacts in the surround area due to the operation of the Project. Using conservative assumptions that are likely to overstate impacts, the Assessment predicted that the Project would have a negligible incremental impact at the surrounding residential receptor locations. Nevertheless, the site would apply appropriate dust management measures to ensure it minimises the potential occurrence of excessive air emissions from the site. Consequently, impacts are considered to be immaterial from an aggregate economic efficiency perspective and no economic costs are included in the CBA apart from the costs of proposed general mitigation and monitoring measures.

Surface Water and Groundwater

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

The Surface Water Impact Assessment identifies that with respect to surface water the site is self contained. The Project will result in some localised changes to surface runoff, erosion and

sedimentation during construction and operation requiring implementation of sedimentation and erosion control measures.

The Project will also extract water from the Stockton Groundwater Source through moisture content in sand material leaving the site, and through the creation of a 'window' to the groundwater table which will allow direct evaporation, along with direct rainfall input. WALs of up to 100 megalitres per year (ML/yr) will be required from the Stockton Groundwater Source.

The opportunity cost of 100 ML/year extracted from Stockton Groundwater Source has been included in the CBA by applying an assumed market value of water of $5,000/ML. This is a use value of the water. Assuming that the WAL water would otherwise be allocated to other uses, there are no incremental non-use impacts e.g. aquatic ecology impacts, of using this water for extractive instead of alternative uses.

Ecology

The main ecological impact of the Project is associated with the clearing of an estimated 38.14 ha of native vegetation and habitat, which is predominately rehabilitation land from the former quarry pit. No threatened flora are likely to be impacted by the Project. However, some threatened fauna that are mostly likely to ulitise the foraging habitat of the Project area on an intermittent basis will be impacted.

The impacted vegetation, and associated fauna, is likely to have non-use values to the community that would be lost as a result of the Project. 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 is also likely to have non-use values to the community that would be gained as a result of the Project. Provided the values held by the community for the offsets are equal or greater than values that would be lost then no additional economic costs warrant inclusion in the CBA apart from the costs of providing offsets. These costs are estimated are estimated at up to $2M and included in the capital costs of the Project.

Road Transport

The Traffic Impact Assessment found that the impacts of the additional truck movements during on the adjoining road network and intersections during construction and operation would be satisfactory and there will be minimal changes to the Level of Service and vehicle delays on the road network, including at all key intersections. It also found that the Project is not expected to have any negative impacts on the other road users and or on road safety. Consequently, there are no additional economic costs that warrant 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.

A review of background information undertaken for the Aboriginal Cultural Heritage Assessment Report revealed there were no known Aboriginal archaeological sites within the study area and proposed extraction area. While sites do occur within the wider Boral property, the study area is generally highly disturbed due to the previous extraction operations and removal of the bulk of the dune mass. Site inspection with the Aboriginal community confirmed the site condition and no Aboriginal objects, archaeological sites or areas of archaeological potential were identified. Subsurface archaeological deposits are considered unlikely to occur given the study area's geomorphological context and the nature and extent of prior extraction disturbance. No specific Aboriginal cultural values have been identified within the study area.

Hence, there are no material economic costs for inclusion in the CBA.

Bushfire Hazard Assessment

The Bushfire Hazard Assessment establishes that the project is capable of complying with the acceptable solutions of Planning for Bush Fire Protection (2006). However, Boral would need to install a 20,000 litre static water supply with firefighting fittings. For the purpose of the analysis this is assumed to come at a cost of $20,000. It is arguable whether this cost is attributable to the Project or would be required anyway for the existing operation. However, conservatively this cost has been attributed to the Project.

Other Potential Impacts

The Project is not considered likely to have any material historic heritage, visual or greenhouse gas impacts for inclusion in the CBA.

Market Benefits to Workers

The Project will result in all five existing jobs at the quarry being retained together with an additional two new full-time jobs and two casual jobs at the quarry. In addition, jobs associated with the transportation of quarry material will also be retained and additional transport jobs generated.

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). Conservatively, this approach is adopted in this analysis.

Economic Benefits to Existing Landholders

All land required for the Project is owned by the proponent. No benefits to other landholders via land prices in excess of the opportunity cost of the land will occur.

Economic Benefits to Suppliers

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

Net Public Infrastructure Impacts

No net infrastructure costs to government are envisaged as a result of the Project. Given that additional employment will likely be sourced from existing residents of NSW no additional demand for community infrastructure is envisaged.

Loss of Surplus to Other Industries

No loss of surplus to other industries is envisaged as a result of the Project.

4.5 Consolidation of Value Estimates

The present value of costs and benefits, using a 7% discount rate, is provided in Table 4.2. The top half of the Table identifies production costs and benefits of the Project associated with quarrying and product transportation. Quarrying production costs includes capital and operating costs associated with the mitigation, offset and compensation of environmental, social and cultural impacts. The bottom

of the Table summarises the residual environmental, social and cultural impacts of the Project after mitigation, offset and compensation.

The Project is estimated to have total net production benefits (quarrying and product transportation) of $48M. Assuming 75% Australian ownership of Boral and 100% Australian ownership of transport providers, $41M of these net production benefits would accrue to Australia[13]. The estimated net production benefits that accrue to Australia can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the Project, after mitigation, compensation and offset, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the Project. The threshold value indicates the price i.e. $41M, that the Australian community must value any residual environmental impacts of the Project (be willing to pay) to justify in economic efficiency terms the no development option.

However, from Table 4.2 it can be seen that there are few external environmental, social or cultural impacts of the Project, and those that do exist e.g. ecological impacts and groundwater impacts, are internalised into the capital costs of the proponent via payment for ecological offsets and WALs, and hence are incorporated into the estimate of net production benefits. Residual impacts would be immaterial.

Consequently, the Project is estimated to have net social benefits to Australia of $41M and hence is desirable and justified from an economic efficiency perspective.

[13] This is the net production benefits of the Project minus the residual producer surplus accruing overseas.

Table 4.2 - Global and National Cost Benefit Analysis Results of the Project (Present Values @7% discount rate)

	Costs		Benefits	
	Description	**Value ($M)**	**Description**	**Value ($M)**
Net production benefits from quarrying	Opportunity cost of land	$1	Avoided decommissioning and rehabilitation costs	$0
	Opportunity cost of capital	$0	Value of sand	$72
	Development costs	$7	Residual value of land	$1
	Operating costs	$27	Residual value of capital	$0
	Decommissioning and rehabilitation costs	$0		***$73***
	Sub-total	***$34***	***Sub-total***	***$73***
	Net Production Benefits			**$39 ($32)**
Net production benefits from ex-quarry transport	Transport costs	$72	Transport revenue	$81
	Net Production Benefits			**$9 ($9)**
	Total Net Production Benefits			**$48M ($41M)**
Environmental, social and cultural impacts	Noise impacts	No properties impacted by exceedances	Market values of employment	NA
	Air quality impacts	No properties impacted by exceedances	Economic benefits to existing landholders	NA
	Surface water and groundwater	Cost of WALs included in capital costs	Economic benefits to suppliers	NA
	Ecology	Some loss of values but offset. Cost of biodiversity offset included in capital costs		
	Road transport impacts	No material network, level of service or safety impacts.		
	Aboriginal heritage	No material impacts		
	Bushfire hazard	Additional cost of water storage and fire fighting equipment included in capital costs		
	Historic heritage	No material impacts		
	Visual	No material impacts		
	Greenhouse gas	No material impacts		
	Net public infrastructure costs	No material impacts		
	Loss of surplus to other industries	No material impacts		
	Residual non-market impacts sub-total	**$0**		**$0**
NET SOCIAL BENEFITS				**$48 ($41)**

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

Residual net producer surplus to Boral Shareholders i.e. producer surplus less company tax, is apportioned by 75% in accordance with the estimated level of Australian shareholdings.

Road transport providers are assumed to be 100% Australian owned.

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

4.6 NSW Costs and Benefits

The NSW Government (2015) guidelines have a particular focus on the costs and benefits to NSW. Table 4.3 identifies the costs and benefits to NSW. Impacts that have a national dimension are apportioned to NSW, in particular:

- 32% of the estimated company tax generated from the Project (quarrying and product transport) is attributed to NSW (NSW Guidelines 2015);
- 32% of the residual net producer surplus from the quarry is apportioned to NSW i.e. share ownership assumed to be distributed in line with the population;
- 100% of residual net producer surplus of transport provision is apportioned to NSW i.e. ownership is NSW based;
- all other potential environmental, social and cultural impacts would accrue to NSW households. However, in accordance with Government policy and regulation these impacts are largely mitigated, compensated or offset by the proponent.

On this basis, the costs and the benefits of the Project to NSW are summarised in Table 4.3. The estimated Net Social Benefits of the Project to NSW are estimated at $17M, present value at 7% discount rate (the latter including employment benefits). Consequently, as well as resulting in net benefits to Australia, the Project would also result in net benefits to NSW.

Any unquantified residual impacts of the Project after mitigation, offset and compensation would need to be valued at greater than $17M, present value for the Project to be questionable from an NSW economic efficiency perspective.

Table 4.3 - Cost Benefit Analysis Results of the Project - NSW (Present Values @7% discount rate)

COSTS	VALUE ($M)	BENEFITS	VALUE ($M)
Environmental, social and cultural impacts		***Net Production Benefits of Quarrying***	
Noise impacts	No properties impacted by exceedances	Direct company tax	$4
Air quality impacts	No properties impacted by exceedances	Residual net production benefits	$7
Surface water and groundwater	Cost of WALs included in capital costs	***Sub-total***	**$10**
Ecology	Some loss of values but offset. Cost of biodiversity offset included in capital costs	***Net Production Benefits of Product Transport***	
Road transport impacts	No material network, level of service or safety impacts.	Direct company tax	$1
Aboriginal heritage	No material impacts	Residual net production benefits	$6
Bushfire hazard	Additional cost of water storage and fire fighting equipment included in capital costs	***Sub-total***	**$7**
Historic heritage	No material impacts	Market values of employment	NA
Visual	No material impacts	Economic benefits to existing landholders	NA
Greenhouse gas	No material impacts	Economic benefits to suppliers	NA
Net public infrastructure costs	No material impacts	Market values of employment	NA
Loss of surplus to other industries	No material impacts	***Sub-total***	***$0***
Sub-total	***$0***		
NET SOCIAL BENEFITS to NSW			**$17**

The approach used in this section is that where impacts do not exist, are offset or compensated for, it is assumed that they are immaterial. Immaterial does not mean that there will be no impacts but aggregate immaterial impacts are not likely to amount to more than 5% in aggregate of the quantified net production benefits of the Project

It should be noted that this is residual net production benefit is not equivalent to profit and hence should not be used to infer profitability of the Project.

4.7 Distribution of NSW Costs and Benefits

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

The costs and benefits of the Project to NSW are potentially distributed among a range of stakeholders as identified in Table 4.4.

Table 4.4 - Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	MAGNITUDE OF IMPACT ($M)
Net Production Benefits of Quarrying		
Direct company tax	NSW Government and NSW households	$4
Residual net production benefits	Boral and its NSW shareholders	$7
Net Production Benefits of Product Transport		
Direct company tax	NSW Government and NSW households	$1
Residual net production benefits	Transport providers and their owners/shareholders	$6
Additional benefits		
Wage benefits to employment	Employees of the Project who reside in NSW	NA
Economic benefits to existing landholders	Local landholders who sell land required for Project including buffer land	NA
Economic benefits to suppliers	Regional and State suppliers of inputs to production	NA
Environmental, social and cultural costs*		
Noise impacts	Adjoining landholders	No properties impacted by exceedances
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Surface water and groundwater	Local surface water users	$0.5M Cost of WALs included in capital costs
Ecology	Local and NSW households	$2M Some loss of values but offset. Cost of costs
Road transport impacts	Local residents	No material network, level of service or safety impacts.
Aboriginal heritage	Aboriginal people and other local and NSW households who value Aboriginal heritage	No material impacts
Historic heritage impacts	Local and NSW households who value heritage	No material impacts*
Visual impacts	Adjoining landholders and those travelling past the site	No material impacts*
Greenhouse gas	Local and NSW households	No material impacts*
Net public infrastructure costs	NSW Government and NSW households	No material impacts*
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts*

* NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures perfectly mitigate, offset or compensate then no residual impacts occur and all impacts are borne by the proponent. This table identifies who bears residual impacts if they did occur as a result of the Project and mitigation, offset and compensation was imperfect.

4.8 Risk and sensitivity analysis

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

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

The Independent Planning Commission has previously identified that the financial viability of projects is a risk assumed by the project proponents. Nevertheless, it should be noted that the Project is the continuation of an existing financially viable operation. Boral is willing to invest in the Project and has a fiduciary responsibility to its shareholders. It is highly unlikely Boral's investment would take place and then operations would cease, leaving residual environmental impacts at the site. Strong current and foreseeable demand for sand is also likely to underpin the financial viability of the Project.

The provision of biodiversity offsets can be associated with a number of risks, including in relation to the biodiversity benefits of additional management of offsets, success in reconstruction of ecological communities, time-lags between impacts and provision of offsets as well as between management actions and achievement of ecological outcomes. These risks are mitigated through offset ratio

requirements in the calculation of offsets requirements or fund payments, and commitment to the provision/payment for offset actions prior to the commencement of works under approval.

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

The net present values (NPVs)[14] of the Project presented in Table 4.2 and Table 4.3 are based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a CBA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV[15].

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

- Opportunity costs of land;
- Quarry capital costs including offsets, WALs and fire fighting requirements;
- Quarry operating costs;
- Quarry decommissioning costs;
- Value of sand;
- Quarry production levels;
- Residual value of quarry land; and
- Net transport revenue.

Results are reported in Table 4.5. What this analysis indicates, is that CBA results at the NSW level are most sensitive to increases in operating costs, reductions in the value of sand and reductions in production volume.

The Project is the continuation of an existing quarrying operation and hence operating costs in this location and geological environment are known. Estimates of operating costs of the Project are therefore likely to be reasonably accurate and a 20% increase that is maintained each and every year of the analysis as reported in the sensitivity analysis is highly unlikely.

The strong demand for sand that underpins the Project suggests that sustained reductions in sand value and annual production levels is highly unlikely

The sensitivity analysis also indicated that the CBA results are not sensitive to changes in capital costs, opportunity costs of land or environmental costs that have not already been internalised into production costs, such as WALs and offsets. Since mitigation, offset and compensation costs are small components 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.

[14] NPV is the present value of benefits less the present value of costs. Present values are calculated using a discount rate that reflects peoples time preferences.

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

Table 4.5 - NSW CBA Results Sensitivity Testing (Present Value $Millions)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	**$23**	**$17**	**$13**
INCREASE 20%			
Opportunity cost of quarry land	$23	$17	$13
Quarry development costs	$23	$17	$13
Quarry operating costs	$21	$16	$12
Quarry decommissioning costs	$23	$17	$13
Value of sand	$28	$21	$16
Volume of quarry production	$28	$21	$16
Residual value of land	$23	$17	$13
Transport net revenue	$25	$19	$15

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE 20%			
Opportunity cost of quarry land	$23	$17	$13
Quarry development costs	$23	$18	$14
Quarry operating costs	$25	$19	$15
Quarry decommissioning costs	$23	$17	$13
Value of sand	$18	$14	$11
Volume of quarry production	$18	$14	$10
Residual value of land	$23	$17	$13
Transport net revenue	$21	$16	$12

5 LOCAL EFFECTS ANALYSIS

5.1 Introduction

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

The Local Area is defined as the LGA of Port Stephens (within which the Project is located) as well as the adjoining LGAs of Maitland and Newcastle. This is the local region that primarily benefits from and supplies inputs to the Project.

5.2 Direct Effects Related to Employment

All current and prospective quarry employment is likely to be sourced from the Local Area while 64% of transport employment is estimated to be sourced from the Local Area.

The Project will provide continued quarry employment for approximately five (four full time and one casual) employees currently on-site and another four (two full time and two casual). In the absence of the Project employment would reduce generally in line with reduced production and in 2028 would be zero.

The Project is estimated to provide continued transport employment for 17 people from the Local Area, plus employment for an additional 9 people from the Local Area.[16] Based on estimated wages for quarry workers and average wage from the input-output table for the road transport sector, the Project is estimated to provide initial incremental net income to the local area of $0.6M increasing to around $1M when production levels reduce to 500,000 tpa. The increased disposable net income in the region may be as high as $1.6M if current production levels could not be maintained under the base case due to shortages of sand.

The above level of benefit to the Local Area economy, may be reduced if people employed by the Project would otherwise have been employed elsewhere in the Local Area and the increased demand for labour as a result of the Project has no job chain effects i.e. it is assumed that employment in the quarry and transport, simply substitutes for other jobs in the region.

Table 5.1 - Analysis of Income and Job Effects

	Current Employment	Project Employment	Increment
a) Direct employment during operations phase sourced from Local Area			
Quarry	5	9	4
Road Transport	17	26	9
Total	***22***	***35***	***13***
b) Net income in quarrying and transport sector			
Quarry	$290,480	$502,184	$211,704
Road Transport	$747,197	$1,120,796	$373,599
Total	***$1,037,677***	***$1,622,979***	***$585,302***

5.3 Direct Effects Related to Non-labour Expenditure

The total annual non-labour expenditure (after subtraction of wages to quarry workers) is estimated at $2.4M per annum when production is at 750,000 tpa and $1.6M per annum when the production is at

[16] Transport employment estimates are based on the estimated expenditure on transport and ratios in the regional input-output table for the road transport sector. See Section 6. Additional employment in transport is provided to people located outside the region.

500,000 tpa. This was estimated based on the ratio of local expenditure to total (non-labour) expenditure in the regional input-output table for the *non metallic mineral mining sector*. Refer to Section 6.

5.4 Second Round and Flow-on Effects

The incremental expenditure by employees and non-labour expenditure that is captured by the local area provides flow-on economic activity to the local economy, which can be estimated in terms of economic activity indicators of output, value-added, income and employment. Section 6 provides a full assessment of flow-on effects arising from both labour expenditure and non-labour expenditure.

5.5 Effects on Other Industries

5.5.1 Wage impacts

In the short-run, increased regional demand for labour as a result of the Project (relative to the situation of no Project) 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 level of labour demand is low, there are substantial labour resources available in the Local Area and from outside the local area. 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.

5.5.2 Housing impacts

The Project is a continuation and extension of an existing quarry operation. All quarry employment is anticipated to be sourced from the Local Area with 64% of transport employment sourced from the Local Area. No substantial migration of labour is anticipated and hence there will be no additional demand for housing or community infrastructure.

5.5.3 Displacement of other land uses

The Project will not displace any other land uses and will have no significant impact on tourism or recreation.

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

The main externalities that potentially accrue from the Project and the magnitude of these to the local area are summarised in Table 5.2.

Table 5.2 - Environmental and Social Impacts on the Local Community ($M)

Environmental, social and cultural costs	Incidence of Impacts	Magnitude of Local Impact
Noise impacts	Adjoining landholders	No properties impacted by exceedances
Air quality impacts	Adjoining landholders	No properties impacted by exceedances
Surface water and groundwater	Local surface water users	$0.5M Cost of WALs included in capital costs
Ecology	Local and NSW households	$2M Some loss of values but offset. Cost of costs
Road transport impacts	Local residents	No material network, level of service or safety impacts.
Aboriginal heritage	Aboriginal people and other local and NSW households who value Aboriginal heritage	No material impacts
Historic heritage impacts	Local and NSW households who value heritage	No material impacts*
Visual impacts	Adjoining landholders and those travelling past the site	No material impacts*
Greenhouse gas	Local and NSW households	No material impacts*
Net public infrastructure costs	NSW Government and NSW households	No material impacts*
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts*

5.7 Summary of Local Effects

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

Table 5.3 - Summary of Local Effects

	Current Employment	Project Employment	Increment
Direct employment during operations phase sourced from Local Area			
Quarry	5	9	4
Road Transport	17	26	9
Total	***22***	***35***	***13***
Net income in quarrying and transport sector			
Quarry	$290,480	$502,184	$211,704
Road Transport	$747,197	$1,120,796	$373,599
Total	***$1,037,677***	***$1,622,979***	***$585,302***
Second round and flow-on effects	Refer to Section 6		
Contraction in other sectors	No material impact		
Displaced activities	Not applicable		
Wage price impacts	No material impact		
Housing price impacts	No material impact		
Externality impacts	**Incidence of Impacts**	**Magnitude of Impact**	
Noise impacts	Adjoining landholders	No properties impacted by exceedances	
Air quality impacts	Adjoining landholders	No properties impacted by exceedances	
Surface water and groundwater	Local surface water users	$0.5M Cost of WALs included in capital costs	
Ecology	Local and NSW households	$2M Some loss of values but offset. Cost of costs	
Road transport impacts	Local residents	No material network, level of service or safety impacts.	
Aboriginal heritage	Aboriginal people and other local and NSW households who value Aboriginal heritage	No material impacts	
Historic heritage impacts	Local and NSW households who value heritage	No material impacts*	
Visual impacts	Adjoining landholders and those travelling past the site	No material impacts*	
Greenhouse gas	Local and NSW households	No material impacts*	
Net public infrastructure costs	NSW Government and NSW households	No material impacts*	
Loss of surplus to other industries	Local industries adversely impacted by the Project	No material impacts*	

6 SUPPLEMENTARY LOCAL EFFECTS ANALYSIS

6.1 Introduction

This Section uses IO analysis to identify the gross economic activity footprint associated with the Project on the Local Area economy.

6.2 Structure of the Local Area Economy

For the purpose of the analysis the Local Area is defined as the Port Stephens, Maitland and Newcastle LGA.

A 2016-17 IO table of the regional economy was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 7) using a 2016-17 IO table of the National economy as the parent table and 2016 Census employment by industry data for NSW and the region. The 114 sector IO table of the regional economy was aggregated to 50 sectors and 8 sectors for the purpose of describing the economy.

A highly aggregated 2016-17 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). 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.

Output for the regional economy is estimated at $83,220M. Value-added for the regional economy is estimated at $24,440M, comprising $12,702M to households as wages and salaries (including payments to self employed persons and employees) and $11,737M in OVA.

The employment total working in the regional economy was 149,733.

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 and utilities sectors in the regional economy are of greater relative importance than they are to the NSW economy, while the business services sectors and public personal 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.

In terms of output, the metal manufacturing, public administration and professional/scientific/technical services are the most significant sectors to the regional economy. In terms of value-added the public administration, finance, education and health sectors are the most significant sectors. The public administration, education, health and professional/scientific/technical services sectors are the most significant sector for income while the health, retail and education sectors are the most significant sectors for employment. The metal manufacturing sector is the most significant sector for both imports and exports, with the coal mining sector being the second most significant sector for exports.

Table 6.1 - Aggregated Transactions Table: Regional Economy 2016-17 ($M)

	Ag, forestry, fishing	Mining	Manuf.	Utilities	Building	Trade/ Accom	Bus. Srvcs	Public/ Pers. Srvcs	TOTAL	Household Expenditure	OFD	Exports	Total
Ag, forestry, fishing	16	0	105	0	1	31	5	5	**165**	31	184	143	**522**
Mining	0	93	283	8	22	4	13	6	**430**	5	147	1,738	**2,321**
Manuf.	18	68	487	21	470	166	166	165	**1,561**	399	921	3,719	**6,601**
Utilities	9	18	149	559	39	58	143	103	**1,079**	232	781	46	**2,138**
Building	13	55	35	59	1,276	61	392	294	**2,184**	18	3,334	25	**5,560**
Trade/Accom	14	47	193	22	156	163	254	247	**1,095**	2,146	361	825	**4,428**
Bus.Srvcs	40	225	632	237	599	811	3,044	1,052	**6,638**	4,049	1,963	1,958	**14,608**
Public/Pers Srvcs	3	48	70	24	71	43	306	276	**840**	1,836	6,042	493	**9,211**
TOTAL	**114**	**555**	**1,953**	**930**	**2,635**	**1,337**	**4,322**	**2,148**	**13,993**	**8,717**	**13,732**	**8,947**	**45,389**
Household Income	73	267	1,057	261	1,124	1,639	3,469	4,812	**12,702**	-	-	-	**12,702**
OVA	222	1,181	664	669	716	798	4,908	992	**10,150**	869	712	7	**11,737**
Imports	114	318	2,927	278	1,085	655	1,909	1,259	**8,544**	3,153	1,456	239	**13,392**
TOTAL	**522**	**2,321**	**6,601**	**2,138**	**5,560**	**4,428**	**14,608**	**9,211**	**45,389**	**12,739**	**15,900**	**9,192**	**83,220**
Employment (no.)	**1,238**	**2,166**	**10,624**	**2,356**	**11,624**	**30,580**	**31,104**	**60,042**	**149,733**				

Figure 6.1 - Summary of Aggregated Sectors: Regional Economy (2016-17)

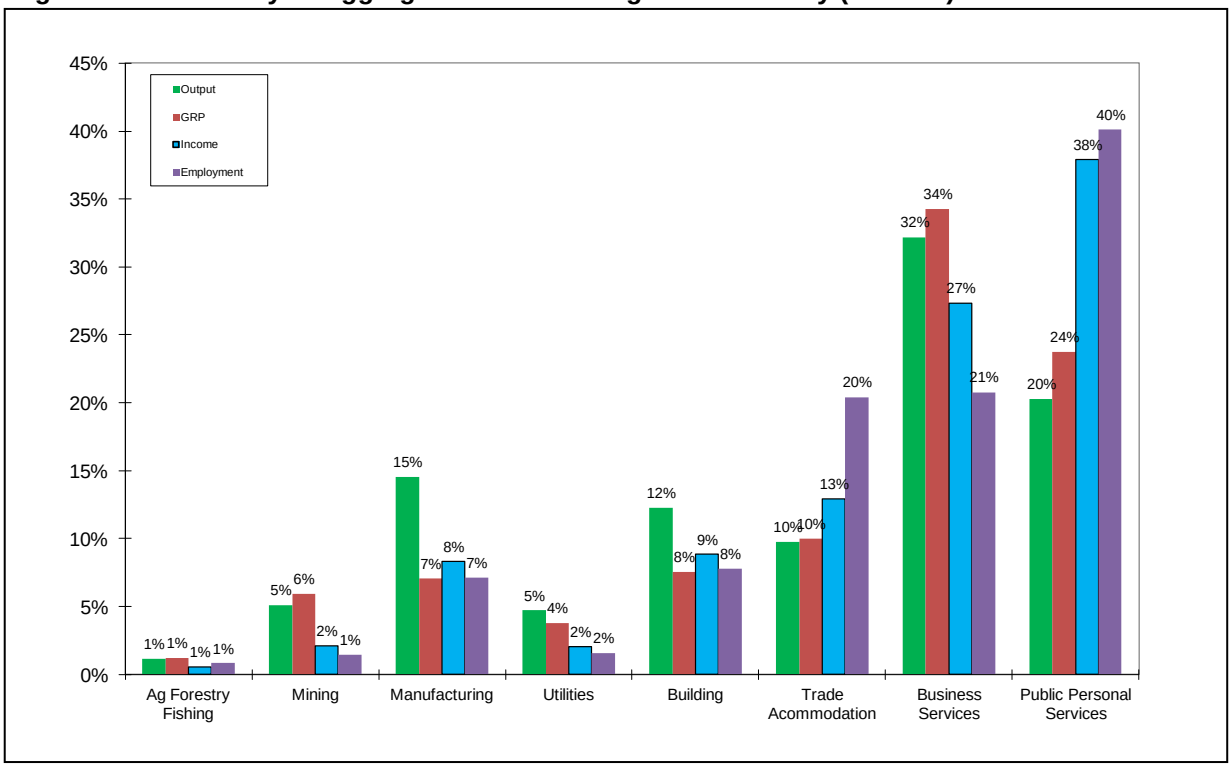


Figure 6.2 - Summary of Aggregated Sectors: NSW Economy (2016-17)

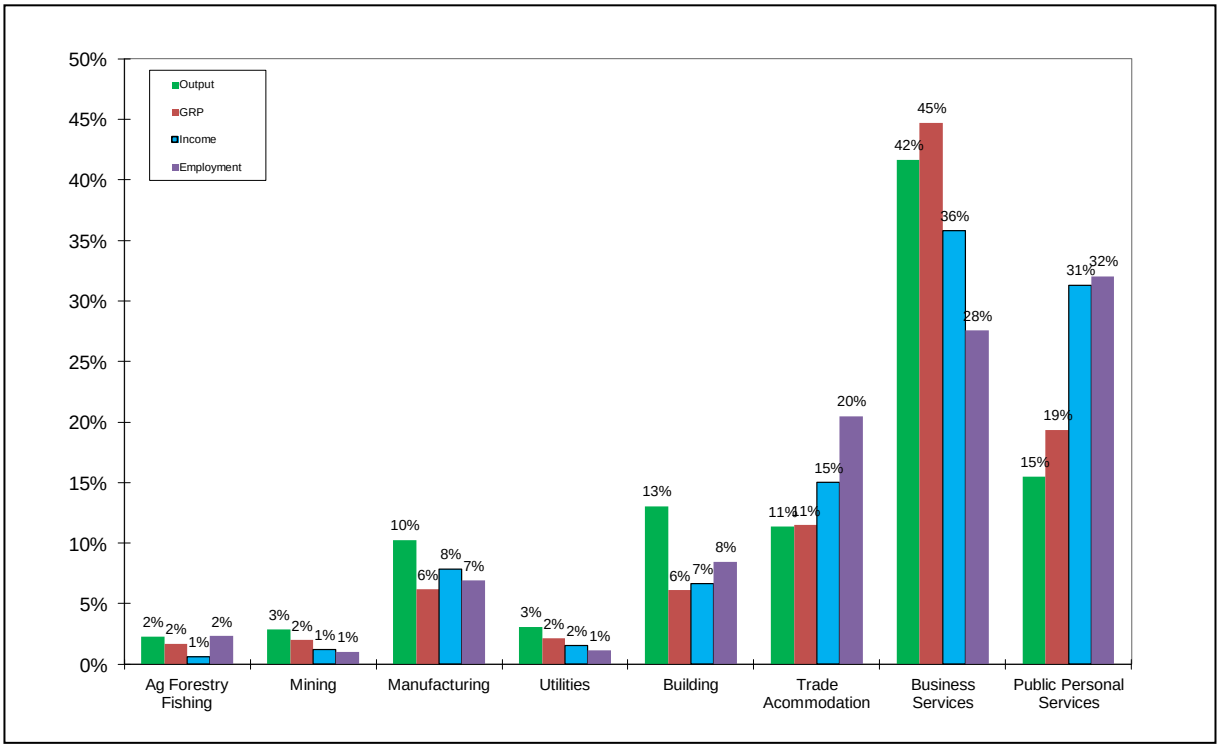


Figure 6.3 Sectoral Distribution of Gross Regional Output and Value Added ($M)

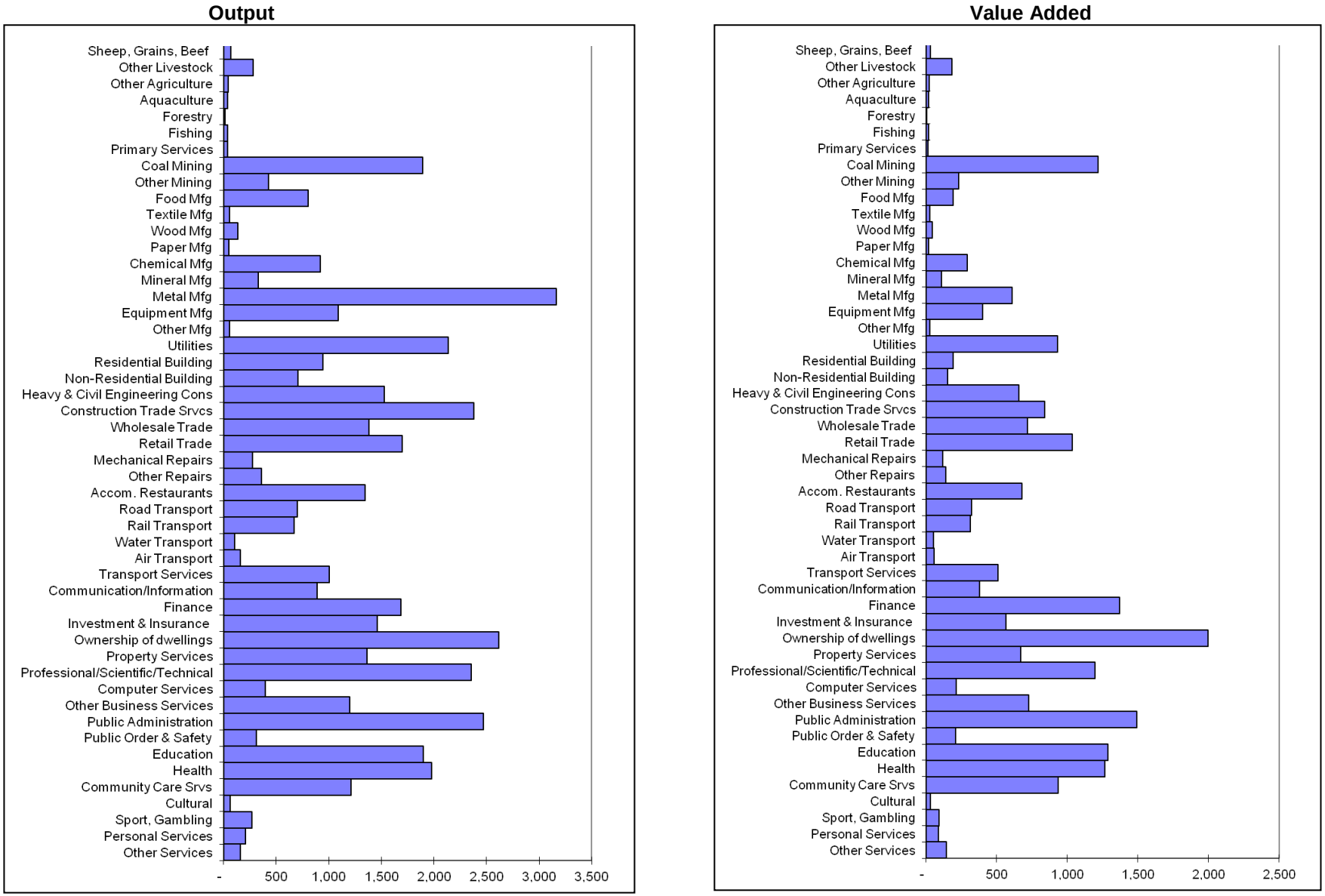


Figure 6.4 Sectoral Distribution of Income ($M) and Employment (No.)

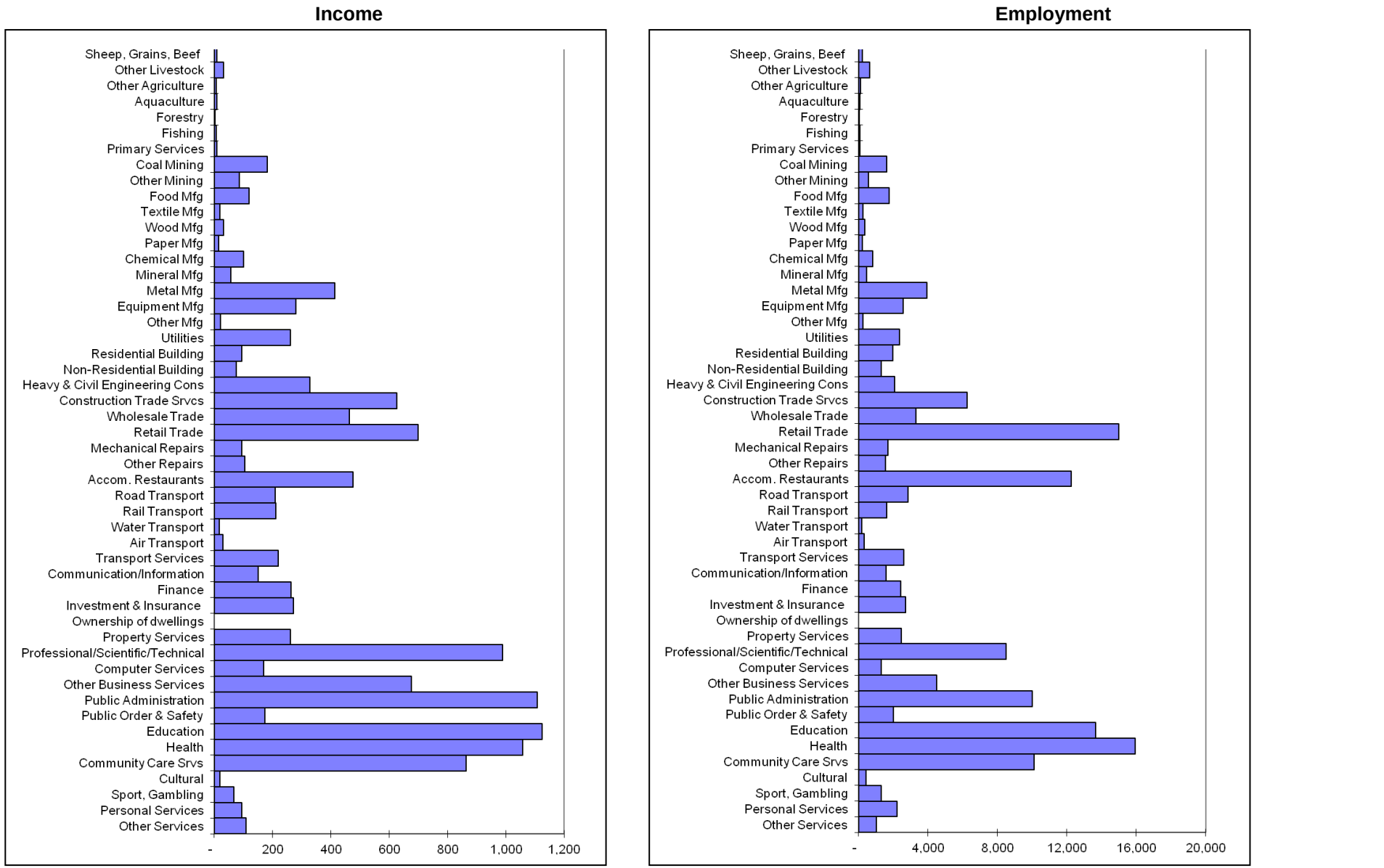
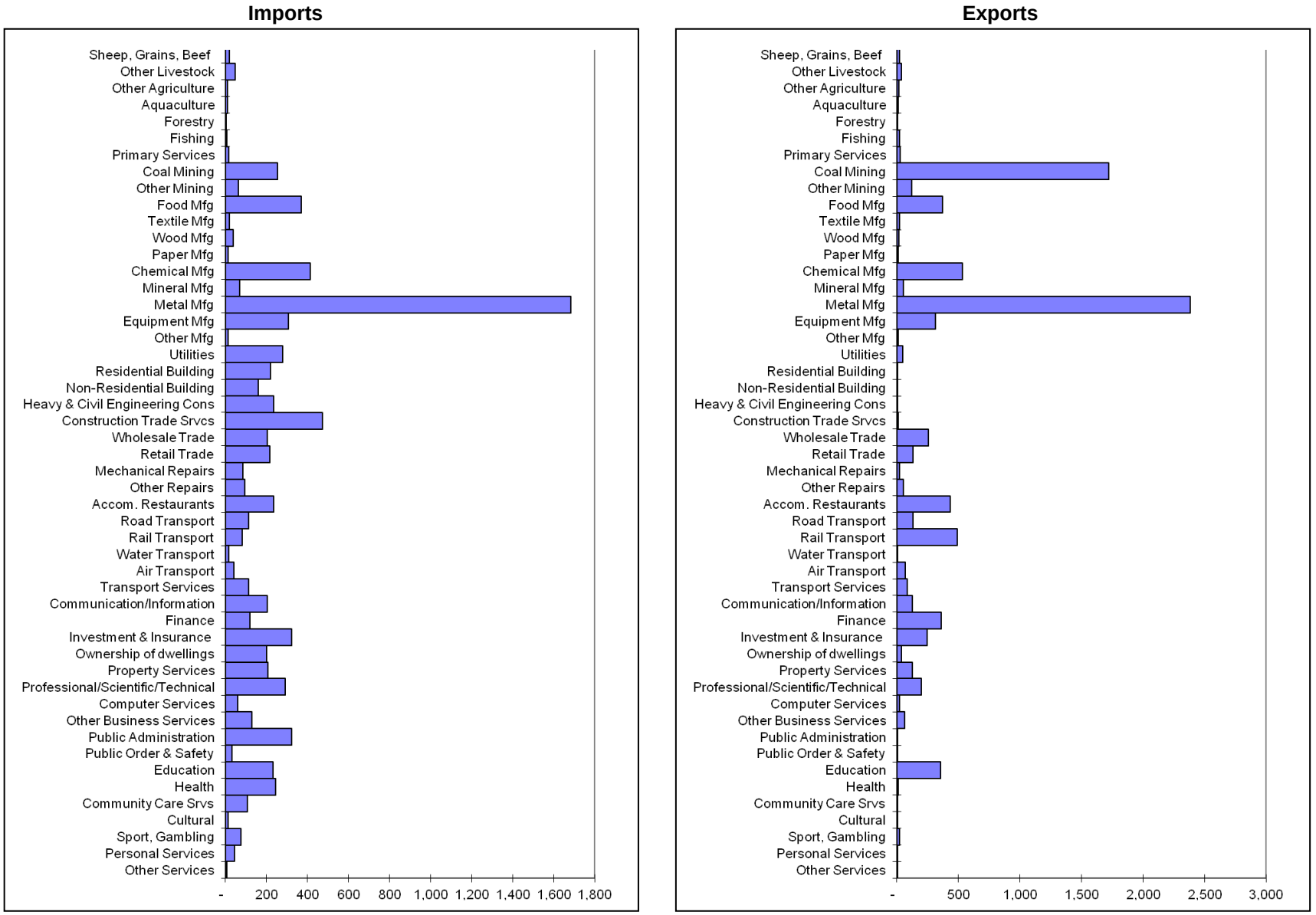


Figure 6.5 Sectoral Distribution of Imports and Exports ($M)



6.3 Local Area Impacts of the Project

6.3.1 Introduction

There is no substantive construction phase associated with the Project and hence this assessment focuses on the economic activity to the Local Area economy i.e. the output, value-added, income and employment associated with the quarrying operation and delivery of quarry products. All other things being equal, the economic activity arising from the Project will depend on:

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

Impacts are reported separately for quarrying and transport components of the Project

6.3.2 Quarry Operation

Introduction

For the analysis of the quarry operation, new Project sectors were inserted into the regional IO table reflecting operations at 500,000 tpa and 750,000 tpa. The annual revenue, operating costs, and gross profit for the new sectors were obtained from financial information provided by Boral. For these new sectors:

- the estimated gross annual revenue from the region was allocated to the *Output* row;
- gross profit was allocated to the *Other Value Added* row;
- the estimated wage bill of employees residing in the region was allocated to the *household wages* row (100% live in the region);
- non-wage expenditure was allocated between *intermediate* sectors in the regional economy and *imports* based on expenditure profile in the *non metallic mineral mining sector*[17] of the regional input-output table; and
- direct employment by the Project in the region was allocated to the *employment* row.

Impacts

The total and disaggregated annual impacts of the quarry operation on the regional economy (in 2019 dollars) at two different levels of production i.e. 500,000 tpa and 750,000 tpa are shown in Table 6.2. Incremental impacts are also provided.

[17] This the industry sector that sand quarrying is located.

Table 6.2 - Economic Impacts of Quarry Operation on the Regional Economy ($2019)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
500,000 tpa					
OUTPUT ($M)	7.0	2.5	0.9	3.4	10.4
Type 11A Ratio	1.00	0.36	0.13	0.49	1.49
VALUE ADDED ($M)	4.4	1.2	0.5	1.7	6.1
Type 11A Ratio	1.00	0.28	0.12	0.40	1.40
INCOME ($M)	0.4	0.4	0.2	0.6	1.0
Type 11A Ratio	1.00	1.17	0.44	1.61	2.61
EMPL. (No.)	5	6	3	9	14
Type 11A Ratio	1.00	1.23	0.65	1.88	2.88
750,000 tpa					
OUTPUT ($M)	10.5	3.5	1.4	4.9	15.4
Type 11A Ratio	1.00	0.33	0.14	0.47	1.47
VALUE ADDED ($M)	6.8	1.6	0.8	2.5	9.2
Type 11A Ratio	1.00	0.24	0.12	0.36	1.36
INCOME ($M)	0.7	0.6	0.3	0.9	1.5
Type 11A Ratio	1.00	0.95	0.40	1.35	2.35
EMPL. (No.)	9	9	5	14	23
Type 11A Ratio	1.00	0.96	0.56	1.52	2.52
Incremental Impact					
OUTPUT ($M)	3.5	1.0	0.5	1.5	5.0
Type 11A Ratio	1.00	0.27	0.15	0.42	1.42
VALUE ADDED ($M)	2.4	0.4	0.3	0.7	3.1
Type 11A Ratio	1.00	0.17	0.13	0.30	1.30
INCOME ($M)	0	0	0	0	1
Type 11A Ratio	1.00	0.68	0.36	1.00	2.00
EMPL. (No.)	4	3	2	5	9
Type 11A Ratio	1.00	0.64	0.45	1.10	2.09

Quarry production at 750,000 tpa relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $5M in annual direct and indirect regional output or business turnover;
- $3M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 9 direct and indirect jobs.

This is a minimum incremental impact. Based on the available sand resource and production profiles identified in Figure 4.1, without the Project, sand extraction will decline significantly below approved levels. Consequently, incremental impacts will likely to be closer to the levels identified above for 750,000 tpa and 500,000 tpa.

Main Sectors Affected

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

- Professional, Scientific and Technical Services;
- Construction Services;

- Coal Mining;
- Exploration and Mining Support Services;
- Retail Trade sector;
- Wholesale Trade sector; and
- Employment, Travel Agency and Other Administrative Services.

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

6.3.3 Transportation of Quarry Products

Introduction

For the analysis of the transportation of quarry products, the revenue accruing to transport operators from the transport of 500,000 tpa and 750,000 tpa was estimated. This was then adjusted by 64% on the advice of Boral that 36% of transport operators are located outside the region. The impact of this level of final demand on the regional economy was then calculated using the IO7 program.

Impacts

The total and disaggregated annual impacts of the transportation of quarry products on the regional economy (in 2019 dollars) at two different levels of production i.e. 500,000 tpa and 750,000 tpa are shown in Table 6.3. Incremental impacts are also provided.

Table 6.3 - Economic Impacts of the Quarry Product Transport on the Regional Economy ($2019)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
500,000 tpa					
OUTPUT ($M)	4.45	2.50	1.61	4.11	8.56
Type 11A Ratio	1.00	0.56	0.36	0.92	1.92
VALUE ADDED ($M)	2.04	1.22	0.93	2.16	4.20
Type 11A Ratio	1.00	0.60	0.46	1.06	2.06
INCOME ($M)	0.89	0.53	0.29	0.83	1.72
Type 11A Ratio	1.00	0.60	0.33	0.93	1.93
EMPL. (No.)	17.36	9.00	5.85	14.85	32.21
Type 11A Ratio	1.00	0.52	0.34	0.86	1.86
750,000 tpa					
OUTPUT ($M)	6.67	3.75	2.41	6.16	12.84
Type 11A Ratio	1.00	0.56	0.36	0.92	1.92
VALUE ADDED ($M)	3.06	1.83	1.40	3.24	6.30
Type 11A Ratio	1.00	0.60	0.46	1.06	2.06
INCOME ($M)	1.33	0.80	0.44	1.24	2.57
Type 11A Ratio	1.00	0.60	0.33	0.93	1.93
EMPL. (No.)	26.04	13.51	8.77	22.28	48.32
Type 11A Ratio	1.00	0.52	0.34	0.86	1.86
Incremental Impact					
OUTPUT ($M)	2.22	1.25	0.80	2.05	4.28
Type 11A Ratio	1.00	0.56	0.36	0.92	1.92
VALUE ADDED ($M)	1.02	0.61	0.47	1.08	2.10
Type 11A Ratio	1.00	0.60	0.46	1.06	2.06
INCOME ($M)	0.44	0.27	0.15	0.41	0.86
Type 11A Ratio	1.00	0.60	0.33	0.93	1.93
EMPL. (No.)	8.68	4.50	2.92	7.43	16.11
Type 11A Ratio	1.00	0.52	0.34	0.86	1.86

Transportation of quarry product at 750,000 tpa relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $4M in annual direct and indirect regional output or business turnover;
- 2M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 16 direct and indirect jobs.

This is a minimum incremental impact. Based on the available sand resource and production profiles identified in Figure 4.1, without the Project, sand extraction will decline significantly below approved levels. Consequently, incremental impacts will likely to be closer to the levels identified above for 750,000 tpa and 500,000 tpa.

Main Sectors Affected

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

- Professional, Scientific and Technical Services;

- Retail Trade sector;
- Wholesale Trade sector.
- Automotive Repairs and Maintenance sector;
- Road Transport sector;
- Transport Support Services and Storage; and
- Employment, Travel Agency and Other Administrative Services.

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

6.4 Potential Contraction in Other Sectors

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

'Crowding out' would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region. However, the regional economy is not at full employment and has access to external labour resources. Consequently, 'crowding out' of economic activity in other sectors as a result of the Project would not be expected to be significant at the regional level.

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.

7 CONCLUSION

A CBA of the Project indicated that it would have net social benefits to Australia of $41M, and net social benefits to NSW of $17M. Hence the Project is desirable and justified from an economic efficiency perspective. Environmental, social and cultural impacts of the Project have been minimised through Project design and mitigation, offset and compensation measures. In particular, Boral will purchase required Water Access Licences, provide required biodiversity offsets and establish required bushfire hazard reduction measures. The costs of these actions are included in the estimate of the net social benefits of the Project. The economic value of residual impacts are considered to be immaterial from an aggregated 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 $41M for the Project to be questionable from an Australian economic efficiency perspective, and greater than between $17M for the Project to be questionable from NSW economic efficiency perspective.

The Project will provide continued quarry employment for approximately five (four full time and one casual) employees currently on-site and another four (two full time and two casual). The Project is also estimated to provide continued transport employment for 17 people from the Local Area, plus employment for an additional 9 people from the Local Area.

Economic activity analysis, using IO analysis, estimated that quarry production at 750,000 tpa relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $5M in annual direct and indirect regional output or business turnover;
- $3M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 9 direct and indirect jobs.

This is a minimum incremental impact. Based on the available sand resource and likely production profiles without the Project, sand extraction will decline significantly below approved levels. Consequently, incremental impacts will likely to be closer to the levels identified in the report for 750,000 tpa and 500,000 tpa.

Transportation of quarry product at 750,000 tpa relative to 500,000 tpa is estimated to make up to the following incremental contribution to the regional economy:

- $4M in annual direct and indirect regional output or business turnover;
- $2M in annual direct and indirect regional value added;
- $1M in annual direct and indirect household income; and
- 16 direct and indirect jobs.

This is also a minimum incremental impact given that without the Project sand extraction will decline significantly below approved levels.

8 REFERENCES

NSW Department of Trade and Investment (2016) NSW Offshore Sand Review.

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

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

James, D. and Gillespie. R. (2002) *Draft Guideline for Economic Effects and Evaluation in Environmental Impact Assessment*, prepared for Planning NSW.

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

NSW Government (2015) *Guideline for 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.*

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

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

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

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

ATTACHMENT 1 – LEGISLATIVE CONTEXT FOR ECONOMIC ANALYSIS IN EIA

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

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

Secretary's Environmental Assessment Requirements

- The Project SEARs include a requirement for:
  - an assessment of the likely economic impacts of the development, paying particular attention to:
    - the significance of the resource;

- the economic benefits of the project for the State and region; and
- the demand for the provision of local infrastructure and services.

- the reasons why the development should be approved having regard to biophysical, **economic** and social **considerations**, including the principles of ecologically sustainable development.

Other Economic Guidelines

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

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

ATTACHMENT 2 – INTRODUCTION TO ECONOMIC METHODS

Benefit Cost Analysis

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

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

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

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

Economic Activity Analysis

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

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

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

Economic Analysis and Decision-Making

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

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

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

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

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

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

However, first is a comparison between how IO analysis treats direct employment and income effects (as explained above) and that 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 (including quarrying) 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 to take jobs in a project and who already reside in the region. The entire wage of those migrating into the region is additive to regional income in comparison to wage increments for those already residing in the region.

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

Table 1 - Incremental Income when Immigrating Workforce is Included

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

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

An already employed person in the region moving into a mining (including quarrying) 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 jobs. It would only be discounted if the chain ends with employment of those from local residents in the unemployment pool (who are receiving an allowance and hence already are spending income in the region) or if jobs remain unfilled. In periods of higher unemployment rates, jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new jobs.

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

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

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

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

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

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

Input-Output Analysis

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

Computable General Equilibrium Modelling

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

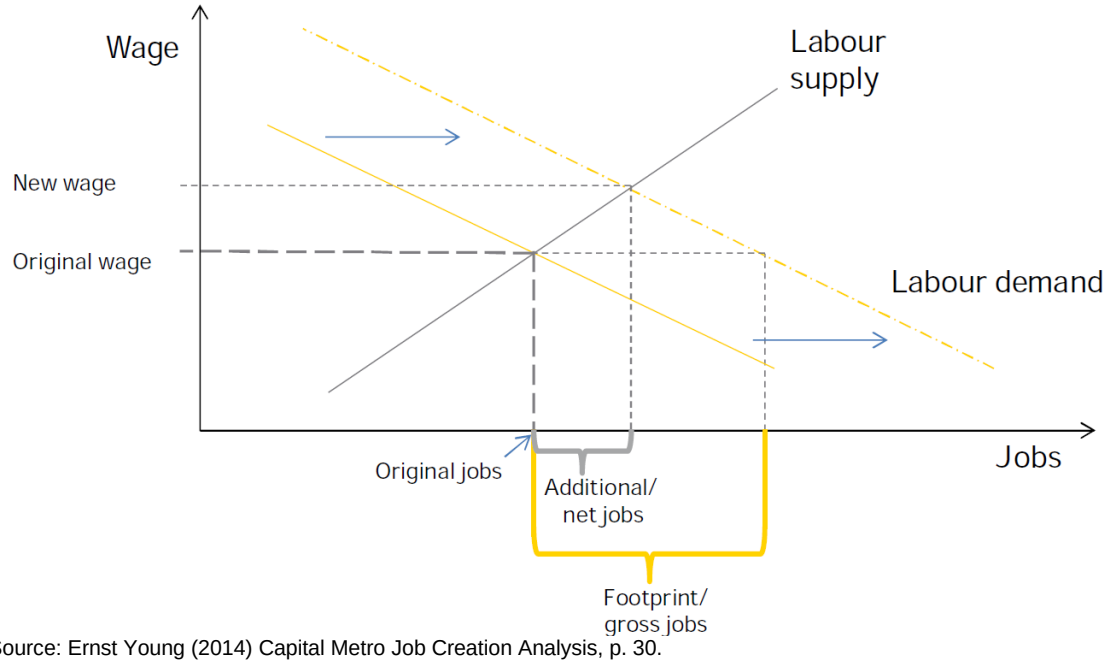
[19] Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

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

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

Comparison of IO Analysis and CGE Modelling

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



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

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

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I's *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.
- NSW Treasury (2009) *Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government,* supports the use of IO for deriving estimates for

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

employment supported by NSW Government actions, programs and policies, and clarifies the interpretation of such estimates.

- Other guidelines to recognise the role of IO analysis include:
  - 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).
- World Bank economist Mustafa Dinc (2015) Introduction to Regional Economic Development: Major Theories and Basic Analytical Tools, Edward Elgar, UK, identifies IO as one of the most widely used models around the world for undertaking regional economic impact analysis and a solid framework to analyse the interdependence of industries in an economy.

Government Applications of IO Analysis

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

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO is its use as a substitute for CBA, not its use for estimating direct and indirect regional economic activity impacts.
  - NSW Treasury (2009) "*Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (CBA)".*

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

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

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

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

Latest Use of IO Analysis

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

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

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

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

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

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

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

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

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

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

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

Components of the conventional output multiplier are as follows:

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

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

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

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

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

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

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

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

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

A description of the different ratio multipliers is given below.

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

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

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

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

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

REFERENCES

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

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

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

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

ATTACHMENT 6 – CBA AND ASSESSMENT OF EXTERNALITIES

Consideration of Externalities in the Economic Assessment

Introduction

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

Threshold Value Analysis

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

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

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

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

- Qualitative consideration of potential impacts and any subsequent valuation of impacts relied on the assessment of biophysical impacts provided in the Project EIS 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	No significant GHG emissions
Noise impacts		
Significant	Property valuation method	Cost of acquiring properties encompasses property value impacts due to noise - but no impacts of the Project and hence no acquisitions required.
Moderate and low	Defensive expenditure	Noise mitigation costs at properties - but no impacts of the 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. However, no surface WALs required.
Use of groundwater	Market value of water	Cost of Water Access Licences reflects marginal value product of water. Cost of acquisitions included in the capital costs of the Project.
Groundwater drawdown	Defensive expenditure	No material impacts on private bores predicted.
Water discharges		Regulated under the Protection of Environment Operations Act 1997.
Ecology	Replacement cost	Costs of offsets have been included in capital costs. Assumes that offsets levels are sufficient to compensate the community for values lost. This is a requirement of Govt. Policy.
Road transport impacts	Defensive expenditure	Cost of road investment required as a result of the Project. However, no material impacts and hence no road investment required.
Aboriginal heritage	Defensive expenditure	Costs of actions to mitigate impacts. However, no material Aboriginal heritage impacts predicted.
Historic heritage	Defensive expenditure Benefit transfer of CM data	Costs of mitigation or values from community willingness to pay studies. However, no historic heritage impacts predicted.
Visual	Defensive expenditure	Costs of mitigation measures. However, no material impacts predicted.

Additional Threshold Value Analysis

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

ATTACHMENT 7 – THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES

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

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

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

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). This means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A7.1 (Powell and Chalmers, 1995).

Table A7.1
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.