F.11 Economic assessment

Gunlake Quarry Continuation Project
Economic Assessment

Prepared for

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Background

Gunlake Quarries Pty Ltd (Gunlake) operates a hard rock quarry (the 'Quarry') located at 715 Brayton Road, Marulan NSW. The Quarry is approximately 7 kilometres (km) north-west of the centre of Marulan in the Goulburn Mulwaree local government area (LGA).

Since the Quarry received its most recent approval in 2017, the tonnage of product dispatched by the Quarry has steadily increased and, with an infrastructure boom across the State, Gunlake forecast that demand for products from the Quarry will continue to increase. In response to the increased demand for products from the Quarry, it is proposed to increase the tonnage of product dispatched along the Primary Transport Route. This will require more truck movements than currently approved. The additional truck movements will all occur on the recently upgraded Primary Transport Route that has been designed with ample capacity for additional truck movements. These proposed changes are known as the Gunlake Quarry Continuation Project (the 'Continuation Project'). The ignimbrite hard-rock resource will continue to be extracted and processed using the methods currently employed at the Quarry.

The proposed development is classified as a State Significant Development (SSD) under Schedule 1, Clause 7 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). Gunlake propose to lodge a new SSD application and environmental impact statement (EIS) for the Continuation Project.

Economic Assessment Methods

The Economic Assessment of the Continuation Project comprises:

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

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

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

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

Cost Benefit Analysis

A CBA of the Continuation Project indicated that, compared to the Extension Project, it would have incremental net production benefits to NSW of $74M (present value at 7% discount rate) comprising $64M in quarrying benefits and $10M in ex quarry transport benefits.

If the incremental 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 the incremental net production benefits of the Continuation Project to NSW includes the costs of environmental mitigation costs. The main incremental residual environmental impacts of the Project, that have not already been incorporated into the estimate of net production benefits, relate to greenhouse gas (GHG) emissions (valued at $0.002M), and the opportunity cost of groundwater WALs (valued at $0.13M). The value of these incremental residual economic costs is considerably less than the estimated net production benefits of the Continuation Project. Consequently, the Continuation Project is estimated to have net social benefits to NSW, and hence is desirable and justified from an economic efficiency perspective.

Local Effects Analysis

As well as providing net 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 Continuation Project will provide a total of 228 direct jobs, comprising 90 quarry jobs and 138 transport jobs (full-time equivalent). 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 net income and incremental net employment to local residents as a result of the Continuation Project ramps up to $1.7M in net income and 22 jobs from 2026 to 2042. It increases to $6.2M in net income and 79 jobs in 2043 and maintains this level of incremental impact until 2051.

Total incremental non-labour expenditure accruing to the region each year from the Continuation Project is estimated at $20M from 2023 to 2042, and $51M from 2043 to 2051.

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

Supplementary Local Effects Analysis

The supplementary LEA, 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 quarrying component of the Continuation Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $143M in output;
- $58M in value-added;
- $18M in gross wages; and
- 276 jobs.

The ex-quarry transport component of the Continuation Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $134M in output;
- $57M in value-added;
- $29M in gross wages; and
- 455 jobs.

These are the total regional impacts of the Continuation Project but also represent the incremental impacts from 2043 to 2051. In earlier years the incremental impacts of the Continuation Project will be approximately 38% of these impacts.

1 INTRODUCTION

1.1 Overview

Gunlake Quarries Pty Ltd (Gunlake) operates a hard rock quarry (the 'Quarry') located at 715 Brayton Road, Marulan NSW. The Quarry is approximately 7 kilometres (km) north-west of the centre of Marulan in the Goulburn Mulwaree local government area (LGA). The land surrounding the Quarry is rural land with a low population density.

Since the Quarry received its most recent approval in 2017, the tonnage of product dispatched by the Quarry has steadily increased and, with an infrastructure boom across the State, Gunlake forecast that demand for products from the Quarry will continue to increase. In response to the increased demand for products from the Quarry, it is proposed to increase the tonnage of product dispatched along the Primary Transport Route. This will require more truck movements than currently approved. The additional truck movements will all occur on the recently upgraded Primary Transport Route that has been designed with ample capacity for additional truck movements. These proposed changes are known as the Gunlake Quarry Continuation Project (the 'Continuation Project'). The ignimbrite hard-rock resource will continue to be extracted and processed using the methods currently employed at the Quarry.

The proposed development is classified as a State Significant Development (SSD) under Schedule 1, Clause 7 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). Gunlake propose to lodge a new SSD application and environmental impact statement (EIS) for the Continuation Project.

1.2 Assessment approach and requirements

Economic Assessment requirements in EISs 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); and
- the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and ***economic impacts in the locality***.

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 Continuation Project, issued on 15 April 2020 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 Continuation Project are needed:

- a CBA; and
- a LEA.

This report comprises of the following sections:

- Section 2 - a description of the Continuation Project and its local setting;
- Section 3 - a discussion of the significance of the resources;
- Section 4 - a CBA of the Continuation Project;
- Section 5 - a description of the regional economy;
- Section 6 - a LEA including an assessment of regional economic impacts using IO analysis;
- Section 7 - a conclusion.

The individual SEARs requirements relevant to this Economic Assessment and where they are addressed in this report are provided in Table 1.1.

Table 1.1 SEARs Relating to the Economic Assessment

Assessment requirement from SEARs	Section of report where addressed
• the significance of the resource;	Section 3
• 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	Section 4
• the demand on local infrastructure and services	Section 6

2 PROJECT DESCRIPTION AND SETTING

2.1 The site

The Quarry is located wholly on Lot 13 DP 1123374. There are biodiversity management areas in Lot 13 DP1123374, Lot 12 DP1123374, Lot 271 DP750053 and Lot 1 DP841147. These lots are owned by Gunlake Quarries Pty Ltd.

The land surrounding the Quarry is rural with low population density, predominately used for agriculture, generally grazing. Built features immediately surrounding the Quarry include dams, access tracks and fences. There are a small number of residences around the Quarry. The nearest town is Marulan, about 7 km south-east of the site boundary.

Holcim's Johnniefelds Quarry is about 1 km east of Gunlake Quarry and, at its closest point Holcim's Lynwood Quarry is about 750 m south of Gunlake Quarry.

The native vegetation in the Quarry site and surrounds has been highly modified by historical clearing and grazing. Patches of remnant vegetation largely occur in drainage lines. There are some large blocks of native vegetation south and south-east of the Quarry site.

There are two creek systems in the Quarry site, Chapmans Creek and an unnamed tributary of Chapmans Creek. Chapmans Creek is an ephemeral watercourse located on the northern site boundary. Chapmans Creek flows north-east into Joarimin Creek. Joarimin Creek is also ephemeral and drains to Wollondilly River, approximately 8.6 km north-east of the Quarry site.

2.2 Continuation Project description

Gunlake seeks a new development approval for the Continuation Project that allows:

- ongoing Quarry operations;
- a maximum of 375 inbound and 375 outbound daily truck movements with up to 4.2 million tonnes per annum (Mtpa) of Quarry products transported from the site in any calendar year;
- 24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday;
- an extraction depth of 546 metres Australian Hight Datum (mAHD); and
- a 30-year Quarry life (from the date of Continuation Project approval).

The Continuation Project operations would remain similar to the currently approved Extension Project operations with a summary of the key elements of the approved Extension Project compared to the Continuation Project is provided in Table 2.1.

Table 2.1 Extension Project compared to the Continuation Project

Project element	Approved Extension Project	Proposed Continuation Project
Extraction method	Blasting and excavation.	Blasting and excavation.
Resource	Ignimbrite hard-rock.	Ignimbrite hard-rock.
Extraction	Quarry pit - pit depth of 572 mAHD.	Quarry pit - pit depth of 546 mAHD (ie 26 m deeper than the Extension Project). No change to pit disturbance area.
Operations	Onsite rock processing, including crushing and screening.	Onsite rock processing, including crushing and screening.
Product transport	Transport of up to 2.6 million tonnes per annum (Mtpa) of Quarry products. Truck movements limited to: • a maximum of 295 inbound movements and 295 outbound movements, including no more than 38 outbound truck movements on the Secondary Transport Route, per working day; and • an average of 220 inbound movements and 220 outbound movements, including no more than 25 outbound movements on the Secondary Transport Route, per working day (averaged over the working days in each quarter).	Transport of up to 4.2 Mtpa of quarry products. Total truck movements limited to: • a maximum of 375 inbound movements and 375 outbound movements, including no more than 38 outbound laden movements on the Secondary Transport Route, per working day; and • an average of no more than 25 outbound movements on the Secondary Transport Route, per working day (averaged over the working days in each quarter).
General infrastructure	Offices, amenity buildings, processing plant and other minor infrastructure.	Offices, amenity buildings, processing plant and other minor infrastructure.
Management of wastes	Overburden[1] is emplaced in designated emplacement areas. Receipt of up to 30,000 tonnes of cured concrete per calendar year for beneficial reuse/recycling. No other classified waste materials to be received on site.	Overburden is emplaced in designated emplacement areas. Receipt of up to 50,000 tonnes of cured concrete per calendar year for beneficial reuse/recycling. No other classified waste materials to be received on site.
Hours of operation	24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday.	24-hours Quarry operations Monday to Saturday, except 6 pm Saturday to 2 am Monday.
Blasting	Up to twice weekly, 9 am to 5 pm Monday to Friday.	Up to twice weekly, 9 am to 5 pm Monday to Friday.
Quarry life	To 30 June 2042.	Extension of the Quarry life to 30 years from the date of approval.

These changes will require an increased quarry and transport workforce.

Further information on the Continuation Project is available in the Continuation Project EIS.

[1] 'Overburden': any extracted unsalable material.

3 SIGNIFICANCE OF THE RESOURCE

The rock resource at Gunlake Quarry is within the Devonian Bindook Volcanic. The complex comprises a north-northeast trending series of volcanic units located north of the intrusive Marulan granite. Gunlake Quarry is located on a proven rock resource of approximately 180 Mt of ignimbrite. The igneous rock deposit continues well over 100 m below the surface (EMM, 2016).

The hard rock is suitable for uses in a range of quarry products including concrete and sealing aggregates, rail ballast, manufactured sand and road bases. To date, only a small proportion of the 180 Mt of the resource has been quarried (EMM, 2016).

The demand for quarry products is driven by population growth and the resulting need for additional housing, land subdivision, provision of trunk infrastructure, major landscaping projects, upgrading of road, rail and other transport networks, additional commercial and industrial development and the development of community, cultural and recreational infrastructure.

The largest individual market for quarry products in NSW is the Sydney region. Until recently, the supply of quarry products to the Sydney Region was dominated by production at Penrith Lakes. The Penrith Lakes Scheme (as it was known) provided both construction sand and gravel but ceased production in 2016. Gunlake Quarry along with other quarries in the Illawarra, Central Coast and Lower Hunter have become important replacement sources of quarry products, in close proximity to Sydney.

While there is strong and growing demand for quarry products, their supply in proximity to Sydney is limited to specific areas where the required geological formations exist, and it is economic to extract. The Gunlake Quarry is one of these locations.

4 COST BENEFIT ANALYSIS

4.1 Introduction

CBA of the Continuation Project involves the following key steps:

- identification of the "with" and "without" Continuation Project scenarios;
- identification and valuation of the incremental benefits and costs;
- consolidation of value estimates using discounting to account for temporal differences;
- application of decision criteria;
- sensitivity testing;
- consideration of non-quantified benefits and costs; and
- consideration of the distribution of costs and benefits.

What follows is a CBA of the Continuation Project based on the production, financial, technical and environmental advice provided by Gunlake and its specialist consultants. An explanation of CBA is provided in Attachment 1.

4.2 Identification of the "Without" Continuation Project Scenario

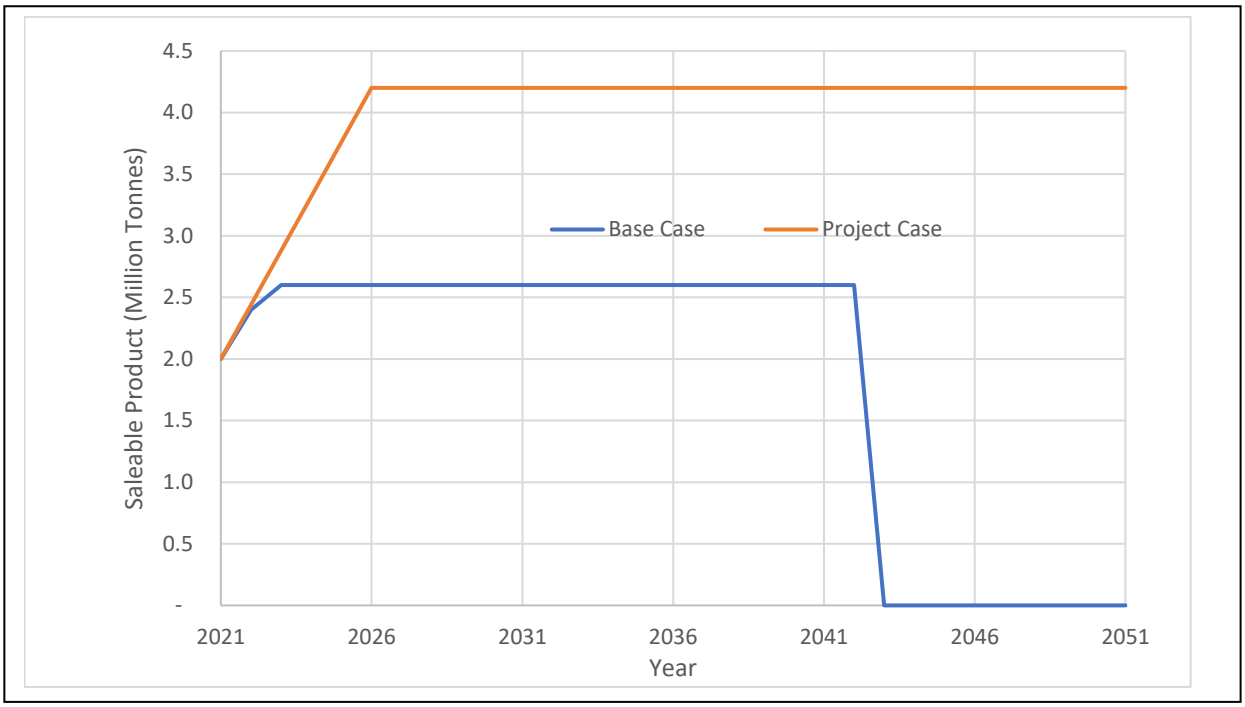
A starting point for CBA is to establish the "without" Continuation Project scenario for the land impacted by the Continuation Project. This becomes the base case against which to assess the potential economic, social and environmental impacts of changes due to the Continuation Project. Without the Continuation Project extraction under the existing approval (the Extension Project, as modified) is limited to 2.6 Mtpa of saleable product until 2042.

4.3 Identification of the "With" Continuation Project Scenario

The Continuation Project is seeking approval for extraction of up to 4.2 Mtpa. It is assumed that production at these levels ramps up over 5 years – commencing in 2022.

Figure 4.1 illustrates the indicative incremental production of the Continuation Project relative to the base case.

Figure 4.1 – Indicative Incremental Production from the Continuation Project Relative to the Base Case



4.4 Identification of Benefits and Costs

Relative to the base case, or "without" Continuation Project scenario, the Continuation Project may have the potential incremental economic benefit and cost categories shown in Table 4.1.

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

Table 4.1 - Potential Incremental Economic Benefits and Costs of the Continuation Project

Category	Costs	Benefits
Net production benefits from quarrying	• Opportunity cost of land in 2042 • Opportunity cost of capital in 2042 • Development costs • Operating costs at quarry gate • Decommissioning costs at cessation of the Continuation Project	• Avoided decommissioning and rehabilitation costs in 2042 • Sale value of quarry product at quarry gate • Residual value of capital and land at the end of the Continuation Project
Net production benefits from ex-quarry transport	• Capital and operating costs	• Revenues
Potential environmental, social and cultural impacts of extraction, processing and transportation, after mitigation, offsetting and compensation	• Noise and vibration impacts • Air quality impacts • Greenhouse gas generation • Groundwater impacts • Surface water impacts • Biodiversity impacts • Traffic and transport impacts • Aboriginal heritage impacts • Historic heritage impacts • Visual impacts • Agriculture impacts • Net public infrastructure costs • Loss of surplus to other industries	• Wage benefits to workers • Economic benefits to existing landholders • Economic benefits to suppliers

Framed in another but equivalent way the potential incremental costs and benefits of the Continuation Project are as per Table 4.2. No royalties accrue to Government from quarrying and hence these are omitted from the estimation of net production benefits.

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

Costs	Benefits
Direct costs	***Direct benefits***
Nil	Net production benefits from quarrying • *Company tax* • *Net producer surplus*
	Net production benefits from ex quarry transport
	• *Company tax*
	• *Net producer surplus*
Indirect costs	***Indirect benefits***
Environmental, social and cultural impacts of quarrying and transportation, after mitigation, offsetting and compensation	Wage benefits to employment
Net public infrastructure costs	Economic benefits to existing landholders
Loss of surplus to other industries	Economic benefits to suppliers

4.5 Quantification/Valuation of Benefits and Costs

Consistent with NSW Treasury (2017) and NSW Government (2015), the CBA was undertaken in 2021 real values, with discounting at 7 percent (%) and sensitivity testing at 4% and 10%.

The analysis period is 31 years, coinciding with the proposed life of the Continuation Project and one-year pre-Continuation Project. 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.[2]

An attempt has also been made to estimate environmental, cultural and social impacts using market data and benefit transfer[3] and incorporate them into an estimate of the net social benefit of the Continuation Project. This estimated net social benefit of the Continuation Project provides another threshold value that any residual or non-quantified economic costs would need to exceed to make the Continuation Project questionable from an economic efficiency perspective.

4.5.1 Production Costs and Benefits of Quarrying[4]

Opportunity Cost of Land and Capital in 2042

Under the base case scenario, the Gunlake Quarry would be decommissioned in 2042 and residual land and capital value would be realised.

With the Continuation Project the quarry life would be extended to 2051 and hence there would be an opportunity cost of continuing to use the land and capital equipment at Gunlake Quarry. This opportunity cost is estimated at $5.8M for land. Capital equipment is assumed to have no residual value at the end of the base case.

Development Cost of the Continuation Project

Compared to the base case, the Continuation Project would require additional development expenditure over its life estimated at $6.7M over an eight-year period.

Annual Operating Costs of the Continuation Project

Operating costs of the Continuation Project are associated with ramping up of quarrying from 2.0 Mtpa in 2021 to 4.2 Mtpa in 2026 and then extraction at this level until 2051, compared to the base case where quarrying would ramp up from 2.0 Mtpa in 2021 to 2.6 Mtpa in 2023 and then extraction at this level until 2042.

The quarry operating costs of the Continuation Project include those associated with extraction, onsite crushing and stockpiling, general costs (including overheads and administration) and ongoing environmental, social and cultural mitigation costs. These costs include labour costs, which reflect the value of labour resources in their next best use. Unit operating costs are not reported for reasons of commercial confidentiality.

[2]The 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.
[3] Benefit transfer refers to transferring economic values that have been determined for other study sites.
[4] All values reported in this section are undiscounted unless specified.

Decommissioning and Rehabilitation Costs

With the Continuation Project, decommissioning and rehabilitation would occur at the end of the proposed Continuation Project life at an estimated cost of $2.5M. Other annual rehabilitation costs are included in the annual operating costs of the Continuation Project.

Economic Benefits

Avoided Decommissioning and Rehabilitation Costs

Without the Continuation Project, in 2042 the existing consent will expire and the quarry would be decommissioned and rehabilitated, at an estimated cost of $2.5M. With the Continuation Project, these costs in 2042 are avoided in that year and are a benefit of the Continuation Project.

Revenues

The main economic benefit of the Continuation Project is the market value of the hardrock products produced. An average unit price at the quarry gate has been applied to the output of the Quarry based on advice from Gunlake. It has not been reported for reasons of commercial confidentiality.

There is uncertainty around future hardrock prices and hence assumed values have been subjected to sensitivity testing (see Section 4.8).

Residual Value at End of the Evaluation Period

At the end of the Continuation Project, the land and capital equipment required for the Continuation Project would have some residual value that could be realised by sale. This is estimated at $5.8M for land and zero for capital equipment.

4.5.2 Production Costs and Benefits of Product Transport

The costs and benefits of quarrying considered in Section 4.5.1 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 assumed incremental quarry production, an average per tonne transport cost and the percentage of total revenue that is net revenue[5].

[5] 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.

4.5.3 External Costs and Benefits

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

Noise and Vibration

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

The Noise Impact Assessment identified that the noise levels from Quarry operations are predicted to be at, or below, (i.e. comply with) the relevant project noise trigger levels at all assessment locations with the exception of Receptor 2 (R2). This receptor is an existing dwelling that under the existing approval is exposed to quarry noise and already qualifies for voluntary acquisition in accordance with Schedule 3 Condition 1 of the Conditions of Consent of the Extension Project Approval. The predicted incremental change to noise levels at R2 compared to current noise emissions is negligible (<2 dB) and hence there are no material incremental Quarry noise impacts for inclusion in the CBA.

The future total road traffic noise levels, inclusive of Gunlake Quarry trucks associated with the Continuation Project, are predicted to satisfy the relevant road traffic noise criteria at the nearest potentially affected residences on Brayton Road, Ambrose Road and Red Hills Road. It is not proposed to change the number of quarry product trucks approved to use the Secondary Transport Route (a maximum of 38 outbound trucks) so there will be no change to road traffic noise levels along this route. Consequently, there are no material incremental road traffic noise impacts for inclusion in the CBA.

There were 65 blasts at the Quarry between July 2018 and June 2020. During this time, the ground vibration criterion (5 mm/s) has been met on all occasions. The airblast overpressure criterion (115 dB, Lin Peak) was marginally exceeded on one occasion, in August 2018. Notwithstanding, this exceedance satisfied the allowable exceedance limit of 5% per total number of blasts over a period of 12 months. Furthermore, no blasts exceeded the upper criterion of 120 dB, Lin Peak. There would be no change to vibration impact as a result of the Continuation Project compared with existing conditions, which are within relevant criteria. Consequently, there are no material incremental blast impacts for inclusion in the CBA.

Air Quality

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

The Air Quality Impact Assessment (AQIA) found that ambient background concentrations are the major contributor to cumulative concentrations. The predicted concentrations and deposition rates for all pollutants and averaging periods are below the applicable NSW EPA assessment criteria and the air quality criteria specified in Schedule 3 Condition 14, Table 6, of the Extension Project Approval. As such, no additional exceedances of the impact assessment criteria are predicted as a result of the Continuation Project.

Consequently, there are no material incremental air quality impacts for inclusion in the CBA.

Greenhouse Gas Emissions

The AQIA included a greenhouse gas assessment. This found that the Continuation Project would generate 9,784t CO_2-e per year of Scope 1 emissions and 8,748t CO_2-e per year of Scope 2 emissions. These relate to total production under the Continuation Project. For this analysis, incremental greenhouse gas emissions were estimated based on incremental production levels each year.

To place an economic value on CO_2-e emissions, a shadow price of CO_2-e is required. Three shadow prices were used, the Forecast European Union Emission Allowance Units price, the Australian Treasury Clean Energy Future Policy Scenario and the US EPA Social Cost of Carbon. Under these shadow prices the present value of greenhouse gas emission cost is between $2M and $6M dollars, present value. This is a global damage cost of carbon (i.e. the cost of carbon emissions to the population of the whole world).

Consistent with the NSW Government (2015) Guidelines, NSW Government (2018) Technical Notes and the NSW Treasury (2017) Guidelines, 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 purpose of the Economic Assessment, this has been undertaken using Australia's share of the global population (around 0.3%) and NSWs share of the Australian population (32%). NSW DP&E has supported this approach (NSW DP&E, 2017).

On this basis, the present value of the cost of incremental greenhouse gas emissions from the Continuation Project to Australia is estimated at between $4,100 and $19,400 dollars (present value). The cost of greenhouse gas emissions to NSW is estimated at between $1,300 and $6,200 dollars (present value).

Groundwater

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

The Groundwater Assessment found that groundwater impacts were predicted to be minor and locally confined to around the quarry pit. Groundwater inflows to the pit of up to 68 ML/year are predicted over the life of the Continuation Project. There is an opportunity cost of holding WALs for this level of groundwater take which is assumed to be $2,000/ML i.e. $136,000.

A drawdown of 2 m is predicted to extend up to 1.3 km from the edge of the pit at the end of the Continuation Project (2051). This is less that the predicted maximum extent the 2-m drawdown predicted for the Extension Project due to refinements in the model.

It is predicted that there will be no impacts to landholder bores.

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

Surface Water

Water balance modelling undertaken for the Surface Water Assessment found that the increased production, Quarry life and pit depth of the Continuation Project will reduce the likelihood and magnitude of overflows occurring from the water management system compared with the Extension Project. As overflows will be reduced, the Continuation Project is not predicted to result in a negative impact to water quality in the downstream catchments relative to the approved Quarry.

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

Biodiversity

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

The Continuation Project has been designed to minimise additional adverse impacts to biodiversity by restricting disturbance to previously approved areas. The Biodiversity Development Assessment Report identified that the Continuation Project will not have any direct impacts to native vegetation or habitat for threatened species. It will also not result in any direct or indirect impacts to threatened species or communities or migratory species listed under the EPBC Act.

Small portions of plant community types (PCT) 1256 and PCT 1330 are predicted to be impacted at a local scale by groundwater drawdown. However, the prescribed impacts to groundwater-dependent ecosystems arising from the Continuation Project are predicted to be minor in both extent and/or nature and represent a low risk of impact to groundwater-dependent ecosystems. The Continuation Project impacts to GDEs are not predicted to increase as the predicted area of drawdown for the Continuation Project is less than the predicted area of drawdown for the approved Extension Project.

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

Traffic and Transport

The Traffic Impact Assessment (TIA) found that the road safety impacts of increased heavy vehicle movements along the Primary Transport Route are considered to be negligible, with no major road safety hazards from the proposed increase in heavy vehicle volumes identified.

The TIA also identified that the Continuation Project will not result in any increased truck movements along the Secondary Transport Route and so the Continuation Project will not impact current road safety on this route.

Consequently, there are no material traffic and transport impacts for inclusion in the CBA.

Aboriginal Heritage

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

As the original Quarry and Extension Project disturbance areas have been largely cleared and the soil removed, there will be no impacts to Aboriginal heritage in these areas beyond those previously approved.

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

Historical Heritage

Impacts on historical heritage can have use and non-use values that can be potentially estimated using nonmarket valuation methods such as choice modelling. However, no historical heritage sites have previously been identified within or in proximity to the project area.

The Continuation Project is therefore not predicted to impact historical heritage and hence there are no material Historical heritage impacts for inclusion in the CBA.

Visual Impacts

Visual impacts can impact the amenity of others and hence have impacts on people's use values. However, there will be no changes to the currently approved Quarry layout or operations that will be visible from public or private sensitive viewpoints. While the pit depth would increase, this would not be visible from vantage points in the public domain. Continued progressive rehabilitation of the Quarry and the use of the Eastern Emplacement area as a visual screen will further shield the Quarry from public viewpoints.

Consequently, there will be no change to the existing visual amenity of the Quarry site as a result of the Continuation Project and no impacts for inclusion in the CBA.

Wage Benefits to Workers

The Continuation Project will in total provide an estimated 90 direct quarrying jobs (comprising 70 employees and 20 contractors) and 138 road transport jobs (full-time equivalent) when operating at 4.2 Mtpa. Initially the incremental employment will be 15 incremental quarrying jobs and 50 transport jobs when compared to employment under existing approved production of 2.6 Mtpa. However, in 2043 when the existing approval would otherwise have expired, the incremental employment provided by the Continuation Project increases to 90 direct quarrying jobs and 138 transport jobs.

In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus). This approach assumes labour markets clear, with no involuntary unemployment i.e. full employment, and no other distortions (Bartik, 2012). While the NSW Guideline (2015) recognises the potential for wage benefits associated with project employment, conservatively, the standard approach to the treatment of employment in CBA is adopted in this analysis.

Economic Benefits to Existing Landholders

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

Economic Benefits to Suppliers

The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored (Sinden and Thampapillai,

1995). Conservatively, this convention is adopted and hence no secondary benefits to the economic are included.

Net Public Infrastructure Impacts

No net infrastructure costs to government are envisaged as a result of the Continuation Project. With respect to local road infrastructure, Gunlake pay a contribution to Goulburn Mulwaree Council in accordance with the Goulburn Mulwaree Local Infrastructure Contributions Plan 2021. The contributions collected by Council from Gunlake are used to fund road maintenance and rehabilitation of the Primary and Secondary Transport Routes.

Loss of Surplus to Other Industries

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

4.6 Consolidation of Value Estimates

4.6.1 Net Production Benefits

The present value of production costs and benefits, using a 7% discount rate, is provided in Table 4.3.

Relative to the Extension Project, the Continuation Project is estimated to have incremental net production benefits to Australia of $93M (present value at 7% discount rate), comprising $80M in net production benefits from the quarry and $13M associated with ex-quarry transport.

The net production benefits can be further apportioned to NSW based on Gunlake Quarries being 100% NSW owned, an assumption that transport providers are 100% NSW owned, and company tax benefits accruing to NSW based on its population share i.e. 32%. On this basis, the incremental net production benefits of the Continuation Project that accrue to NSW are estimated at $74M (present value at 7% discount rate), comprising $64M in quarry net production benefits and $10M in transport net production benefits.

The estimated incremental 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 Continuation Project, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the Continuation Project. It is a minimum threshold value as it does not include potential wage benefits and benefits to suppliers.

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

Table 4.3 - Net Production Benefits of the Continuation Project ($M Present Values at 7% Discount Rate)

	Quarrying	Ex Quarry Transport
Costs		
Opportunity cost of land in 2042	$1	
Opportunity cost of capital equipment in 2042	$0	
Development costs	$5	
Operating cost	$341	$309
Decommissioning and rehab costs at cessation of Continuation Project	$0	
Sub-total	***$348***	***$309***
Benefits		
Avoided decommissioning and rehab costs in 2042	$1	
Revenue	$426	$222
Residual value of land in 2051	$1	
Residual value of capital equipment in 2051	$0	
Sub-total	***$428***	***$222***
Australian Net Production Benefits	**$80**	**$13**
Company Tax	$24	$4
Residual Net Production Benefits	$56	$9
Australian Net Production Benefits	***$80***	***$13***
Company Tax	$8	$1
Residual Net Production Benefits	$56	$9
NSW Net Production Benefits	***$64***	***$10***

4.6.2 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 Continuation Project. Table 4.4 summarised the results of the consideration of externalities in Section 4.5.3. Only GHG impacts differ between the Australian and NSW scope.

Table 4.4 – Externality Impacts of the Continuation Project (Present Values at 7% Discount Rate)

Benefits	**Australia**	**NSW**
Wage benefits to employment	Not quantified	
Economic benefits to existing landholders	$0	
Economic benefits to suppliers	Not quantified	
Sub-total		
Costs		
Greenhouse gas emissions (Scope 1 and 3)	$0.008	$0.002
Noise and vibration	No material impact*	
Air quality	No material impact*	
Groundwater	$0.13 of WALs	
Surface water	No material impact*	
Biodiversity	No material impact*	
Traffic and transport	No material impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	

* 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."

From Section 4.5.3 it is evident that the main potential impacts of the Continuation Project are internalised into the production costs of the Continuation Project through mitigation measures, ownership of land and water allocations. Other costs not already included in the production costs of the Continuation Project are associated with opportunity cost of WALs and greenhouse gas costs, although from Table 4.4 it is evident that these impacts to Australia and NSW are small or immaterial.

4.6.3 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[6]). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the project, because the community as a whole would obtain net benefits from the project.

The results from Table 4.3 and Table 4.4 are combined in Table 4.5 to estimate the net social benefits of the Continuation Project to Australia and NSW, relative to the base case.

[6] 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.

Table 4.5– Net Social Benefits of the Continuation Project (present value @ 7% discount rate)

Benefits	Australia	NSW
Net Production Benefits Quarrying		
Company Tax	$24	$8
Residual Net Production Benefits	$56	$56
Sub-total	**$80**	**$64**
Net Production Benefits Transport		
Company Tax	$4	$1
Residual Net Production Benefits	$9	$9
Sub-total	**$13**	**$10**
Other Benefits		
Wage benefits to employment	Not quantified	Not quantified
Economic benefits to existing landholders	$0	$0
Economic benefits to suppliers	Not quantified	Not quantified
Sub-total	***$0***	***$0***
Total Benefits	**$93**	**$74**
Costs		
Greenhouse gas emissions (Scope 1 and 2)	$0.01	$0.003
Noise and vibration	No material impact*	
Air quality	No material impact*	
Groundwater	$0.13 of WALs	
Surface water	No material impact*	
Biodiversity	No material impact*	
Traffic and transport	No material impact*	
Aboriginal heritage	No material impact*	
Historic heritage	No material impact*	
Visual	No material impact*	
Net public infrastructure costs	No material impact*	
Sub-total	***$0.14***	***$0.13***
Net Social Benefits	**$93**	**$74**

* 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."

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

While the major environmental, cultural and social impacts have been quantified and included in the Continuation Project CBA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than $93M and $74M for the Continuation Project to be questionable from an Australian and NSW economic efficiency perspective, respectively.

4.7 Distribution of NSW Costs and Benefits

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

The costs and benefits of the Continuation Project to NSW are potentially distributed among a range of stakeholders as identified in Table 4.6.

Table 4.6 - Incidence of NSW Costs and Benefits

BENEFITS AND COSTS	INCIDENCE OF COSTS AND BENEFITS	AUSTRALIA ($M)	NSW ($M)
Quarrying Net Production Benefits			
Company tax	NSW Government and NSW households	$24	$8
Net producer surplus	Gunlake Quarries	$56	$56
Transport Net Production Benefits			
Company tax	NSW Government and NSW households	$4	$1
Net producer surplus	Road Transport operators	$9	$9
Additional benefits			
Wage benefits to employment	Some of the local and NSW labour force	Not quantified	Not quantified
Economic benefits to existing landholders	Local landholders who sell land required for the Project including buffer land	$0	$0
Economic benefits to suppliers	Regional and State suppliers of inputs to production	Not quantified	Not quantified
Environmental, social and cultural costs*			
Greenhouse gas emissions (Scope 1 and 2)	Australian and NSW households	$0.010	$0.003
Noise and vibration	Adjoining residents	No material impact*	
Air quality	Adjoining residents	No material impact*	
Groundwater	Other groundwater users	$0.13 of WALs	
Surface water	Other surface water users	No material impact*	
Biodiversity	Local and NSW households	No material impact*	
Traffic and transport	Local residents	No material impact*	
Aboriginal heritage	Aboriginal people and other local and NSW households	No material impact*	
Historic heritage	Local and NSW households	No material impact*	
Visual	Local residents	No material impact*	
Net public infrastructure costs	Government	No material impact*	

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

* 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."

4.8 Risk and Sensitivity Analysis

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

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

Firstly, it should be noted that the Project is the continuation of an existing financially viable operation that Gunlake plans to continue to invest in. Strong current and foreseeable demand for quarry products is likely to continue to underpin the financial viability of the Project.

The provision of biodiversity offsets can be associated with a number of risks, including in relation to the biodiversity benefits of additional management of offsets, success in reconstruction of ecological communities, time-lags between impacts and provision of offsets as well as between management actions and achievement of ecological outcomes. These risks are mitigated through offset ratio requirements in the calculation of offsets requirements or fund payments. However, as identified in Section 4.5.3 there are no incremental offset requirements as a result of the Continuation Project.

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

The NPV of the Continuation Project presented in Table 4.5 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a CBA can be dealt with through changing the values of critical variables in the analysis (James and Gillespie, 2002) to determine the effect on the NPV[7].

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

- Opportunity costs of land;
- Quarry development costs;
- Quarry operating costs;
- Quarry decommissioning and rehabilitation costs;
- Value of quarry products;
- Residual value of quarry land; and
- Net transport revenue.

Results are reported in Table 4.7. These indicate that CBA results at the NSW level are most sensitive to a sustained 20% increase in operating costs or a sustained 20% reduction in the value of quarry products.

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

[7] 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.

The strong demand for quarry products that underpins the Continuation Project suggests that sustained reductions in the value of quarry products is also highly unlikely.

The sensitivity analysis also indicated that the CBA results are not sensitive to changes in development costs, opportunity costs of land or environmental costs that have not already been internalised into production costs, such as WALs and NSW greenhouse gas costs. Since mitigation, offset and compensation costs are small components of the development and operating costs of the Continuation Project, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

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

Table 4.7 - NSW CBA Results Sensitivity Testing (Present Value $M)

	4% Discount Rate	7% Discount Rate	10% Discount Rate
CENTRAL ANALYSIS	$123	$74	$47
INCREASE 20%			
Opportunity cost of quarry land	$123	$74	$47
Quarry development costs	$122	$73	$47
Quarry operating costs	$34	$20	$12
Quarry decommissioning costs	$123	$74	$47
Value of quarry products	$234	$142	$92
Residual value of land	$123	$74	$47
Transport net revenue	$126	$76	$49

	4% Discount Rate	7% Discount Rate	10% Discount Rate
DECREASE 20%			
Opportunity cost of quarry land	$123	$74	$47
Quarry development costs	$124	$75	$48
Quarry operating costs	$212	$128	$83
Quarry decommissioning costs	$123	$74	$47
Value of quarry products	$12	$6	$3
Residual value of land	$123	$74	$47
Transport net revenue	$120	$72	$46

5 THE REGIONAL ECONOMY

5.1 Introduction

The proposal is located in the Goulburn Mulwaree Local Government Area (LGA) in NSW. This is the locality/region that has the potential to provide inputs to the proposal and derive economic benefits from the proposal.

5.2 Characterisation of the Region

5.2.1 Residents of the Region

Table 5.1 provides some characteristics of the usual residents of locality based on the Australian Bureau of Statistics (ABS) 2016 Census of Population and Housing. In 2016, the region had a population of 29,609 and a labour force of 13,578. In 2016, there were 851 people unemployed representing 6.3% of the labour force.

The main occupations of usual residents were *Professionals* followed by *Managers* (which includes farm managers) and *Technicians and Trade Workers*. Twenty-one per cent of the employed usual residents work outside the region, with the main locations being the ACT, No Fixed Address (NSW), Wingecarribee LGA, Queanbeyan-Palerang Regional LGA and Upper Lachlan Shire LGA.

Table 5.1 - Characteristics of Usual Residents

	Goulburn- Mulwaree LGA	
	No.	**%**
Demographics		
Population	29,609	
Median Age	42	
In Labour Force	13,578	45.9%
Unemployed	851	6.3%
Median household weekly income	1,196	
Unoccupied private dwellings	1,928	
Median rent	260	
Occupations		
Professionals	1,947	15.30%
Managers	1,845	14.50%
Technicians and Trades Workers	1,844	14.50%
Labourers	1,550	12.20%
Community and Personal Service Workers	1,501	11.80%
Sales Workers	1,468	11.50%
Clerical and Administrative Workers	1,266	10.00%
Machinery Operators and Drivers	1,088	8.60%

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

The main industry sectors in which usual residents were employed in 2016 is provided in Table 5.2. *Hospitals (except Psychiatric Hospitals)* was the most significant employment sector followed by *Aged Care Residential Services, Supermarket and Grocery Stores, Other Social Assistance Services* and *Takeaway Food Services*. These sectors indicate the importance of Goulburn Mulwaree LGA as a regional service

centre. Eleven per cent of the people working in the Goulburn Mulwaree LGA live outside the locality, with the main residential locations being the Upper Lachlan Shire LGA, Wingecarribee LGA, ACT and Queanbeyan-Palerang Regional LGA.

Table 5.2 - Top 5 Industry Sectors of Employment for Usual Residents

Sector	No.	%
Hospitals (except Psychiatric Hospitals)	524	4.2
Aged Care Residential Services	363	2.9
Supermarket and Grocery Stores	349	2.8
Other Social Assistance Services	333	2.6
Takeaway Food Services	330	2.6

Source: Australian Bureau of Statistics, 2016 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 immigration[8] 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 located 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 Goulburn Mulwaree LGA has been growing, at a rate of 13.51% since 2006, very similar to the population growth rate for NSW.

Table 5.3 - Population Growth

	2006	2011	2016	Growth Rate 2006 - 2011	Growth Rate 2011 - 2016	Growth Rate 2006 - 2016
Goulburn Mulwaree LGA	26,086	27,481	29,609	5.35%	7.74%	13.51%
NSW	6,549,177	6,917,658	7,480,228	5.63%	8.13%	14.22%

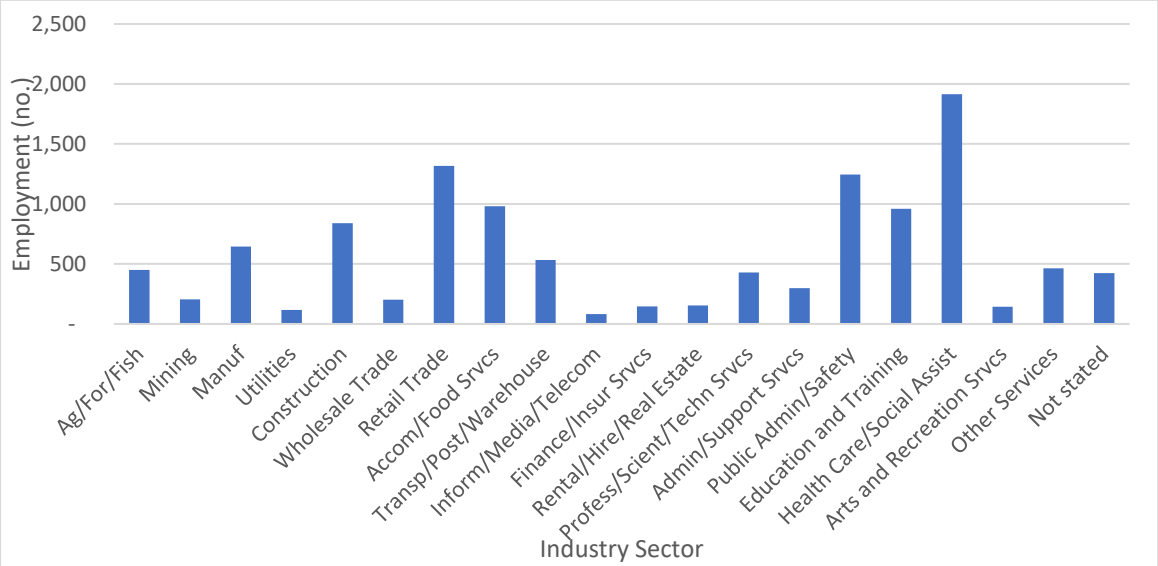
Source: Australian Bureau of Statistics, 2016 Census of Population and Housing, Community Profiles

[8] This can be considered symptomatic of key drivers in the economy based on the regions natural and manmade endowments that give it a comparative advantage in certain sectors.

5.2.2 Economic Activity in the Region

An indication of the nature of the regional economy can be gained by examining place of work employment by 1-digit ANZSIC industry data industry data - refer to Figure 5.1. This indicates the significance of the *Health Care and Social Assistance, Retail Trade and Public Administration and Safety*.

Figure 5.1 - Place of Work Employment by Industry (1-Digit ANZSIC)



Source: Australian Bureau of Statistics, 2016 Census of Population and Housing, Working Population Profiles

Figure 5.2 shows the top 30 IO sectors of employment in the regional economy by place of residence. It indicates that *Retail Trade* is the greatest employing sector in the regional economy, followed by *Health Care Services, Residential Care and Social Assistance Services,* and *Food and Beverage Services.* Across all industry sectors in the regional economy, 85% of people who work in the region also reside in the region. Other key sources of labour are Upper Lachlan (5%), Wingecarribee (2%) and ACT (1%).

Figure 5.2 - Main Employing Sectors in the Regional Economy by Place of Residence

The Gross Regional Product (GRP) of the regional economy was estimated at $1,372 million for 2019/20 (prolife.id.com.au/Goulburn).

The region is a net importer, with exports out of the region of $865 million and imports into the region of $1,319 million. The largest exporting industries by output value are:

- *Manufacturing* ($186 million)
- *Public Administration and Safety ($168 million)*
- *Transport, Postal and Warehousing ($112 million)*
- *Mining ($107 million),* predominantly *Non-metallic mineral mining and quarrying* (prolife.id.com.au/Goulburn).

Exporting sectors are considered to be key drivers of regional economies and reflect a region's endowments and competitive advantages. These sectors drive growth in "enabling" industries (that provide specialised inputs into export sectors e.g. repairs and maintenance of machinery) and "population serving" industries (that service the consumer needs of the population e.g. retail and personal services sectors, health sectors etc). Gunlake Quarry is part of the mining sector which is a key driver of the regional economy.

Based on the ANZSIC One–digit industry classification, in terms of value–added, it is estimated the most significant sectors are *Public Administration and Safety, Construction, Health Care and Social Assistance, Education and Training,* and *Manufacturing* – equal to approximately 52 per cent of the regional economy and 49 per cent of regional employment – Table 5.4. The five largest industry sectors contributed 89% of value added and 49% of regional employment.

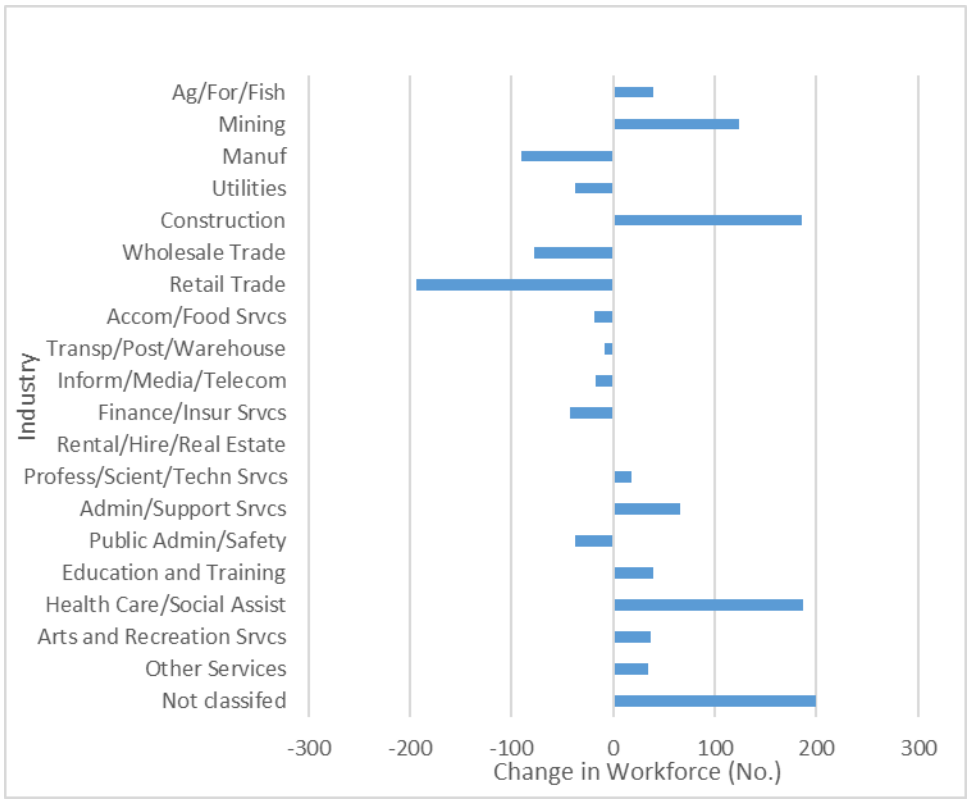
Table 5.4 – Gross Value Added for the 5 Largest Industries in the Regional Economy (ANZSIC One–Digit Sectors)

Industry	Gross Value Added ($m)	Proportion of Regional Economy Value Added (%)	Proportion of Regional Employment (%)
Public Administration and Safety	189.1	13.8	10.8
Construction	169.6	12.4	7.2
Health Care and Social Assistance	158.4	11.6	16.6
Education and Training	101.1	7.4	8.3
Manufacturing	94.5	6.9	5.6

Source: (prolife.id.com.au/Goulburn)

The region has experienced employment growth of 3.6% between 2011 and 2016 (prolife.id.com.au/Goulburn) compared to 4.8% for NSW (ABS Census of Population and Housing, Working Population Profile). The main sectors (One-digit ANZSIC) driving growth in employment were *Health Care and Social Assistance (mainly Hospitals and Other Social Assistance Services), Construction and Mining (*mainly *Construction Material Mining)).* Refer to Figure 5.3.

Figure 5.3 – Employment Growth by One-Digit ANZSIC Industry Sectors



Source: (prolife.id.com.au/Goulburn)

6 LOCAL EFFECTS ANALYSIS

6.1 Introduction

The CBA in Section 4 is concerned with whether the incremental benefits of the Continuation Project exceed the incremental costs and therefore whether the community would, in aggregate, be better off 'with' the Continuation Project compared to 'without' it. This section examines local effects. It focuses on the operational phase of the Continuation Project.

The local area is defined as the LGA of Goulburn Mulwaree, within which the Continuation Project is located and is the region considered likely to be main source of labour and non-labour inputs for the Continuation Project.

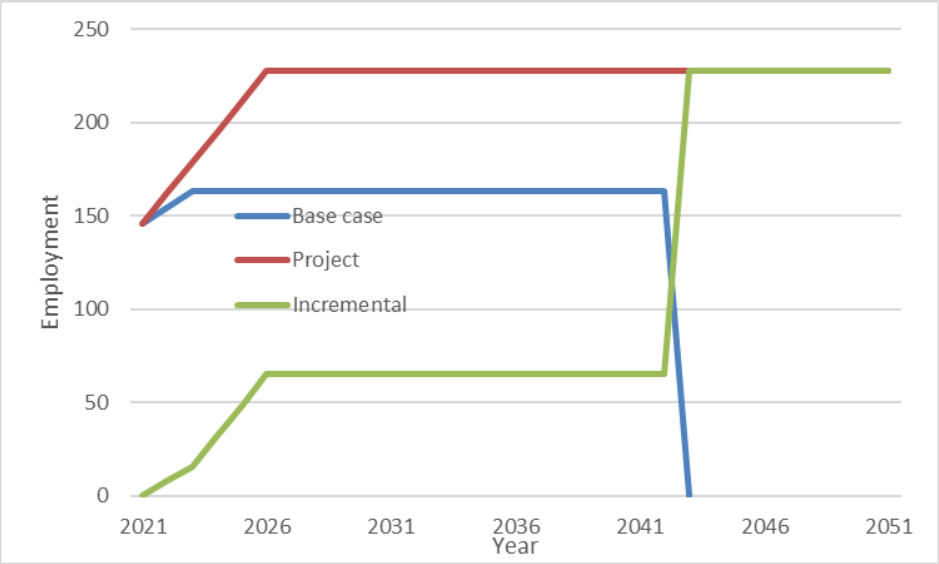
6.2 Direct Effects Related to Employment

The Continuation Project will provide an estimated 90 direct quarrying jobs (comprising 70 employees and 20 contractors) when operating at 4.2 Mtpa. Eighty two percent (74) of these are assumed to reside in the local area,[9] with the remainder commuting from outside the local area.

It will also provide an estimated 138 direct transport jobs when operating at 4.2 Mtpa. Eighty seven percent (121) of these are assumed to reside in the local area,[10] with the remainder commuting from outside the local area.

Consequently, the maximum direct employment provided by the Continuation Project is 228 jobs. This is also the maximum direct incremental employment provided by the Continuation Project between 2043 and 2051. Incremental direct employment provided by the Continuation Project will increase over time as indicated in Figure 6.1.

Figure 6.1 – Incremental Employment



[9] This is based on ABS Census of Population and Housing, 4 digit employment by industry (working in Goulburn Mulwaree LGA) by place of usual residence for the non metallic mineral mining sectors.
[10] This is based on ABS Census of Population and Housing, 4 digit employment by industry (working in Goulburn Mulwaree LGA) by place of usual residence for the road transport sector.

In estimating the effects related to local employment, the LEA method focusses on incremental net income (net wages) that a project provides to the local area. It does this by focusing on the project's 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 Continuation Project. This is a minimum estimate as it assumes full employment in the region and hence the jobs 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 when incremental impacts are at their greatest i.e. between 2043 and 2051 are summarised in Table 6.1.

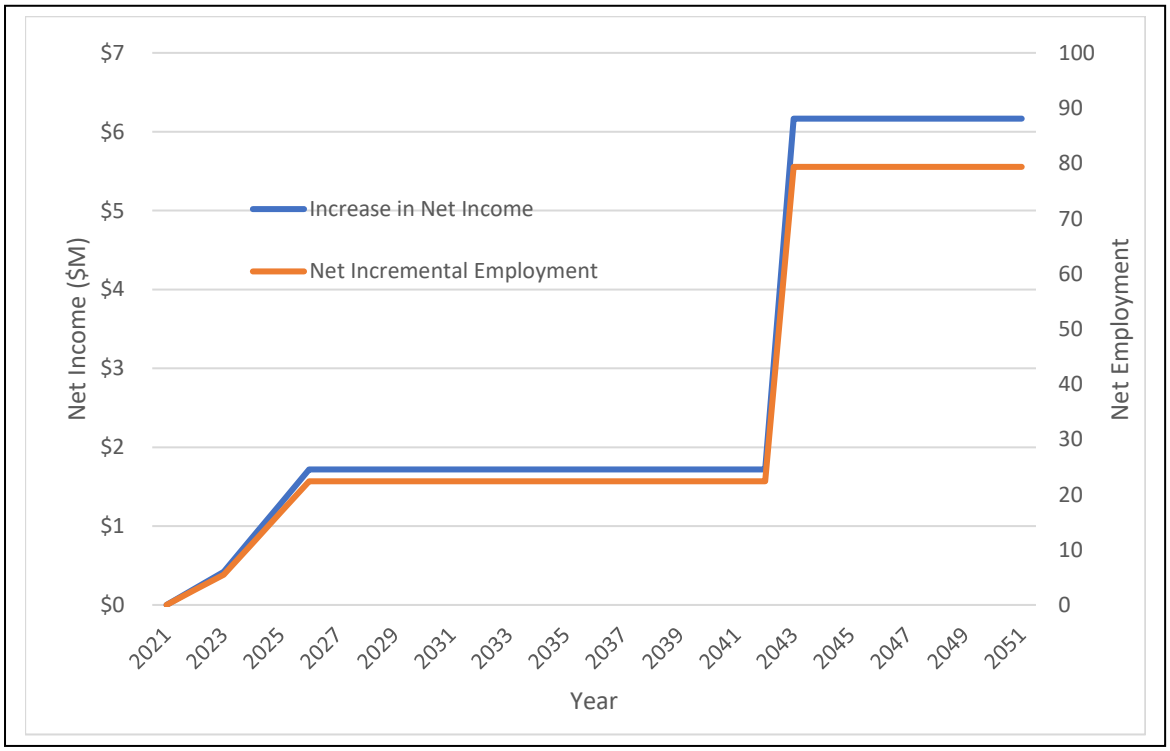
Table 6.1 - Analysis of Net Income Increase and FTE Job Increase Assuming No Job Backfilling (2043 to 2051)

Attribute	Quarry	Transport	Total
a) Direct incremental employment	90	138	228
Number that already reside in the region	74	121	195
b) Average net income in mining	$81,583	$75,033	
c) Average net income in other industries*	$45,842	$45,842	
d) Average increase in net income per job (b-c)	$35,741	$29,191	
e) Increase in net income per year due to direct employment	$2,642,218	$3,523,887	$6,166,106
f) FTE (e/b)	32	47	79

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

The annual incremental net income to local residents and the incremental net FTE jobs to local residents from the Continuation Project relative to the base case (based on the LEA method) is represented in Figure 6.2. Incremental net income and incremental net employment to local residents as a result of the Continuation Project ramps up to $1.7M in net income and 22 jobs from 2026 to 2042. It increases to $6.2M in net income and 79 jobs in 2043 and maintains this level of incremental impact until 2051.

Figure 6.2 – Incremental Net Income and Net FTE Jobs to Local Area



6.3 Direct Effects Related to Non-Labour Expenditure

The incremental annual non-labour expenditure (operating costs of the quarry after subtraction of wages) accruing to the local area was estimated from financial information provided by Gunlake, adjusted for imports based on coefficients from the *Non metallic mineral mining sector* in a 2018-19 IO table of the local area economy.[11] On this basis, $10M of incremental non-labour expenditure is estimated to accrue to the local area from 2023 to 2042, with $25M of incremental non-labour expenditure accruing to the local area from 2043 to 2051.

Based on the IO table coefficients for the road transport sector, $10M of incremental non-labour expenditure is estimated to accrue to the local area from 2023 to 2042, with $26M of incremental non-labour expenditure accruing to the local area from 2043 to 2051.

6.4 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 IO analysis (but also computable general equilibrium analysis), do not utilise direct effects of employment and income effects as calculated above in accordance with the 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 estimate in terms on 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.

6.5 Regional Economic Impact Assessment

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. The presence of job chain effects in a region, means that to the extent that jobs from which people come, to fill the 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 2.

In this framework, the quarrying component of the Continuation Project will provide the following annual direct and indirect annual effects to the local economy of the Continuation Project:

- $143M in output;
- $58M in value-added;
- $18M in gross wages; and
- 276 jobs.

[11] Developed by Gillespie Economics for this report.

Table 6.2 – Gross Annual Direct and Indirect Regional Economic Impacts of Quarrying at 4.2Mtpa

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output ($M)	95	35	13	49	143
Type IIA Multiplier	1.00	0.37	0.14	0.51	1.51
Value Added ($M)	36	14	8	22	58
Type IIA Multiplier	1.00	0.39	0.22	0.60	1.60
Income ($M)	7	8	3	11	18
Type IIA Multiplier	1.00	1.04	0.43	1.47	2.47
Employment (No.)	90	117	70	186	276
Type IIA Multiplier	1.00	1.30	0.78	2.07	3.07

The road transport component of the Continuation Project will provide the following annual direct and indirect annual effects to the local economy of the Continuation Project:

- $134M in output;
- $57M in value-added;
- $29M in gross wages; and
- 455 jobs.

Table 6.3 – Gross Annual Direct and Indirect Regional Economic Impacts of Transport at 4.2Mtpa

Indicator	Direct Impacts	Production Induced Flow-ons	Consumption Induced Flow-ons	Total Flow-ons	Total Impacts
Output ($M)	71	41	21	62	134
Type IIA Multiplier	1.00	0.57	0.30	0.87	1.87
Value Added ($M)	25	20	13	32	57
Type IIA Multiplier	1.00	0.80	0.52	1.32	2.32
Income ($M)	12	12	5	17	29
Type IIA Multiplier	1.00	0.99	0.42	1.41	2.41
Employment (No.)	138	204	113	317	455
Type IIA Multiplier	1.00	1.48	0.82	2.30	3.30

These are the total impacts of the Continuation Project but also represent the incremental impacts from 2043 to 2051. In earlier years the incremental impacts of the Continuation Project will be approximately 38% of these impacts.

6.6 Effects on Other Industries

6.6.1 Regional Economic Impacts of Displaced Agriculture

No agricultural activities will be displaced as a result of the Continuation Project.

6.6.2 Other Wage Impacts

In the short-run, increased regional demand for labour as a result of the Continuation Project (relative to the "without" Continuation 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

Continuation Project and the availability of labour inside and outside the region, wage impacts are not likely to be significant. Where upward pressure on regional wages occurs, it represents an economic transfer between employers and owners of skills and would in turn attract skilled labour to the region leading to future downward pressure on wages.

6.6.3 Housing Impacts

The Continuation 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.

6.6.4 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 Continuation Project involves an increase in production. However, apart from utilities which are provided on a user pays basis, the main potential impact relates to the use of local road infrastructure. However, since the Extension Project Approval was granted in 2017, the Primary Transport Route has been substantially upgraded in accordance with the Austroads Guidelines so that it meets the requirements for rural roads with 1,000 to 3,000 average vehicle movements per day, exceeding the requirements of the Extension Project. Gunlake and Goulburn Mulwaree Council have also implemented a road maintenance work plan and budget to ensure that the transport routes are appropriately maintained by Council using Gunlake Section 94 Contributions.

The Continuation Project will also involve an increase in employment. However, it is envisaged that this will mainly involve employment of existing residents of the region or employment of people who reside outside the region and commute to work. Consequently, no additional consumer demand for local infrastructure and services is envisaged.

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

The distribution of costs and benefits of the Continuation Project are summarised in Table 4.6. The Continuation Project is not anticipated to have any material environmental, social or cultural impacts on the local community.

6.8 Summary of Local Effects

A summary of local effects of the Continuation Project is provided in Table 6.4.

Table 6.4 - Summary of Annual Effects on the Local Community

Annual Local Effects	Direct Total	Direct Already Resident in the Local Area	Maximum Net
Quarry Operation			
Employment FTE	90	74	32
Income ($M)	7	6	3
Incremental non-labour expenditure in the Local Area			25
Road Transport			
Employment FTE	138	121	47
Income ($M)	10	9	4
Incremental non-labour expenditure in the Local Area			26
Regional Impacts of Total Quarry Operation	**Direct**	**Flow-on**	**Total**
Output ($M)	95	49	143
Value-added ($M)	36	22	58
Income ($M)	7	11	18
Employment	90	186	276
Regional Impacts of Total Road Transport	**Direct**	**Flow-on**	**Total**
Output ($M)	71	62	134
Value-added ($M)	25	32	57
Income ($M)	12	17	29
Employment	138	317	455
Other Local Economic Impacts			
Displaced activities	No impact		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Demand for local infrastructure	No uncompensated impacts		
Local Environmental Impacts			
Environmental, social and cultural impacts	No material Impacts*		

* 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."

7 CONCLUSION

A CBA of the Continuation Project indicated that, compared to the Extension Project, it would have incremental net production benefits to NSW of $74M (present value at 7% discount rate) comprising $64M in quarrying benefits and $10M in ex quarry transport benefits.

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

The above estimate of the incremental net production benefits of the Continuation Project to NSW includes the costs of environmental mitigation costs. The main incremental residual environmental impacts of the Continuation Project, that have not already been incorporated into the estimate of net production benefits, relate to greenhouse gas (GHG) emissions (valued at $0.002M), and the opportunity cost of groundwater WALs (valued at $0.13M). The value of these incremental residual economic costs is considerably less than the estimated net production benefits of the Continuation Project. Consequently, the Continuation Project is estimated to have net social benefits to NSW, and hence is desirable and justified from an economic efficiency perspective.

As well as providing net social benefits to NSW, the Continuation 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 Continuation Project will provide a total of 228 direct jobs, comprising 90 quarry jobs and 138 transport jobs (full-time equivalent). 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 net income and incremental net employment to local residents as a result of the Continuation Project ramps up to $1.7M in net income and 22 jobs from 2026 to 2042. It increases to $6.2M in net income and 79 jobs in 2043 and maintains this level of incremental impact until 2051.

Total incremental non-labour expenditure accruing to the region each year from the Continuation Project is estimated at $20M from 2023 to 2042, and $51M from 2043 to 2051.

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 quarrying component of the Continuation Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $143M in output;
- $58M in value-added;
- $18M in gross wages; and
- 276 jobs.

The ex-quarry transport component of the Continuation Project is estimated to provide the following annual direct and indirect annual effects to the local economy:

- $134M in output;
- $57M in value-added;
- $29M in gross wages; and
- 455 jobs.

The main local environmental impacts are internalised into the production costs of Gunlake 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 - COST BENEFIT ANALYSIS

Introduction to CBA

Cost Benefit Analysis (CBA) has its theoretical underpinnings in neoclassical welfare economics. Applications in New South Wales (NSW) are guided by these theoretical foundations as well as the NSW Treasury (2017). CBA applications within the NSW environmental assessment framework are further guided by the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas projects* and the *NSW Government (2018) Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*. While these Guidelines relate to mining and coal seam gas proposals they provide guidance on the economic assessment techniques that are appropriate for addressing the requirements under the EP&A Act.

CBA is concerned with a single objective of the *Environmental Planning and Assessment Act, 1979* (EP&A Act) and governments i.e. economic efficiency. It provides a comparison of the present value of aggregate benefits to society, as a result of a project, policy or program, with the present value of the aggregate costs. These costs and benefits are defined and valued based on the microeconomic underpinnings of CBA. In particular, it is the values held by individuals in the society that are relevant, including both financial and non-financial values. Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), the project is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

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

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

Definition of Society

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

As a tool of investment appraisal for the public sector, CBA can potentially be applied across different definitions of society such as a local area, state, nation or the world. However, most applications of CBA are performed at the national level. This national focus extends the analysis beyond that which is strictly relevant to a NSW government planning authority. However, the interconnected nature of the Australian economy and society creates significant spill-overs between States. These include transfers between States associated with the tax system and the movement of resources over state boundaries.

Nevertheless, "where major impacts spill over national borders, then CBA should be undertaken from the global as well as the national perspective" (Boardman *et al.,* 2001). For mining projects, impacts that spill over national borders include greenhouse gas costs and producer surplus benefits to foreign owners.

CBA at a sub-national perspective is not recommended as it results in a range of costs and benefits from a project being excluded, making CBA a less valuable tool for decision-makers (Boardman *et al*., 2001).

CBAs of mining projects are therefore often undertaken from a global perspective i.e. including all the costs and benefits of a project, no matter who they accrue to, and then truncated to assess whether there are net benefits to Australia. A consideration of the distribution of costs and benefits can then be undertaken to identify the benefits and costs that accrue to NSW and other regions.

However, a project is considered to improve the well-being of society if it results in net benefits to the nation, even if it results in net costs to the local area.

Definition of the Project Scope

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

Mining and quarrying products are intermediate goods i.e. inputs to other production processes such as production of electricity, steel and cement. However, these other production processes themselves require approval and, in CBA, would be assessed as separate projects.

Net Production Benefits

CBA of mining and extractive industry proposals invariably involves a trade-off between:

- the net production (producer surplus) benefits of a project; and
- the environmental, social and cultural impacts (most of which are costs but some of which may be benefits).

Net production benefits can be estimated based on market data on the projected financial[12] value of the mining or quarrying product less the development and operating costs of projects, including opportunity costs of capital and land already in the ownership of mining companies. This is normally commercial in confidence data provided by the proponent. Production costs and benefits over time are discounted to a present value.

Environmental, Social and Cultural Impacts

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

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

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

These environmental, social and cultural impacts generally fall into three categories, those which:

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

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

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

In attempting to value the impacts of a project on the well-being of people there is also the practical principle of materiality. Only those impacts which are likely to have a material bearing on the decision need to be considered in CBA (NSW Government, 2012).

Where benefits and costs cannot be quantified these items should be included in the analysis in a qualitative manner (NSW Treasury, 2007).

Consideration of Net Social Benefits

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

In combining these considerations, it should be noted that the estimates of net production benefits of a project generally include accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. This includes the costs of purchasing properties adversely affected by noise and dust, providing mitigation measures for properties moderately impacted by noise and dust, the costs of providing ecological offsets and the cost of purchasing groundwater and surface water entitlements in the water market etc. Including these costs effectively internalises the respective and otherwise, non-monetary environmental, social and cultural costs. To avoid double counting of impacts, only residual impacts, after mitigation, offset and compensation, require additional consideration.

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

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

Any other residual environmental, cultural or social costs that remain unquantified in the analysis[13] can also be considered using the threshold value approach. The costs of these unquantified environmental, cultural and social impacts would need to be valued by society at greater than the quantified net social benefit of a project to make it questionable from an economic efficiency perspective.

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[13] Including potential impacts that were unknown at the time of the preparation of the relevant assessment document or arise during the Environmental Impact Assessment process due to differences in technical opinions.

ATTACHMENT 2 – COMPARISON OF INPUT-OUTPUT ANALYSIS AND THE LEA METHOD

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the mine site then all these jobs are counted in IO analysis as a direct effect i.e. direct employment in the region, because the jobs are located in the region. 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 (including quarrying) income and the average level of income in other industries in the region. So a project does not directly add to employment but increases the wages of those are already employed. Incremental direct employment is then calculated by dividing this incremental income by the average wage in mining.

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

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

Table 1 - Incremental Income when Immigrating Workforce is Included

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

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