

APPENDIX 16

Economic Impact Assessment

Stone Ridge Quarry Project

Economic Assessment

Prepared for

Australian Resource Development Group Pty Limited

By



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EXECUTIVE SUMMARY

Introduction

Australian Resource Development Group Pty Limited (ARDG) is seeking planning approval for a new hard rock quarry, known as Stone Ridge Quarry (the project). The project is located within Wallaroo State Forest at Balickera, NSW, approximately 30 km north of Newcastle. The project is State Significant Development (SSD) and requires approval under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). An Environmental Impact Statement (EIS) is required to support the development application for the project. This Economic Assessment has been prepared as part of the EIS.

From an economic perspective, there are two important aspects of the project that can be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of the project) which is evaluated using cost benefit analysis (CBA); and
- its effects on the local economy, which is evaluated using local effects analysis (LEA) and input-output (IO) analysis.

Cost Benefit Analysis

A CBA of the project indicated that it would have net production benefits to NSW of \$290M (present value at 7% discount rate) comprising \$278M in quarrying benefits, and \$12M in ex quarry transport benefits.

Provided the residual environmental, social, and cultural impacts of the project that accrue to NSW are considered to be valued at less than the level of net production benefits, the project can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

The above estimate of NSW net production benefits of the project includes capital and operating costs associated with water access licences, biodiversity offsets, road intersection upgrades and road pavement maintenance costs. It also includes the costs of mitigation, monitoring, and management of other potential impacts. Externalities (including calculated costs of greenhouse gas impacts to NSW) which are not captured in operating or capital expenses have been assessed as being negligible. Consequently, the project is estimated to have net social benefits to NSW, and hence is desirable and justified from an economic efficiency perspective.

Local Effects Analysis

The local area used for the Local Effects Analysis comprises the Local Government Areas (LGAs) of Port Stephens, Newcastle, Lake Macquarie, Cessnock, Maitland, and the Central Coast. The project will provide direct economic activity, including jobs, to the local area economy, and indirect economic activity to the local area via both wage and non-wage expenditure. A summary of local economic effects of the project is provided in **Table ES1**.

The project will provide 47 direct jobs, comprising 12 quarry jobs and 35 ex-quarry transport jobs. Assuming that those that already reside in the local area would have otherwise been already employed and that job vacancies created by these people filling the project jobs remain unfilled (i.e. no job chain effects), the incremental disposable wages accruing to the region from project is \$0.7M per annum. This is equivalent to 9 direct full time equivalent (FTE) jobs. This is a minimum estimate as it assumes full employment in the region and hence the jobs from which people come to fill the project jobs remain vacant.

Standard regional economic impact assessment using IO analysis, is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. In this framework, the project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- \$102M in output;
- \$58M in value-added;
- \$14M in gross wages; and
- 176 jobs.

The main local environmental impacts are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

Table ES1 - Summary of Effects on the Local Community

Annual Local Effects	Direct Total	Direct Already Resident in the Local Area	Net
Employment FTE	47	45	9
Net Income (\$M)			0.7
Non-labour expenditure in the Local Area (\$M)	15.6		
Annual Regional Impacts	Direct	Flow-on	Total
Output (\$M)	68	34	102
Value-added (\$M)	41	17	58
Income (\$M)	4	10	14
Employment	47	129	176
Other Local Economic Impacts			
Displaced activities	No material impact*		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Demand on local infrastructure and services	Proponent will fully fund the demand it has for local infrastructure and services for the production process e.g. local roads, intersections etc		
Local Environmental Impacts			
Greenhouse gas emissions (Scope 1 and 3)	\$0.001M**		
Road Transport	Intersection upgrade, local and arterial road maintenance all internalised into cost of the project		
Biodiversity	Impacts on local biodiversity are offset		

* Materiality refers to whether valuation of these impacts would have any bearing on the estimated net social benefits of the Project. NSW Government (2012) identified that if a Project has an NPV of say "\$20 million, costs or benefits valued at less than \$1 million are unlikely to be material."

**This figure is the estimated present value (\$2023 at 7% discount rate) impact on NSW households apportioned to households in the Local Area.

*** Unless otherwise specified monetary amounts are in 2022 dollars.

1 INTRODUCTION

1.1 Background

Australian Resource Development Group Pty Limited (ARDG) is seeking planning approval for a new hard rock quarry, known as Stone Ridge Quarry (the project). The project is located within Wallaroo State Forest at Balickera, NSW, approximately 30 km north of Newcastle. The project is seeking to access a high quality, hard rock resource suitable for producing a wide range of quarry products for the Lower Hunter, Central Coast and northern Sydney construction materials markets.

The project will include the following works:

- Construction of a site access off Italia Road.
- Clearing and earthworks for site preparation and to enable access to the resource and development of the quarry extraction area.
- Installation of on-site processing plant and associated equipment.
- Construction of a weighbridge and associated administrative buildings.
- Extraction and processing of material to enable the transport of approximately 1.5 million tonnes per annum (Mtpa) of extractive materials from the site (subject to traffic/transport constraints).
- General site maintenance and landscaping works.
- Site stabilisation of disturbed areas and progressive rehabilitation.

The project is State Significant Development (SSD) and requires approval under Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act). A development application will be lodged with the NSW Department of Planning, Industry and Environment (DPIE). An Environmental Impact Statement (EIS) will be prepared to support the development application.

Umwelt (Australia) Pty Ltd (Umwelt) has been engaged to prepare an Environmental Impact Statement (EIS) for the project. Gillespie Economics was engaged to prepare an Economic Assessment of the project for incorporation into the EIS.

1.2 Economic Assessment Requirements

Economic Assessment requirements arise from the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Secretary's Environmental Assessment Requirements (SEARs). While there are no specific economic assessment guidelines for extractive industries, the *Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2015) and the *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Government, 2018), provide guidance on the economic assessment techniques that are appropriate for addressing the requirements under the EP&A Act. The requirements are briefly outlined below.

Environmental Planning and Assessment Act 1979

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

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

Economic Assessment Guidelines

The NSW Government (2015) Guideline provides information to assist proponents with providing the necessary economic information to meet the abovementioned requirements of section 4.15 of the EP&A Act. The Guideline identifies that:

- Cost Benefit Analysis (CBA) is used to assess the public interest by estimating the net present value of the project to the NSW community.
- Local Effects Analysis (LEA) is used to assess the likely economic impacts of the development in the locality. The Guideline identifies a specific method for assessing the direct local effects of a mining project. However, it also states that "*a range of techniques are available for estimating second round or flow-on effects. These include CGE (computable general equilibrium) modelling, Input-Output (IO) or multiplier analysis.*"

The NSW Government (2018) Technical Notes provides guidance on including environmental, social, and cultural impacts in the CBA.

Secretary's Environmental Assessment Requirements

The SEARs for the Project require:

"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 a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and
- the demand on local infrastructure and services."

Proposed Economic Assessment Methods

To meet the above requirements, two types of economic assessment of the Project are needed:

- a CBA.
- a LEA.

1.3 Structure of the Report

This report is structured as follows:

- Section 2 identifies the significance of the resource.
- Section 3 provides a CBA of the Project.
- Section 4 provides an overview of the regional economy.
- Section 5 provides a LEA of the Project.
- Section 6 identifies measures to manage economic impacts.
- Conclusions are provided in Section 7.

The individual SEARs requirements relevant to this Economic Assessment and where they are addressed in this report are provided in Table 0.1.

Table 0.1 SEARs Relating to the Economic Assessment

Assessment requirement from SEARs	Section of report where addressed
<ul style="list-style-type: none">• the significance of the resource;	Section 2.0
<ul style="list-style-type: none">• the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates¹	Section 3.0
<ul style="list-style-type: none">• the demand on local infrastructure and services	See the Social Impact Assessment

¹ All products will be sold domestically and hence consideration of exchange rate fluctuation is not required.

2 SIGNIFICANCE OF THE RESOURCE²

2.1 Resource Quality

A comprehensive geotechnical testing program has been undertaken on diamond core from the project area to confirm the suitability of different rock types within the Eagleton Volcanics for producing a range of typical quarry products. The program confirmed that the rhyodacites and dacites achieve the source rock requirements to produce the following important quarry product types:

- Concrete aggregates – coarse and fine (including manufactured sand) to Australian Standard requirements (AS2758.1-2014).
- Asphalt aggregates – coarse and fine (including manufactured sand) to Australian Standard requirements (AS2758.5-2000) and Transport for New South Wales (TfNSW) (formerly Roads and Maritime Service (RMS)) requirements (RMS 3152).
- Sealing aggregates – to Australian Standard requirements (AS2758.2-2009) and TfNSW requirements (RMS 3151).
- Railway ballast – to Australian Standard requirements (AS2758.7-2015).
- Armourstone – to Australian Standard requirements (AS2758.6 – 2008.)
- Aggregates for gabion baskets and wire mattresses – to Australian Standard requirements (AS2758.4-2017).
- Roadbase materials – to TfNSW requirements (RMS 3051).

2.2 Resource Quantity

Modelling of the information obtained from ARDG's resource assessment program has confirmed a combined rhyodacite and dacite quarry resource, sufficient to support the extraction and processing of material to enable the transport of approximately 1.5M tpa, within the conceptual design of the proposed 30-year extraction area. This would be considered a 'measured resource' in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (the 'JORC Code'). Given the limited extent of weathering of rhyodacite and dacite across the project area, there is no significant quantity of overburden.

Extensive additional resources exist outside the footprint (laterally and at depth) of the initial 30-year extraction area. These resources would be classified as an 'indicated resource' in accordance with the JORC Code. Further drilling and testing will be undertaken in due course to increase the level of confidence in the extent of these resources.

2.3 Demand and Supply

Hard rock materials derived from the rhyodacite and dacite resource are a significant and important input for the production of aggregates to produce ready mixed concrete and a range of road pavement and armour rock products. The demand for aggregates and road pavement materials is driven by population growth and the resulting need for additional housing, land subdivision, provision of trunk infrastructure, major landscaping projects, road construction, upgrade and maintenance, rail and other transport network construction, upgrade and maintenance, additional commercial and industrial development and the development of community, cultural and recreational infrastructure. Armourstone and gabion products are used for a variety of uses including erosion protection works.

The largest individual market for aggregates in NSW is the Greater Sydney Region. All crushed rock supply for the GSR is sourced from areas surrounding the GSR, as all quarries historically producing crushed rock

² Resource quality and quantity information is based on Appendix 6 of the Stone Ridge Quarry Environmental Impact Statement.

products with the GSR have closed. Quarries surrounding the GSR also supply local and/or regional markets beyond the GSR.

While there is strong and growing demand for hard rock materials, their supply in proximity to Sydney and surrounding regional markets, is limited to specific areas where the required geological formations exist, and it is economic to extract. The Stone Ridge Quarry is one of these locations.

3 COST BENEFIT ANALYSIS

3.1 Introduction

CBA of the Project involves the following key steps:

- identification of the “with” and “without” Project scenarios.
- identification and valuation of the incremental benefits and costs of the Project relative to the “without” scenario or ‘base case’.
- consolidation of value estimates using discounting to account for temporal differences.
- application of decision criteria.
- sensitivity testing.
- consideration of non-quantified benefits and costs.
- consideration of the distribution of costs and benefits.

What follows is a CBA of the Project based on technical, financial and environmental information provided by ARDG and Umwelt.

3.2 Identification of the “Without” Project Scenario

A starting point for CBA is to establish the “without” project scenario for the land impacted by the project. This becomes the base case against which to assess the potential economic, social, and environmental impacts of changes due to the project.

Timber Harvesting has not occurred in Wallaroo State Forest since 1986. Production prior to 1986 focused on production of small round timber for Masonite billet wood and round mining timber. There is no commitment to supply sawlogs from the forest and there have been no attempts to produce sawlogs from the forest for more than 20 years.

Without the project, the land impacted by the project would continue to be used for forestry – periodic production of small wood, with associated environmental values of regrowth forest.

3.3 Identification of the “With” Project Scenario

“With” the project, extraction at an average rate of up to 1.5 Mtpa would continue for at least 30 years. A summary of the key aspects of the project are provided in Table 3.1.

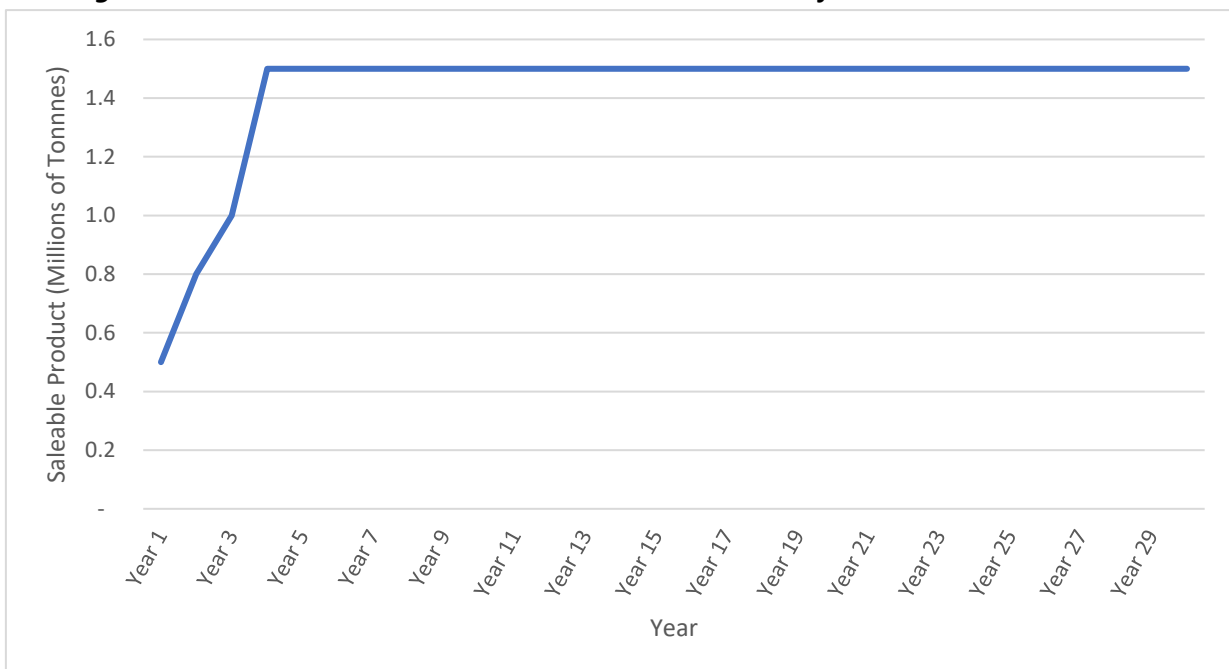
Table 3.1 Summary of Key Project Aspects

Aspect	Proposed for the Project
Project Life	30 years
Limits of production	Up to 1.5Mtpa of quarry product/sales per year
Project disturbance area	Approximately 79 ha (including extraction, processing, and stockpiling areas)
Extraction method	Drill, blast, and haul
Material processing	Processing on site using mobile crushing and screening plant, with provision for future fixed processing plant
Overburden management	Overburden will be minimal. Any topsoil and overburden will be stockpiled on site for use in rehabilitation
Product transport	Road transport of up to 1.5M tpa of product via the Pacific Highway

Site access	Single access point on Italia Road. No trucks will turn right out of the site onto Italia Road towards East Seaham
Employment	Up to 10 full time employees, 3 – 5 part time employees
Hours of operation	The proposed hours of operation are: <ul style="list-style-type: none"> • 6.00am to 10.00pm Monday to Friday, with the only activities occurring after 6.00pm being loading and maintenance operations • 7.00am to 3.00pm on Saturdays • No operation on Sundays apart from maintenance activities as required
Rehabilitation and final landform	Rehabilitation will be undertaken progressively where appropriate in the context of further resources remaining available in the project area at the end of the planned 30-year approval life. The final landform will include final voids which will progressively fill with water. Post mining land use for the site will be primarily environmental however there may be opportunities to use the water stored in voids for other uses including for bushfire fighting purposes.

Figure 3.1 illustrates the indicative incremental production of the project relative to the base case.

Figure 3.1 – Indicative Incremental Production from the Project Relative to the Base Case



3.4 Identification of Benefits and Costs

Relative to the base case, or “without” project scenario, the project may have the potential incremental economic benefit and cost categories shown in **Table 3.2**. The scope of the CBA includes the delivery of saleable products to customers, since assessment of road transport impacts are a requirement of the SEARs.

It should be noted that the potential environmental, social, and cultural costs listed in **Table 3.2** 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.

Table 3.2 - Potential Incremental Economic Benefits and Costs of the Project

Category	Costs	Benefits
Net production benefits from extraction and processing	<ul style="list-style-type: none"> • Opportunity cost of forestry land • Opportunity cost of capital • Capital costs • Operating costs at quarry gate • Decommissioning and rehabilitation costs at cessation of the Project 	<ul style="list-style-type: none"> • Sale value of quarry product at quarry gate • Residual value of capital and land at the end of the project
Net production benefits from ex-quarry transport	<ul style="list-style-type: none"> • Capital and operating costs 	<ul style="list-style-type: none"> • Revenues
Potential environmental, social and cultural impacts of extraction, processing and transportation, after mitigation, offsetting and compensation	<ul style="list-style-type: none"> • Air quality impacts • Greenhouse gas generation • Noise and blasting impacts • Road transport impacts • Groundwater impacts • Surface water impacts • Biodiversity impacts • Aboriginal heritage impacts • Historic heritage impacts • Visual impacts • Net public infrastructure costs • Loss of surplus to other industries 	<ul style="list-style-type: none"> • Economic benefits to existing landholders • Economic benefits to suppliers • Wage benefits to employment • Nonmarket employment benefits

Framed in another but equivalent way, the potential incremental costs and benefits of the project are as per **Table 3.3**.

Table 3.3 - Alternative Frame of Potential Economic Benefits and Costs of the Project

Costs	Benefits
<i>Direct costs</i>	<i>Direct benefits</i>
Nil	Net production benefits from extraction and processing <ul style="list-style-type: none"> • <i>Royalties³</i> • <i>Company tax</i> • <i>Net producer surplus</i> Net production benefits from ex quarry transport <ul style="list-style-type: none"> • <i>Company tax</i> • <i>Net producer surplus</i>
<i>Indirect costs</i>	<i>Indirect benefits</i>
Environmental, social, and cultural impacts of extraction, processing and transportation, and concrete production after mitigation, offsetting and compensation	Economic benefits to existing landholders
Net public infrastructure costs	Economic benefits to suppliers
Loss of surplus to other industries	Wage benefits to employment
	Nonmarket employment benefits

³ Because the proposed extraction occurs on State Forest (SF) land, royalties are payable to SF.

3.5 Quantification/Valuation of Benefits and Costs

Consistent with NSW Government (2015), the CBA was undertaken in 2022 real values, with discounting at 7 percent (%) and sensitivity testing at 3% and 10%.

The analysis period is 31 years, coinciding with the proposed duration of the development consent plus one year pre-commencement. Any impacts that occur after this period are included in the final year of the analysis as a terminal value.

Where competitive market prices are available, they have generally been used as an indicator of economic values. Environmental, cultural, and social impacts have initially been left unquantified and interpreted using the threshold value method.⁴

Environmental, cultural, and social impacts were then estimated using market data and benefit transfer⁵ and incorporated into an estimate of the net social benefit of the project. This estimated net social benefit of the project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the project questionable from an economic efficiency perspective.

3.5.1 Production Costs and Benefits of Extraction and Processing⁶

Opportunity Cost of Land and Capital

All capital equipment required to the Project would be purchased or leased. The cost of this is included in the capital costs and operating costs of the Project, respectively.

Under the base case scenario, the land would continue to be used for minor periodic production of small wood. The value of this production is unknown and has been excluded from the analysis. However, the magnitude of this opportunity cost is likely to be immaterial from an aggregate economic efficiency perspective.

Capital Cost of the Project

Capital costs of the Project are associated with: the development of the site and provision of required infrastructure; the purchase of crushing and screening plant, mobile equipment fleet, light vehicle fleet, and generators; a Biodiversity Conservation Trust Fund contribution; and the Project's share of the Pacific Highway access upgrade.

These capital costs, including sustaining capital, are estimated at \$61M and included in the analysis in the years they are expected to occur.

Annual Operating Costs of the Project

The quarry operating costs include those associated with lease costs, labour costs, extraction, crushing and screening, rehabilitation, general costs (including overheads and administration) and ongoing environmental, social, and cultural management and mitigation costs. Operating cost over the life of the Project, excluding royalties, are estimated at \$275M.

⁴The threshold value method uses the value of quantified net production benefits as the amount that unquantified environmental, social and cultural costs would need to exceed to make a project questionable from an economic efficiency perspective.

⁵ Benefit transfer refers to transferring economic values that have been determined for other study sites.

⁶ All values reported in this section are undiscounted unless specified.

Access to the resource on State Forest land is contingent on the payment of a royalty to State Forests. While royalties are a cost to ARDG they are part of the overall net production benefit of the quarrying activity that is redistributed to government. Royalties are therefore not included in the calculation of the resource costs of operating the Project.

Annual depreciation has also 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 years in which they are proposed to occur.

Decommissioning and Rehabilitation Costs

While there is sufficient hard rock resource for quarrying beyond the requested approval life, for the purpose of the analysis annual rehabilitation costs of \$75,000 as well as a final rehabilitation and decommissioning cost of \$0.5M are included in the operating costs of the Project.

Revenues

The main economic benefit of the Project is the market value of the hard rock products produced. An average unit price at the quarry gate has been applied to the output of the quarry based on advice from ARDG. It has not been reported for reasons of commercial confidentiality. However, the assumed price is considered by ARDG to be conservative.

There is uncertainty around future hard rock prices and hence assumed values have been subjected to sensitivity testing (see Section 3.8).

Residual Value at End of the Evaluation Period

At the end of the Project, the land and capital equipment required for the Project may have some residual value. Conservatively, this is assumed to be zero.

3.5.2 Production costs and benefits of product transport

The costs and benefits of quarrying considered in Section 3.5.1 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 providers.

The annual net production benefit of product transport has been estimated based on the assumed incremental quarry production, average transport revenue of \$15 per tonne and 4%⁷ of total revenue to transport providers being net revenue.

3.5.3 External 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.

⁷ Based on the ratio of gross operating surplus to revenue for the road transport sector in the 2018-19 National Input-Output Table, adjusting for mixed income.

Air Quality

The impact of the Project emissions can potentially be valued using the:

- 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.;
- the willingness to pay of impacted people to avoid the impacts.
- the defensive expenditure method, where the costs of mitigation are estimated.

However, the Air Quality Impact Assessment determined that air quality impacts associated with the Project would meet the relevant assessment criteria from the Environment Protection Authority's (EPA's) Approved Methods and not trigger either mitigation or acquisition obligations under the Voluntary Land Acquisition and Mitigation Policy (VLAMP) for State Significant Mining, Petroleum and Extractive Industry Developments 2018. Specifically, it was predicted that:

- Construction and operational dust emissions are not expected to cause adverse air quality impacts at the nearby sensitive receptors based on modelling which showed compliance with the EPA assessment criteria. No VLAMP mitigation or acquisition triggers were exceeded.
- No exceedances of the EPA's NO₂ criteria from diesel exhaust emissions or from blasting.
- Emissions from truck diesel exhausts travelling on public roads will have an acceptable level of impact based on modelling which showed that maximum kerbside concentrations would not exceed EPA criteria.
- Monitoring from a similar nearby site and results from modelling suggest that the Project is not expected to cause, adverse air quality impacts with respect to crystalline silica.

Consequently, air quality 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.

Greenhouse Gas

The greenhouse gas assessment concluded that the Project would be associated with approximately 151,000t Scope 1 and Scope 3 CO₂-e emissions from diesel usage, blasting, vegetation clearing and from customer truck movements. The Project will have negligible Scope 2 impacts due to it not involving electricity use at the site.

To place an economic value on CO₂-e emissions, a shadow price of CO₂-e is required. The NSW Treasury (2023) Guide recommends using prices from the European Union Emissions Trading Scheme (EUETS). The Technical Note to the Guide (NSW Treasury 2023b) provides an Australian dollar value estimate for the year 2023 of \$123/t CO₂-e increasing in real terms by 2.5% per annum.

Under this shadow price the present value of greenhouse gas emission costs over the life of the Project is \$10M dollars, present value. However, the EUETS permit price is an "exchange price" that reflects the regulations and rules of the trading scheme. It is also a financial price rather than an economic value i.e. no real resources are exchanged for payment. This price is therefore far removed from the appropriate value for CBA which is the value of emission impacts to the households and businesses that will feel the impacts. Notwithstanding, in efficiently designed scheme the permit price may be a proxy for the global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the NSW Government (2015) Guidelines, NSW Government (2018) Technical Notes, the focus of CBA is on costs and benefits to the population of NSW. In the absence of any studies that have

focused on the social damage cost of carbon emissions to NSW residents, some means of apportioning global damage costs borne by Australians is required. For the Economic Assessment, this has been undertaken using Australia's share of the global population (around 0.32%) and NSW's share of the Australian population (32%). NSW DP&E has previously supported this approach (NSW DP&E, 2017).

On this basis, the present value of the cost of greenhouse gas emissions from the Project to Australia and NSW is estimated at \$33,000 and \$10,000 dollars (present value), respectively.

Noise and Blasting

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

The NSW Noise Policy for Industry (NPfI) includes a process for determining levels of potential noise impact which would not have significant impacts on residents based on background levels at those residences; noise impacts below these noise levels are considered to have an acceptable level of impact. Additional assessment criteria are adopted for construction related impacts which are typically of shorter duration, and for increases to road noise associated with additional traffic movements. Blasting impacts are also assessed having regard to acceptable levels of vibration and (in the case of blasting) overpressure impacts.

The Noise Impact Assessment, undertaken in accordance with the NPfI and other relevant assessment criteria specified in the SEARS, identified that:

- potential construction noise impacts would comply with the relevant construction noise criteria noise management levels.
- potential operational noise levels would comply with applicable day, evening, and morning shoulder noise criteria at nearby sensitive receivers and there would be no exceedances of operational cumulative noise criteria.
- potential structural damage and human annoyances from vibration inducing construction and operational equipment is anticipated to be negligible.
- operational and construction road traffic noise will comply at the nearest most potentially affected dwelling.

The assessment of blast impacts found that blasting activities associated with the Project would not have a significant impact on Hunter Water infrastructure.

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.

Road Transport Impacts

Road transport associated with the Project could be associated with a number of potential externalities including capacity and safety issues and road wear and tear.

The Traffic Impact Assessment identifies that the quarry will be accessed via Italia Road, with all vehicles traveling via the Pacific Highway. To address safety concerns associated with increased traffic from the Project and two other quarry operations which will also utilise this intersection, the Italia Road/Pacific Highway intersection will be upgraded. These upgrade works will be undertaken by ARDG, Boral and Eagleton Quarry and subject to a separate assessment and approval process. ARDG's share of this cost has been included in the capital cost of the Project. In addition, ARDG have committed to heavy vehicles

associated with the Project turning left only at the Pacific Highway such that no heavy vehicles will turn right. All heavy vehicles with a destination to the south would undertake a U-turn at the Tarean Road interchange.

The Project would also result in some wear and tear on Italia Road (a local road) and the Pacific Highway. In accordance with the Port Stephens Council S94 Plan 2020, ARDG will pay a road maintenance levy calculated by reference to heavy vehicle movements associated with the Project. These contributions are included in the operating costs of the Project. Heavy vehicle registration charges (part of the transport operating costs) also include an allowance for road damage on arterial roads.

Consequently, the road transport externality costs of the Project have been internalised into the costs of the Project. There are no material residual road transport externality costs for inclusion in the CBA.

Groundwater

The Project will result in some drawdown in ground water from surrounding areas with potential impacts on Groundwater Dependent Ecosystems (GDEs) and other groundwater users. However, the Groundwater Impact Assessment found that both existing users and the high priority GDEs are well outside the project's radius of drawdown. No drawdown is expected to occur at any private bores, or at the high priority GDEs as a result of the project. The project is not expected to cause any significant change in groundwater quality or in the beneficial use of the groundwater. The impact of the project therefore meets the NSW Aquifer Interference Policy (AIP) Level 1 Minimal Impact Considerations for landholder bores, GDEs and groundwater quality.

Based on the maximum predicted inflow predictions which would occur in Stage 8 of the development of the main pit, ARDG would be required to obtain a Water Access Licence (WAL) for up to 47 ML/year associated with groundwater inflows to the pit. Based on recent trades within the New England Fold Belt Coast Groundwater Source there is sufficient market depth for ARDG to obtain the necessary WALs to cover this predicted take. In addition, water supply for the operation during dry periods will be supplemented by groundwater obtained from licensed bores. Up to 119 ML/year is predicted to be required from groundwater sources during dry periods. The market value for WALs can be considered to give a reasonable indication of its economic value in alternative uses i.e. its opportunity cost. The cost of these WALs is included in the operating costs of the Project.

Surface Water

The proposed Project is located within the drinking water catchment of Grahamstown Dam. The Surface Water Impact Assessment found that:

- The Project can on average achieve a Neutral or Beneficial Effect (NorBE) on water quality (as required for developments within the Grahamstown Dam catchment) provided adequate site storage capacity is available for all stages of the quarry operation, an appropriate water treatment system is installed and maintained to ensure controlled discharge water quality targets are achieved and appropriate water inventory management is implemented to minimise the volume and frequency uncontrolled discharges.
- The Project will have an adequate and reliable water source (i.e. captured rainfall runoff and groundwater bore) for all stages of the Project.
- There is a predicted overall loss of catchment yield during Stage 1 of the Project and during dry years of Stage 9 of the Project, however, on average catchment yields are expected to increase as a result of the Project during the intermediate and latter operational stages due to the increased runoff potential of the developed quarry site and the requirement to manage surplus rainfall runoff through controlled discharges.

- Loss of catchment yield will have a negligible impact on overall Grahamstown Dam catchment yields as the Project WMS will occupy less than 0.5% of the Grahamstown Dam catchment. The minor low of flows into the Williams River catchment are also negligible.
- Potential stream stability issues associated with discharges are expected to be manageable and any required mitigation measures (e.g. scour protection, discharge flow rate limits) will be informed by the hydrologic and hydraulic assessment.
- The Project will have no impact on local or broader catchment flood regimes.

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

Biodiversity Impacts

The Project will involve the clearing of approximately 79 hectares of vegetation which will impact five plant community types of which approximately 5.12 hectares meets the listing criteria as an endangered ecological community under the *NSW Biodiversity Conservation Act 2016* (BC Act) and/or the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In addition to the vegetation communities requiring offsetting, five threatened entities species (1 plant and 3 fauna species) have also been identified as requiring offset requirements under the NSW Biodiversity Assessment Methodology. After impact avoidance and mitigation measures biodiversity credits would be required to offset the impacts of the Project. The biodiversity offset strategy for the Project will be developed during the assessment process in consultation with the NSW Department of Planning and Environment and based on the following offset options available under the BC Act, including:

- Land based offsets (potentially within the Wallaroo State Forest);
- Purchasing of credits from the market; and/or
- Payment into the Biodiversity Conservation Fund.

From an economic perspective, 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 on a 'no net loss' principle. The provision of offsets is therefore likely to have non-use values to the community that would be gained as a result of the Project. On the basis that the NSW offset policy works on the principle of 'no net loss', no additional economic costs warrant inclusion in the CBA apart from the costs of providing offsets. An allowance for biodiversity offset costs has been included in the capital costs of the Project.

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.

However, the Aboriginal Cultural Heritage Assessment identified that no Aboriginal objects or areas of archaeological potential were identified during the survey, and the entirety of the Project Area is considered to be of low archaeological potential. No significant Aboriginal cultural value were identified by Aboriginal parties contributing to the assessment. As such, the proposed quarry project is not expected to result in impacts to Aboriginal sites or values that would warrant an assessment of the economic value of these impacts.

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

Historic Heritage

Impacts on historic heritage can potentially have non-use values to the community, that can potentially be estimated using nonmarket valuation methods such as choice modelling. However, the Historic Heritage Assessment concluded that the Project is not considered to have an adverse impact on significant heritage fabric, views to, or the setting of any places or items of historical heritage significance within the Project Area or its vicinity. Consequently, there are no economic externality costs for inclusion in the CBA.

Visual Impacts

Visual impacts can potentially be estimated using the defensive expenditures method or property valuation method. However, the Visual Impact Assessment (VIA) identified that due to both topographic shielding and intervening forest vegetation, the quarry extraction and infrastructure areas are not likely to be visible from public or private viewing locations, including Italia Road, Nine Mile Road, the Pacific Highway or private residences. Visual impacts are likely to be limited to possible indirect glow associated with lighting for mobile equipment and the loading/operations area of the quarry which would be operational up until 10 pm Monday to Friday. Given the relative remoteness of the operations, and the intervening vegetation and topography, lighting is not expected to significantly or adversely affect the amenity of residences in the area.

The Visual Impact Assessment concluded that the potential for any adverse visual impacts associated with the Project is therefore considered limited. Consequently, there are no material economic externality costs for inclusion in the CBA.

Net Public Infrastructure Impacts

No net infrastructure costs to government are envisaged as a result of the Project. As detailed above, road maintenance costs will be subject to developer contributions to Port Stephens Council and the construction costs associated with the improved Pacific Highway intersection will be jointly borne by ARDG, Boral and Eagleton with no additional cost to the NSW Government or Council.

Given that 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. The contribution to the Pacific Highway intersection upgrade may have a positive impact on other operations in that this will further share the costs of these works which would otherwise have only been borne by Boral and Eagleton. These benefits have not been included in the CBA.

Economic Benefits to Existing Landholders

All land required for the Project is owned by State Forests. There is an opportunity cost to State Forest of allowing the land to be used for quarrying instead of forestry. ARDG will lease the subject land from State Forests, providing a financial payment. While in the CBA framework this payment itself is a transfer payment it can be conceptualised as being indicative of the opportunity cost that society faces. It is included in the operating costs of the Project rather than a benefit. Royalties payable to State Forests for quarry products are considered separately.

Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. In competitive markets, there are no real secondary benefits and costs either to suppliers to a project or purchasers of a project's output.⁸ Conservatively, this convention is adopted and hence no secondary benefits to the economic are included in the CBA.

Market Benefits to Workers

The Project will result in employment of 13 FTE people in quarrying and processing operations, and 35 people in transport.

As identified in the NSW Government (2015) Guideline, there may potentially be wage benefits associated with employment. Notwithstanding, there is considerably controversy about the measurement and inclusion of these benefits in NSW CBAs. Consequently, for the purpose of the CBA analysis, wage benefits have conservatively been left unquantified. Wage benefits are considered further in the LEA.

3.6 Consolidation of Value Estimates

3.6.1 Net Production Benefits

The present value of production costs and benefits, using a 7% discount rate, is provided in **Table 3.4**.

Based on the assumptions in Section 3.5, the project is estimated to have net production benefits of \$348M (present value at 7% discount rate), comprising \$334M in quarrying net production benefits and \$14M in ex-quarry transport benefits.

The net production benefits can be further apportioned to Australia and NSW based on ARDG being 100% NSW owned, an assumption that transport providers are 100% NSW owned, and company tax benefits (at a rate of 27.5%) accruing to NSW based on its population share i.e. 32%. On this basis, the net production benefits of the project that accrue to Australia and NSW are estimated at \$348M and \$290M (present value at 7% discount rate), respectively.

The estimated net production benefits that accrue to Australia and NSW can be used as a minimum threshold value or reference value against which the relative value of the residual environmental impacts of the project, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the project. It is a minimum threshold value as it does not include any potential wage benefits, any potential benefits to suppliers, any allowance for real price rises for sand as future demand outstrips limited supply.

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

⁸ There are no net benefits to suppliers because in a competitive market, all resources are fully employed so increases in net benefits to suppliers will be offset elsewhere in the economy from the withdrawal of resource that allow the suppliers to increase their production. There are no net benefits to purchasers because in a competitive market, competition in the purchasing of the project output will result in no net income to the purchaser and the project fully capturing the marginal value product (Sinden and Thampapillai, 1995, p. 57).

Table 3.4 - Net Production Benefits of the Project (\$M Present Values at 7% Discount Rate)

	Quarrying	Ex Quarry Transport	Total
Costs			
Opportunity cost of land	\$0		
Opportunity cost of capital	\$0		
Capital costs	\$33		
Operating cost	\$101	\$236	
Sub-total	\$134	\$236	\$369
Benefits			
Revenue	\$467	\$250	
Residual value of land and capital equipment	\$0		
Sub-total	\$467	\$250	\$717
Global Net Production Benefits	\$334	\$14	\$348
Community Payments	\$1		
Royalties	\$35		
Company Tax	\$81	\$4	
Residual Net Production Benefits	\$217	\$10	
Global Net Production Benefits	\$334	\$14	\$348
Community Payments	\$1		
Royalties	\$35		
Company Tax	\$81	\$4	
Residual Net Production Benefits	\$217	\$10	
Australian Net Production Benefits	\$334	\$14	\$348
Community Payments	\$1		
Royalties	\$35		
Company Tax	\$26	\$1	
Residual Net Production Benefits	\$217	\$10	
NSW Net Production Benefits	\$278	\$12	\$290

*Differences in totals are due to rounding.

3.6.2 Externalities

Instead of leaving the analysis as a threshold value exercise, an attempt has been made to qualitatively consider and where possible quantify the main environmental, cultural, and social impacts of the Project. **Table 3.5** summarises the results of the consideration of externalities in Section 3.5.3. Only GHG impacts differ between the Australian and NSW scope, albeit in a minor way.

Table 3.5 – Externality Impacts of the Project (\$M Present Values at 7% Discount Rate)

Benefits	Australia	NSW
Wage benefits to employment	Unquantified	
Economic benefits to existing landholders	No benefit - lease payment to FNSW assumed to reflect opportunity cost	
Economic benefits to suppliers	Unquantified	
Sub-total		
Costs		
Greenhouse gas emissions (Scope 1 and 3)	\$0.03	\$0.01
Air quality	Meets relevant criteria - no material residual impact	
Noise and blasting	Meets relevant criteria – no residual material impact	
Road transport	Cost of intersection upgrade included in capital costs Cost of local road pavement damage payment included in operating costs Cost of arterial road pavement damage included in heavy vehicle transport registration costs No material residual impact	
Surface water	No material residual impact	
Groundwater	Cost of WALs included in capital costs No material residual impact	
Biodiversity	Impacts on biodiversity are offset – cost of offsets included in capital costs	
Aboriginal heritage	No impact	
Historic heritage	No impact	
Visual	No material residual impact	
Net public infrastructure costs	No impact	
Loss of surplus to other industries	No impact	

From Section 3.5.3, it is evident that the main potential impacts of the Project are internalised into the production costs of the Project through mitigation measures, compensation payments, offsets and purchase of water allocations. Other quantified costs not already included in the production costs of the Project are associated with greenhouse gas costs, although from **Table 3.5** it is evident that these impacts to Australia and NSW are small or immaterial.

3.6.3 Net Social Benefits to Australia and NSW

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

The results from **Table 3.4** and **Table 3.5** are combined in **Table 3.6** to estimate the net social benefits of the Project to Australia and NSW, relative to both the base case.

Table 3.6– Net Social Benefits of the Project (\$M present value @ 7% discount rate)

Benefits	Australia	NSW
Net Production Benefits Quarrying		
Community Payments	\$1	\$1
Royalties	\$35	\$35
Company Tax	\$81	\$26
Residual Net Production Benefits	\$217	\$217
Sub-total	\$334	\$278
Net Production Benefits Ex-Quarry Transport		
Company Tax	\$4	\$1
Residual Net Production Benefits	\$10	\$10
Sub-total	\$14	\$12
Other Benefits		
Economic benefits to existing landholders	Assumed that lease payment reflects foregone timber production – no net benefit	Assumed that lease payment reflects foregone timber production – no net benefit
Economic benefits to suppliers	Unquantified	Unquantified
Wage benefits to employment	Unquantified	Unquantified
Sub-total	\$0	\$0
Total Benefits	\$348	\$290
Costs		
Greenhouse gas emissions (Scope 1 and 3)	\$0.03	\$0.01
Air quality	Meets relevant criteria - no material residual impact	
Noise and blasting	Meets relevant criteria – no residual material impact	
Road transport	Cost of intersection upgrade included in capital costs Cost of local road pavement damage payment included in operating costs Cost of arterial road pavement damage included in heavy vehicle transport registration costs No material residual impact	
Surface water	No material residual impact	
Groundwater	Cost of WALs included in capital costs No material residual impact	
Biodiversity	Impacts on biodiversity are offset – cost of offsets included in capital costs	
Aboriginal heritage	No impact	
Historic heritage	No impact	
Visual	No material residual impact	
Net public infrastructure costs	No impact	
Loss of surplus to other industries	No impact	
Sub-total	\$0	\$0
Net Social Benefits -	\$348	\$290

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

While the major environmental, cultural and social impacts have been quantified and included in the Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than approximately \$348M and \$290M for the Project to be questionable from an Australian and NSW economic efficiency perspective, respectively.

3.7 Distribution of NSW Costs and Benefits

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

The costs and benefits of the Project to NSW are potentially distributed among a range of stakeholders as identified in **Table 3.7**.

Table 3.7 - Incidence of NSW Costs and Benefits

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BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	AUSTRALIA (\$M)	NSW (\$M)
<i>Extraction and Processing Net Production Benefits</i>			
Community payments	Local community	\$1	\$1
Royalties	Forestry Corporation/NSW Government	\$35	\$35
Company tax (ARDG Pty Ltd)	Australian and NSW Government and households	\$81	\$26
Residual net producer surplus	ARDG Pty Ltd	\$217	\$217
<i>Transport Net Production Benefits</i>			
Company tax (Transport providers)	Australian and NSW Government and households	\$4	\$1
Net producer surplus	Transport providers	\$10	\$10
<i>Additional benefits</i>			
Economic benefits to existing landholders	Forestry Corporation	\$0	\$0
Economic benefits to suppliers	Suppliers of inputs to production	Not quantified	Not quantified
Wage benefits to employment	People employed in extraction and road transport	Not quantified	Not quantified

Table 3.7 (Cont'd) - Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	AUSTRALIA (\$M)	NSW (\$M)
<i>Environmental, social, and cultural costs*</i>			
Greenhouse gas emissions	Australian and NSW households	\$0.03	\$0.01
Air quality	Adjoining landholders	Meets relevant criteria - no material residual impact	
Noise and blasting	Adjoining landholders	Meets relevant criteria - no material residual impact	
Road transport	Users of local and arterial roads, Council and NSW Government	Intersection upgrade, local and arterial road maintenance all internalised into cost of the project No material residual impact	
Surface water	Other water users	No material residual impact	
Groundwater	Other water users and Australian and NSW households	No drawdown impacts on registered groundwater bores or groundwater dependent ecosystems Cost of WALs included in costs	
Biodiversity	Australian and NSW households	Impacts on biodiversity are offset – cost of offsets included in capital costs	
Aboriginal heritage	Aboriginal people and Australian and NSW households	No impact	
Historic heritage	Australian and NSW households	No impact	
Visual	Nearby landholders	No material residual impact	
Net public infrastructure costs	Australian and NSW Government	No impact	
Loss of surplus to other industries	Other local businesses	No impact	

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

3.8 Risk and Sensitivity Analysis

The main areas of environmental risk associated with Project relate to:

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

The Independent Planning Commission (formerly the Planning Assessment Commission) has previously identified that the financial viability of projects is a risk assumed by the project proponents (NSW PAC, 2018). Strong current and foreseeable demand for hard rock products is likely to underpin the financial viability of the project.

Any risks associated with funding rehabilitation costs in the event of early closure will be managed through a legally binding commitment between ARDG and the Forestry Corporation.

Risks associated with achieving intended biodiversity offsets requirements are assumed to be managed through the legislative scheme under the Biodiversity Conservation Act 2016 which is managed by the NSW Government.

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)⁹ of the Project presented in **Table 3.6** 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 NPV¹⁰.

In this sensitivity analysis, the CBA results for NSW were tested for a 20% change to the following variables¹¹ at a 4%, 7% and 10% discount rate:

- Quarry capital costs.
- Quarry operating costs.
- Quarry revenue.
- Net transport revenue.
- Greenhouse gas emission costs.

In addition, the sensitivity analysis includes a scenario where 100% of the global social damage costs of GHG emissions from the Project are included in the analysis, rather than just the impacts on NSW households.

Results are reported in **Table 3.8**. What this analysis indicates, is that CBA results at the NSW level are most sensitive to reductions in the value of hard rock products and increases in operating costs.

The strong demand for aggregates, armour rock, and road pavement materials that underpins the Project, together with limits on financially viable supply in proximity to major markets, suggests that sustained reductions in hard rock product value is highly unlikely. IBISWorld (2022) reports that crushed rock volumes are forecast to increase at a slow pace over the next five years with this limited supply growth expected to push prices higher.

Operating cost estimates are based on a detailed financial model of the business operations prepared by ARDG. The financial model draws on ARDG's experience in quarry operations at eight (8) different sites across NSW since 2018, as well as extensive experience in the resources sector over the last two decades. Consequently, sustained increases in modelled operating costs are unlikely.

The sensitivity analysis also indicated that the CBA results are not sensitive to changes in capital costs, which includes mitigation, compensation, and offset costs. 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

⁹ 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.

¹⁰ 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.

¹¹ An assessment of sensitivity to exchange rate fluctuations as required by the SEARs is not applicable to this development as all product is sold for domestic use. Potential flow-on effects from exchange rates on supplies (e.g. fuel) or capital (e.g. equipment) are captured in the consideration of sensitivity to operating and capital costs

these cost levels would have any significant impact on the CBA results. The CBA results are also not sensitive to the inclusion of global social damage costs of GHG emissions from the Project instead of the costs to NSW households only.

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

Table 3.8 - NSW CBA Results Sensitivity Testing (\$M Present Value)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	\$434	\$290	\$204
INCREASE 20%			
Quarry capital costs	\$428	\$284	\$199
Quarry operating costs	\$402	\$268	\$188
Value of quarry products	\$546	\$366	\$258
Net transport revenue	\$438	\$292	\$206
Greenhouse gas emission costs	\$434	\$290	\$204
DECREASE 20%			
Quarry capital costs	\$441	\$295	\$208
Quarry operating costs	\$467	\$312	\$220
Value of quarry products	\$322	\$214	\$149
Net transport revenue	\$431	\$287	\$202
Greenhouse gas emission costs	\$434	\$290	\$204
	100% GLOBAL SOCIAL DAMAGE COST		
Greenhouse gas emission costs	\$420	\$279	\$196

4 THE REGIONAL ECONOMY

4.1 Introduction

The project is in the Port Stephens LGA, approximately 30 km north of Newcastle. However, the locality/region that has the potential to provide inputs to the project and derive economic benefits from the project includes the LGAs of Port Stephens, Newcastle, Lake Macquarie, Cessnock, Maitland, and the Central Coast. This is the locality/region that is considered in this Economic Assessment.

4.2 Characterisation of the Region

4.2.1 Residents of the Region

Table 4.1 provides some characteristics of the usual residents of the six LGAs comprising the regional economy based on the Australian Bureau of Statistics (ABS) 2021 Census of Population and Housing. In 2021, the region had a population of 958,448 and a labour force of 457,547, with the Central Coast LGA comprising 36 per cent and 35 per cent of the total, respectively. In 2021, there were 21,862 people unemployed with the majority of these located in the Central Coast LGA and the highest unemployment rate (5.6%) being in Cessnock LGA.

The main occupations of usual residents varied from LGA to LGA with the main occupation in the Newcastle, Maitland, Lake Macquarie, and Central Coast LGAs being Professionals and the main occupation in the Cessnock, and Port Stephens LGAs being Technicians and Trades Workers. The main occupation in the region is Professionals (21.5%) followed by Technicians and Trades Workers (15.2%) and Community and Personal Service Workers (13.5%).

The main industry sectors (4-digit) in which usual residents were employed in 2021 are provided in **Table 4.2**. For the total region the most significant sectors were *Hospitals (except Psychiatric Hospitals), Other Social Assistance Services, Supermarket and Grocery Stores, Aged Care Residential Services, and Takeaway Food Services*. However, there is some heterogeneity between LGAs with the most significant sector in the Newcastle LGA being *Hospitals (except Psychiatric Hospitals)*, the most significant sector in the Maitland and Cessnock LGAs to the northwest of Newcastle being *Coal Mining*, and the most significant sector in the Port Stephens LGA being *Defence* (driven by Williamstown Royal Australian Air Force (RAAF) base).

Sixteen per cent of the working usual residents of the region work outside the region, with the main locations being No Fixed Address (NSW) (5%), Sydney (2%), Singleton (2%) and Hornsby (1%). The main industry sectors that people working outside the region are engaged in are *Construction, Health Care and Social Assistance, and Mining*.

Table 4.1 - Characteristics of Usual Residents

	Newcastle		Maitland		Cessnock		Port Stephens		Lake Macquarie		Central Coast		Total Region	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Demographics														
Population	168,873		90,226		63,632		75,276		213,845		346,596		958,448	
Median Age	37		36		37		47		42		43			
In Labour Force	90,453	53.6%	45,398	50.3%	28,712	45.1%	32,618	43.3%	102,070	47.7%	158,296	45.7%	457,547	47.7%
Unemployed	4,392	4.9%	2,118	4.7%	1,595	5.6%	1,632	5.0%	4,662	4.6%	7,463	4.7%	21,862	4.8%
Median household weekly income	1,760		1,766		1,493		1,372		1,623		1,507			
Unoccupied private dwellings	5,531	7.7%	1,744	5.10%	2,108	8.5%	5,236	15.4%	5,384	6.3%	14,532	9.9%	34,535	
Median rent	400		370		340		370		375		400			
Occupations														
Professionals	24,987	29.0	7,369	17.0	3,204	11.8	4,803	15.5	20,897	21.5	30,741	20.4	92,001	21.5
Community and Personal Service Workers	11,544	13.4	5,789	13.4	3,765	13.9	4,338	14.0	12,834	13.2	19,613	13.0	57,883	13.5
Technicians and Trades Workers	10,417	12.1	7,031	16.2	4,914	18.1	5,310	17.1	15,383	15.8	22,054	14.6	65,109	15.2
Clerical and Administrative Workers	10,025	11.6	5,399	12.5	2,919	10.8	3,840	12.4	12,800	13.1	19,738	13.1	54,721	12.8
Managers	9,782	11.4	4,519	10.4	2,547	9.4	3,472	11.2	10,586	10.9	18,585	12.3	49,491	11.5
Sales Workers	7,072	8.2	3,955	9.1	2,411	8.9	2,848	9.2	8,383	8.6	13,860	9.2	38,529	9.0
Labourers	6,765	7.9	4,466	10.3	3,472	12.8	3,381	10.9	8,820	9.1	14,666	9.7	41,570	9.7
Machinery Operators and Drivers	4,260	4.9	4,057	9.4	3,388	12.5	2,371	7.7	6,267	6.4	9,014	6.0	29,357	6.8

Source: ABS, 2016 Census of Population and Housing, Community Profiles

Table 4.2 - Top 5 Industry Sectors of Employment for Usual Residents

Newcastle	No.	%	Maitland	No.	%	Cessnock	No.	%	Port Stephens	No.	%	Lake Macquarie	No.	%	Central Coast	No.	%	Total Region	No.	%
Hospitals (except Psychiatric Hospitals)	5,654	6.6	Coal Mining	2,191	5.1	Coal Mining	2,021	7.5	Defence	1,199	3.9	Hospitals (except Psychiatric Hospitals)	5,127	5.3	Hospitals (except Psychiatric Hospitals)	7,484	5.0	Hospitals (except Psychiatric Hospitals)	20,736	5.5
Other Social Assistance Services	3,656	4.2	Other Social Assistance Services	1,729	4.0	Other Social Assistance Services	912	3.4	Aged Care Residential Services	1,062	3.4	Other Social Assistance Services	3,653	3.8	Other Social Assistance Services	5,194	3.4	Other Social Assistance Services	14,062	3.7
Cafes and Restaurants	2,389	2.8	Hospitals (except Psychiatric Hospitals)	1,701	3.9	Aged Care Residential Services	858	3.2	Supermarket and Grocery Stores	1,001	3.2	Aged Care Residential Services	2,902	3.0	Aged Care Residential Services	4,838	3.2	Supermarket and Grocery Stores	11,779	3.1
Takeaway Food Services	2,251	2.6	Takeaway Food Services	1,236	2.9	Hospitals (except Psychiatric Hospitals)	795	2.9	Other Social Assistance Services	955	3.1	Supermarket and Grocery Stores	2,765	2.8	Supermarket and Grocery Stores	4,711	3.1	Aged Care Residential Services	11,734	3.1
Higher Education	2,167	2.5	Supermarket and Grocery Stores	1,140	2.6	Supermarket and Grocery Stores	741	2.7	Takeaway Food Services	832	2.7	Takeaway Food Services	2,477	2.5	Takeaway Food Services	4,225	2.8	Takeaway Food Services	11,399	3.0

Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Community Profiles

An indication of the health of an economy can be gained from population changes. This theory of regional economic growth suggests that places that are able to attract population immigration¹² create increased demand for goods and services and thus more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen, 1990). Conversely, population losses can contribute to a 'vicious cycle' of decline whereby reduced populations results in closure of services, which in turn makes it difficult to attract new populations (Sorensen, 1990).

Trends in regional economies as a result of globalisation and associated structural adjustment include:

- loss of significant industries such as abattoirs and timber mills from many rural areas;
- increased mechanisation of agriculture and aggregation of properties, resulting in loss of employment opportunities in this industry;
- growth of regional centres, at the expense of smaller towns;
- preference of Australians for coastal living, particularly for retirement; and
- preference of many of today's fastest growing industries for locating in large cities (Collits, 2000).

The result is that there has been declining population in many rural LGAs that are in non-coastal areas. There has also been a decline in the population of smaller towns even in regions where the population has been growing.

Against this backdrop, it is evident that the population of the region has been growing, at a rate of 15.1% since 2011, slightly lower than the population growth rate for NSW (which is driven by the population growth rate for Greater Sydney), but higher than the growth rate for areas outside Greater Sydney. The regions proximity to Greater Sydney is a main reason for its high population growth.

Table 4.3 - Population Growth

	2011	2016	2021	Growth Rate 2011 - 2016	Growth Rate 2016 - 2021	Growth Rate 2011- 2021
Newcastle	148,535	155,411	168,873	4.6%	8.7%	13.7%
Maitland	67,478	77,305	90,226	14.6%	16.7%	33.7%
Cessnock	50,840	55,560	63,632	9.3%	14.5%	25.2%
Port Stephens	64,807	69,556	75,276	7.3%	8.2%	16.2%
Lake Macquarie	189,006	197,371	213,845	4.4%	8.3%	13.1%
Central Coast	312,186	327,736	346,596	5.0%	5.8%	11.0%
Total Region	832,852	882,939	958,448	6.0%	8.6%	15.1%
NSW	6,917,658	7,480,228	8,072,163	8.1%	7.9%	16.7%

Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Community Profiles

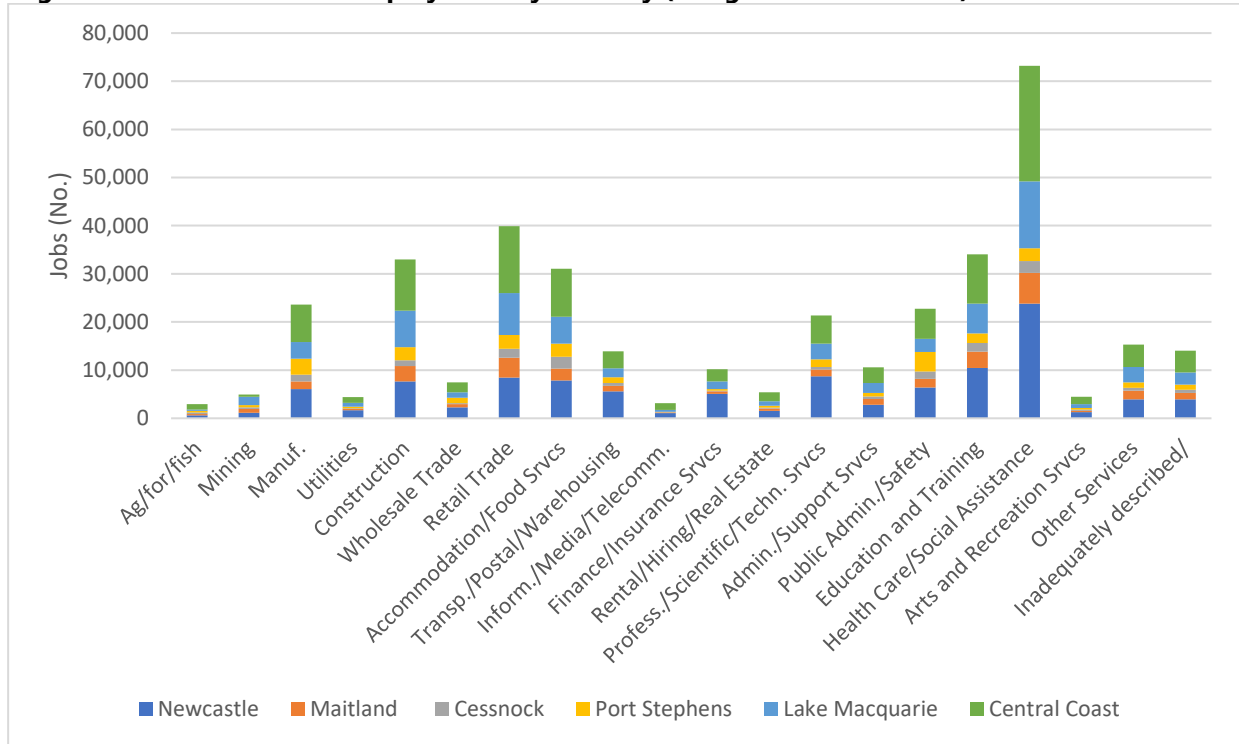
4.2.2 Economic Activity in the Region

An indication of the nature of the regional economy can be gained by examining place of work employment by industry data - refer to Figure 4.1. This indicates the significance of the *Health Care and Social Assistance, Retail Trade, Construction, Accommodation and Food Services, Education and Training, and Manufacturing* sectors. Health Care and Social Assistance is the largest sector in all LGAs apart from Cessnock where Accommodation and Food Services is the largest sector and Port Stephens where Public Administration and Safety is the largest sector. Retail Trade is the second largest sector in all LGAs apart

¹² Mainly due to natural endowments and comparative advantage in certain industry sectors.

from Port Stephens where Manufacturing is the second largest sector and Newcastle where Education and Training is the second largest sector.

Figure 4.1 - Place of Work Employment by Industry (1-digit ANZSIC Sectors)



Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Working Population Profiles

Gillespie Economics has produced an Input-Output (IO) table for the regional economy using the Generation of Regional Input Output Tables (GRIT) procedure developed by the University of Queensland and recognised internationally - Refer to Attachment 1. The Gross Regional Product (GRP) of the regional economy was estimated at \$54,707 million for 2020.

The region is a net importer, with exports out of the region of \$19,235 million and imports into the region of \$37,761 million. Using the IO industry classifications, the largest exporting industries by value are:

- *Coal Mining* (\$5,930 million)
- *Basic Non-Ferrous Metal Manufacturing* (\$4,255 million)
- *Insurance and Superannuation Funds* (\$1,483 million)
- *Petroleum and Coal Product Manufacturing* (\$585 million)
- *Iron and Steel Manufacturing* (\$576 million).

Exporting sectors are considered to be key drivers of regional economies and reflect a region’s endowments and competitive advantages.

The following analysis uses the IO table data but reports the findings in terms of both the IO industry classifications and the ANZSIC One-digit industry classification.

Using the IO industry classifications, in terms of value-added, it is estimated that *Defence; Retail Trade; Health Care Services; Residential Care and Social Assistance; and Construction Services* had the highest value added - in total, equal to approximately 23 per cent of the regional economy and 32 per cent of regional employment – Table 4.4.¹³

Table 4.4 - Gross Value Added for the 5 Largest Industries in the Regional Economy (IO Sectors)

Industry	Gross Value Added (\$m)	Proportion of Regional Economy (%)	Proportion of Regional Employment (%)
Coal mining	3,568	7%	1%
Residential Care and Social Assistance Services	3,149	6%	9%
Health Care Services	3,015	6%	11%
Retail Trade	2,524	5%	11%
Primary and secondary education services (inc preschool and special schools)	2,173	4%	7%
Total	14,430	26%	39%

Source: Gillespie Economics Input-Output Table

Based on the ANZSIC One-digit industry classification, in terms of value-added, it is estimated that *Rental, Hiring and Real Estate Services; Health Care and Social Assistance; Construction; Mining; and Financial and Insurance Services* had the highest value added - in total, equal to approximately 49 per cent of the regional economy and 35 per cent of regional employment - Table 4.5.

Table 4.5 - Gross Value Added for the 5 Largest Industries in the Regional Economy (ANZSIC One-Digit Sectors)

Industry	Gross Value Added (\$m)	Proportion of Regional Economy (%)	Proportion of Regional Employment (%)
Rental, Hiring and Real Estate Services	8,572	16%	1%
Health Care and Social Assistance	6,164	11%	20%
Construction	4,567	8%	9%
Mining	4,029	7%	1%
Financial and Insurance Services	3,664	7%	3%
Total	26,997	49%	35%

Source: Gillespie Economics Input-Output Table

¹³ Gross Value Added (GVA) measures the value of goods and services produced in a region.

5 LOCAL EFFECTS ANALYSIS

5.1 Introduction

The CBA in Section 3 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 examines local effects. It focuses on the operational phase of the Project.

The local area is defined as the LGAs of Port Stephens, Newcastle, Lake Macquarie, Cessnock, Maitland, and the Central Coast., within which the Project is located and is the region considered likely to be main source of labour and non-labour inputs for the Project.

5.2 Direct Effects Related to Employment of Existing Residents Only

The Project will generate employment for approximately 12 full time equivalent (FTE) quarry workers and 35 transport jobs from 2030 when operating at full production i.e. 47 FTE in total. Ninety seven percent of quarry workers and 94% of transport workers are assumed to reside in the local area,¹⁴ with the remainder commuting from outside the local area.

In estimating the effects related to local employment, the LEA method focusses on net income (net wages) that a project provides to the local area. It does this by focusing on the projects employment that would ordinarily be resident in the locality and for these people estimating the net increase in income as the difference between income in the project compared to the average level of net income in the local area (i.e. what they might otherwise receive in an alternative job). The increase in net income is converted to net FTE jobs by dividing this incremental net income by the average net wage in the project. This is a minimum estimate as it assumes full employment in the region and hence employees ordinarily resident in the locality would always be employed in some capacity in the region, albeit at a lower wage, and the jobs in the region from which people come to fill the projects jobs remain vacant. On this basis, the net income to the local area and net jobs provided by the project are summarised in Table 5.1.

Table 5.1 - Analysis of Net Income Increase and FTE Job Increase Assuming Full Employment

Attribute	Quarry	Transport	Total
a) Direct incremental employment	12	35	47
Number that already reside in the region	12	33	45
b) Average net income in sector	\$90,573	\$57,348	
c) Average net income in other industries*	\$50,143	\$50,143	
d) Average increase in net income per job (b-c)	\$40,430	\$7,205	
e) Increase in net income per year due to direct employment	\$470,605	\$237,045	\$707,650
f) FTE (e/b)	5	4	9

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

5.3 Direct Effects Related to Non-Labour Expenditure

The total annual non-labour expenditure (operating costs of the Project after subtraction of wages) is \$7.8M and \$18.7M, respectively for extraction and transport.

¹⁴ Based on ABS 2021 Census of Population and Housing 4-digit employment by industry by place of usual residence data.

However, not all this expenditure will accrue to the local area. From a 2020 input-output table of the local area economy developed by Gillespie Economics, the percentage of this non-labour expenditure accruing to the local area is 54% and 61%, respectively i.e. \$4.2M and \$11.4M.

5.4 Second Round and Flow-On Effects

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

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

5.5 Regional Economic Impact Assessment

Standard regional economic impact assessment using input-output analysis, is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. The presence of job chain effects in a region, means that to the extent that jobs from which people come, to fill Project jobs, are themselves filled and their jobs are also filled until the lowest paid jobs are filled by people from unemployment, new labour force participants, then new wages in the region will approximate the total incremental wages associated with the project. Refer to Attachment 1.

In this framework, the annual direct and indirect economic activity impacts in the local area from the quarry operations, ex-quarry transport and in total are summarised in **Tables 5.2, 5.3** and **5.4**, respectively.

Table 5.2 – Gross Annual Direct and Indirect Regional Economic Impacts of the Quarry

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output (\$M)	45	6	3	10	55
<i>Type IIA Multiplier</i>	1.00	0.14	0.08	0.21	1.21
Value Added (\$M)	37	3	2	5	42
<i>Type IIA Multiplier</i>	1.00	0.08	0.05	0.13	1.13
Income (\$M)	1	2	1	3	4
<i>Type IIA Multiplier</i>	1.00	1.20	0.59	1.79	2.79
Employment (No.)	12	19	13	32	44
<i>Type IIA Multiplier</i>	1.00	1.60	1.09	2.69	3.69

Table 5.3 – Gross Annual Direct and Indirect Regional Economic Impacts of Ex-Quarry Transport

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output (\$M)	23	16	8	25	47
<i>Type IIA Multiplier</i>	1.00	0.73	0.37	1.09	2.09
Value Added (\$M)	4	8	5	12	16
<i>Type IIA Multiplier</i>	1.00	1.98	1.27	3.25	4.25
Income (\$M)	2	5	2	7	10
<i>Type IIA Multiplier</i>	1.00	2.18	0.85	3.04	4.04
Employment (No.)	35	65	32	97	132
<i>Type IIA Multiplier</i>	1.00	1.85	0.90	2.76	3.76

Table 5.4 – Gross Annual Direct and Indirect Regional Economic Impacts of Quarrying and Transport

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output (\$M)	68	23	12	34	102
<i>Type IIA Multiplier</i>	1.00	0.33	0.17	0.51	1.51
Value Added (\$M)	41	10	7	17	58
<i>Type IIA Multiplier</i>	1.00	0.25	0.17	0.42	1.42
Income (\$M)	4	7	3	10	14
<i>Type IIA Multiplier</i>	1.00	1.82	0.76	2.57	3.57
Employment (No.)	47	84	45	129	176
<i>Type IIA Multiplier</i>	1.00	1.79	0.95	2.74	3.74

5.6 Other Effects

5.6.1 Regional Economic Impacts of Displaced Forestry

The subject land is only periodically used to produce small wood. The regional economic activity associated with this would be negligible relative to the economic activity associated with the project.

5.6.2 Other Wage Impacts

In the short term, increased regional demand for labour as a result of the project (relative to the “without Project” scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the region and the availability and mobility of labour from outside the region. However, given the scale of the project employment and the availability of labour inside and outside the region, wage impacts would be negligible. Where upward pressure on regional wages occurs, it represents an economic transfer between employers and owners of skills and would in turn attract skilled labour to the region leading to future downward pressure on wages.

5.6.3 Housing Impacts

The project is not expected to result in any substantial in-migration of workers and their families and consequently the impact on housing prices is expected to be negligible.

5.6.4 Demand on Local Infrastructure and Services

Demand for local infrastructure and services arises from the production process as well as demands of the workforce and their families. The project will fully fund any demand it has for local infrastructure and services for the production process e.g. local roads, intersections etc. It will not result in any changes in population levels in the local area and therefore will not generate any additional community demand for local infrastructure and services.

It is also noted that quarry products such as those that will be produced by the project are often a key input to the provision of community infrastructure such as roads.

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

The distribution of costs and benefits of the project are summarised in **Table 3.6**. The main potential effects on the local community are road transport impacts and biodiversity impacts – both of which will be mitigated and offset at the proponent’s cost. Local greenhouse gas impacts are immaterial.

5.8 Summary of Local Effects

A summary of local effects of the Project is provided in **Table 5.5**.

Table 5.5 - Summary of Effects on the Local Community

Annual Local Effects	Direct Total	Direct Already Resident in the Local Area	Net
Employment FTE	47	45	9
Net Income (\$M)			0.7
Non-labour expenditure in the Local Area (\$M)	15.6		
Annual Regional Impacts	Direct	Flow-on	Total
Output (\$M)	68	34	102
Value-added (\$M)	41	17	58
Income (\$M)	4	10	14
Employment	47	129	176
Other Local Economic Impacts			
Displaced activities	No material impact*		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Demand on local infrastructure and services	Proponent will fully fund the demand it has for local infrastructure and services for the production process e.g. local roads, intersections etc		
Local Environmental Impacts			
Greenhouse gas emissions (Scope 1 and 3)	\$0.001M**		
Road Transport	Intersection upgrade, local and arterial road maintenance all internalised into cost of the project		
Biodiversity	Impacts on local biodiversity are offset		

* Materiality refers to whether valuation of these impacts would have any bearing on the estimated net social benefits of the Project. NSW Government (2012) identified that if a Project has an NPV of say “\$20 million, costs or benefits valued at less than \$1 million are unlikely to be material.”

**This figure is the estimated impact on NSW households apportioned to households in the Local Area. The regional population is 12% of the NSW population.

*** Unless otherwise specified monetary amounts are in 2022 dollars.

6 ECONOMIC MANAGEMENT MEASURES

It is evident from Section 5 that construction and operation of the project will have net positive impacts on the level of economic activity in the regional economy.

ARDG proposes to work in partnership with the local Council and the local community to help maximise the projected economic regional benefits whilst minimising any impacts. In this respect, a range of general economic management measures are proposed and would include for example:

- Employment of regional residents preferentially where they have the required skills and experience and can demonstrate a cultural fit with the organisation.
- Participating, as appropriate, in business group meetings, events or programs in the regional community.
- Locally sourcing non-labour inputs to production where local producers can be cost and quality competitive.
- Provision of community grants through various initiatives and programs within the local community, including the education, arts, sporting, and culture sectors.

7 CONCLUSION

A CBA of the project indicated that it would have net production benefits to NSW of \$290M (present value at 7% discount rate) comprising \$278M in quarrying benefits, and \$12M in ex quarry transport benefits.

The above estimate of NSW net production benefits of the project includes capital and operating costs associated water access licences, biodiversity offsets, road intersection upgrades and road pavement maintenance costs. It also includes the costs of mitigation, monitoring, and management of other potential impacts. Externalities (including calculated costs of greenhouse gas impacts to NSW) which are not captured in operating or capital expenses have been assessed as being negligible. Consequently, the project is estimated to have net social benefits to NSW, and hence is desirable and justified from an economic efficiency perspective. Given the nature of predicted impacts, it is considered highly unlikely that residual environmental and social impacts would result in any significant change to the predicted net social benefits of the project to NSW.

The project's predicted net social benefits to NSW remain robust under a range of different sensitivity scenarios considered.

As well as providing net economic and social benefits to NSW, the Project will provide direct economic activity, including jobs, to the local area economy, and indirect economic activity to the local area via both wage and non-wage expenditure.

The project will provide 47 direct jobs, comprising 12 quarry jobs and 35 ex-quarry transport jobs. Assuming that those that already reside in the local area would have otherwise been already employed and that job vacancies created by these people filling the project jobs remain unfilled (i.e. no job chain effects), the incremental disposable wages accruing to the region from project is \$0.7M per annum. This is equivalent to 9 direct full time equivalent (FTE) jobs. This is a minimum estimate as it assumes full employment in the region and hence the jobs from which people come to fill the project jobs remain vacant.

Standard regional economic impact assessment using IO analysis, is not restricted to a focus on the existing labour force in the local area and does not assume an absence of job chain effects. In this framework, the project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- \$102M in output;
- \$58M in value-added;
- \$14M in gross wages; and
- 176 jobs.

The main local environmental impacts are internalised into the production costs of ARDG via mitigation, offset and compensation costs. Residual local environmental impacts after mitigation, offset and compensation are likely to be immaterial.

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ATTACHMENT 1 – COMPARISON OF INPUT-OUTPUT ANALYSIS AND THE LEA METHOD

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the quarry site then all these jobs are counted in IO analysis as a direct effect i.e. direct employment in the region, because the jobs are located in the region. All income paid to employment is also included as it is generated in the economy and IO tables are based on place of work. However, in assessment of the impacts of a project on the regional economy only the income of employees living in the region are counted as direct income effects since it is only wages expenditure of those living in the region that flows through the regional economy. In IO analysis, if 40% of a project's jobs are filled by people who already reside in the region then the **total** wages of these people is counted as a direct regional income effect of the project. Similarly, if 40% of the new jobs are taken by people who migrate into the region this is also counted as direct income for the region, as it is income that will accrue to people living in the region even though they are new residents. In impact assessment using 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 "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 (income and the average level of income in other industries in the region. Incremental direct employment is then calculated by dividing this incremental income by the average wage in mining.

The guideline ignores workers who migrate into the region to work. However, using the rationale of the guideline, workers who migrate into the region to take jobs in a project provide a greater level of incremental income and spending in the region than those that 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 "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 mining jobs. It would only be discounted if the chain ends with employment of those from local residents in the unemployment pool (who are receiving an allowance and hence already are spending income in the region), if jobs remain unfilled or if jobs are filled by a commuter workforce. The latter is less likely for lower paying jobs down the job chain. In periods of higher unemployment rates, jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new jobs.

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

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

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

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

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