Cowal Gold Mine
Extension Modification
Socio-Economic Assessment

Prepared for

Barrick Australia Ltd

By

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EXECUTIVE SUMMARY

Barrick (Cowal) Ltd (Barrick), a wholly owned subsidiary of Barrick (Australia Pacific) Limited, owns and operates the Cowal Gold Mine (CGM) which is located approximately 38 kilometres north-east of West Wyalong in New South Wales (NSW).

The CGM Extension Modification (the Modification) requires the preparation of an Environmental Assessment (EA) in accordance with the requirements of the NSW Environmental Planning and Assessment Act, 1979. A socio-economic assessment has been prepared as part of the EA.

From a socio-economic perspective there are three important aspects of the Modification that can be considered:

- its economic efficiency (i.e. consideration of the economic costs and benefits of the Modification);
- its regional economic impacts (i.e. the economic stimulus that the Modification would provide to the regional economy); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations) often considered in terms of the impacts on employment, population and community infrastructure.

A Benefit Cost Analysis (BCA) of the Modification indicated that it would have incremental (i.e. in comparison to the approved CGM) net production benefits to Australia of $50 million (M). Provided the residual environmental, social and cultural impacts of the Modification that accrue to Australia are considered to be valued at less than $50M, the Modification can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

Instead of leaving the environmental, cultural and social impacts unquantified an attempt was made to quantify them. The main quantifiable environmental impacts of the Modification, which have not already been incorporated into the estimate of net production benefits (e.g. noise mitigation and biodiversity offset costs have been included in the Modification capital and operating costs), relate to greenhouse gas emissions and water licences. These incremental impacts to Australia are estimated at $1M, considerably less than the estimated net production benefits of the Modification.

There may also be some non-market benefits of employment provided by the Modification which are estimated to be in the order of $26M.

Overall, the Modification is estimated to have incremental net benefits to Australia of between $49M (excluding employment benefits) and $75M (including employment benefits) and hence is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Modification BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $49M and $75M for the Modification to be questionable from an Australian economic efficiency perspective.

An economic impact analysis, using input-output analysis estimated that the Modification would make up to the following direct and indirect total annual average contributions to the Lachlan SA3 regional economy (which includes the Bland, Lachlan and Forbes Local Government Areas [LGAs]):

- $432M in annual direct and indirect regional output or business turnover;
- $243M in annual direct and indirect regional value-added;
- $45M in annual direct and indirect household income; and
- 621 direct and indirect jobs.
In addition, the Modification would make up to the following direct and indirect total annual average contributions to the Bland LGA regional economy:

- $400M in annual direct and indirect regional output or business turnover;
- $229M in annual direct and indirect regional value-added;
- $29M in annual direct and indirect household income; and
- 484 direct and indirect jobs.

These total annual average contributions to the Lachlan SA3 and Bland LGA regional economies would be greatest during an 8 year period (2014 to 2021) of both mining and ore processing during the life of the Modification, and would reduce towards the end of the Modification when mining ceases and only the processing of stockpiled ore would occur.

These total annual average contributions to the Lachlan SA3 and Bland LGA are also indicative of the maximum incremental contribution of the Modification in comparison to the approved CGM, with this maximum incremental contribution occurring in approximately 2020.

The Modification would also contribute economic activity to the Forbes and Lachlan LGAs.

Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. However, there is not expected to be any additional direct workforce for the Modification compared to the existing CGM. While there may be some additional flow-on employment in the region as a result of the increased operational expenditure of the CGM in the region, this is likely to be modest and in the context of long-term population decline in the region is unlikely to place any strain on existing community infrastructure. In contrast, extending the life of the approved CGM may slow the decline of the regional population and hence slow any overall decline in the provision of community infrastructure and services to the region.

The Modification will delay cessation of mining and ore processing at the CGM by 5 years. Cessation of the CGM will lead to a reduction in economic activity in the region and NSW. The significance of these cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Modification cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given these uncertainties it is not possible to foresee the likely circumstances within which Modification cessation would occur. It is therefore important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Modification brings to the region, to strengthen and broaden the region’s economic base.

Consistent with the existing CGM Development Consent (DA 14/98), it is recommended that prior to closure of the CGM, Barrick should work with local shire councils and the community to prepare a workforce phase-out plan to minimise disruption associated with CGM employment cessation.
1 INTRODUCTION

Barrick (Cowal) Ltd (Barrick), a wholly owned subsidiary of Barrick (Australia Pacific) Limited, owns and operates the Cowal Gold Mine (CGM), an open cut gold mining operation located approximately 38 kilometres north-east of West Wyalong in New South Wales (NSW) (Figure 1.1). The CGM has been operating since 2005 and is approved under Development Consent (DA 14/98) to operate until 31 December 2019.

Barrick is seeking approval to modify the CGM Development Consent to extend the life of the CGM by approximately 5 years by accessing additional gold-bearing ore adjacent to the existing open pit (the CGM Extension Modification [the Modification]). Barrick is preparing an Environmental Assessment (EA) for the Modification in accordance with the requirements of the NSW Environmental Planning and Assessment Act, 1979.


It is noted that while the NSW Government’s (2012) Draft Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals is not directly relevant to metalliferous mines, it does however endorse Benefit Cost Analysis (BCA) as the appropriate methodology for evaluating coal mining proposal.

From a socio-economic perspective, there are three important aspects of the Modification:

- the economic efficiency of the Modification (i.e. consideration of economic costs and benefits);
- the regional economic impacts of the Modification (i.e. the economic stimulus that the Modification would provide); and
- the distribution of impacts between stakeholder groups (i.e. the equity or social impact considerations).

The DP&I’s Draft Guideline identifies economic efficiency as the key consideration of economic analysis. BCA is the method used to consider the economic efficiency of proposals. The DP&I’s Draft Guideline identifies BCA as essential to undertaking a proper economic evaluation of proposed developments that are likely to have significant environmental impacts. The NSW Government’s Draft Guideline also endorses BCA as the appropriate methodology for evaluating mining proposals. In BCA a project is considered to improve the welfare of society if the aggregate benefits exceed the aggregate costs (Attachment 1).

The NSW Government’s Draft Guideline does not provide guidance on other forms of economic assessment. However, the DP&I’s Draft Guideline indicates that a regional economic impact assessment may provide additional information as an adjunct to the economic efficiency analysis. Economic stimulus to the regional economy can potentially be estimated using a range of methods including input-output modelling (regional economic impact assessment).
The DP&Is Draft Guideline also identifies the need to consider the distribution of benefits and costs in terms of:

- intra-generational equity effects – the incidence of benefits and costs within the present generation; and
- inter-generational equity effects – the distribution of benefits and cost between present and future generations.

However, there is no 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 (Attachment 1).

Impacts on employment, population, community infrastructure and services are also of interest to decision-makers.

This study relates to the preparation of each of the following types of analyses:

- a BCA (threshold value analysis) of the Modification including a discussion of intra and inter-generation equity (Section 2);
- a regional economic impact assessment of the Modification (Section 3); and
- consideration of employment, population and community infrastructure assessment issues arising from the Modification (Section 4).

A consultation programme for the EA was undertaken by Barrick and is described in Section 1.4 of the Main Report of the EA.
2 BENEFIT COST ANALYSIS

2.1 INTRODUCTION

BCA of the Modification involves the following key steps:

- identification of the “with” and “without” Modification 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; and
- consideration of non-quantified benefits and costs.

What follows is a BCA of the Modification based on the production schedule proposed by the Barrick and financial, technical and environmental advice provided by Barrick and its specialist consultants. An explanation of BCA is provided in Attachment 1.

2.2 IDENTIFICATION OF THE “WITH” AND “WITHOUT” MODIFICATION SCENARIOS

Identification of the “with” or “without” Modification scenario is required in order to facilitate the identification and measurement of the incremental economic benefits and costs of the Modification.

The base case, or “without” Modification scenario, refers to the approved CGM, which in accordance with the existing CGM Consolidated Development Consent (DA 14/98) involves cessation of mining and ore processing activity in 2019, followed by decommissioning of the CGM (in 2020) and associated rehabilitation.

The “with” Modification scenario involves the operation of the CGM as described in the Main Text of the EA prepared for the Modification.

In summary, compared to the approved CGM, the Modification would involve:

- extension of the operational life of the CGM by an additional 5 years (i.e. until 2024);
- no change to Mining Lease (ML 1535), and no requirement for additional mining lease tenement applications;
- continued development of open pit mining operations at the CGM, including expansion of the extent and depth of the existing open pit (Figure 2.1);
- an increase in the total quantities of waste rock, ore and tailings produced over the life of the mine;
- continued use of the existing mine fleet;
- an increase in total gold production to approximately 3.8 million ounces;
- no change to the existing process plant or its currently installed capacity to continue ore processing at a rate up to 7.5 million tonnes per annum;
- continued and expanded development of the existing northern and southern waste rock emplacements within ML 1535 for placement of mined waste rock over the life of the CGM (Figure 2.1);
continued use of the existing tailings storage facilities for the deposition of tailings produced over the life of the CGM, including raising the maximum design height of (Figure 2.1):
- the northern tailings storage facility to 248 metres (m) Australian Height Datum (AHD); and
- the southern tailings storage facility to 255 m AHD;
• an increase in the total disturbance area of approximately 122 hectares (ha) (i.e. in addition to the currently approved disturbance area of 1,095ha);
• additional internal surface water management infrastructure, including (Figure 2.1):
  - modifications to the existing contained water storage D5 to maintain the storage capacity of the existing D5; and
  - construction of a new water supply storage (D10);
• no change to the operation of the existing saline groundwater supply bores within ML 1535 during suitable lake conditions;
• no change to the use of currently approved external water supply sources (e.g. Bland Creek Palaeochannel Borefield, eastern saline borefield and Lachlan River water entitlements via the Jemalong Irrigation Channel);
• no change to approved daily and annual extraction limits for the Bland Creek Palaeochannel Borefield;
• construction of a new pump station on the eastern side of Lake Cowal to improve capacity/flow of the existing mine water supply pipeline, and associated diesel generator and access tracks;
• no change to the approved operating hours (i.e. 24 hours per day, seven days per week) of the CGM;
• no change to the existing CGM workforce numbers;
• an additional 5 years of workforce employment; and
• no change to existing deliveries and consumables.

Barrick’s alternatives for the CGM are essentially limited to different scales, designs, technologies, processes and timing. However, these alternatives could be considered to be variants of the preferred proposal rather than distinct alternatives. Consequently, this BCA focuses on Barrick’s preferred proposal (the Modification) compared to the base case (i.e. approved CGM) identified above.

2.3 IDENTIFICATION OF BENEFITS AND COSTS

Relative to the base case, or without Modification scenario, the Modification may have the potential incremental economic benefits and costs shown in Table 2.1.

It should be noted that the potential external costs, listed in Table 2.1, are only economic costs to the extent that they affect individual and community wellbeing through direct use of resources by individuals or non-use. If the potential impacts are mitigated to the extent where community wellbeing is insignificantly affected, then no external economic costs arise.
### Table 2.1
Potential Economic Benefits and Costs of the Modification

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<th>Category</th>
<th>Costs</th>
<th>Benefits</th>
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<tr>
<td>Production</td>
<td>• Opportunity cost of land</td>
<td>• Revenue from ore</td>
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<td>• Opportunity cost of capital</td>
<td>• Residual value of capital and land at the cessation of the Modification</td>
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<td></td>
<td>• Capital costs including sustaining capital</td>
<td>• Avoided decommissioning costs under the base case in 2020</td>
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<td></td>
<td>• Operating costs, including administration, mining, ore processing</td>
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<td></td>
<td>and transportation</td>
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<td></td>
<td>• Decommissioning costs at cessation of the CGM</td>
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<tr>
<td>Externalities</td>
<td>• Greenhouse gas generation</td>
<td>• Non-market benefits of employment</td>
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<td></td>
<td>• Operational noise impacts</td>
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<td>• Road transport impacts</td>
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<td>• Road transport noise impacts</td>
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<td>• Blasting impacts</td>
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<td>• Aboriginal heritage impacts</td>
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<td></td>
<td>• Non-Aboriginal heritage impacts</td>
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<td></td>
<td>• Visual impacts</td>
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2.4 QUANTIFICATION/VALUATION OF BENEFITS AND COSTS

Consistent with NSW Treasury (2007) guidelines, the DP&I’s Draft Guidelines and the NSW Government’s Draft Guidelines, the analysis has been undertaken in real values with discounting at 7 percent (%) and sensitivity testing at 4% and 10%. The analysis period is 12 years. Any costs or benefits that continue after this period are included in the final year of the analysis as present values. 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\(^1\). An attempt has also been made to estimate the main environmental, cultural and social impacts using market data and benefit transfer\(^2\). Where some impacts remain unquantified these have been interpreted using the threshold value method.

2.4.1 Production Costs and Benefits\(^3\)

**Economic Costs**

*Opportunity Cost of Land and Plant*

Under the base case, the CGM would be decommissioned in Year 16 (i.e. 2020) and $6 million (M) of residual land and capital value would be realised. However, with the Modification the CGM would continue for another 5 years and hence there is an opportunity costs in Year 16 of continuing to use this land and capital.

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\(^1\) 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.

\(^2\) Benefit transfer refers to borrowing economic values that have been determined for other study sites.

\(^3\) All values reported in this section are undiscounted unless specified.
**Capital Cost of the Modification**

Incremental (i.e. in comparison to the approved CGM) capital costs for the Modification are associated with the upgrade/purchase of mining fleet, progressive raising of the northern and southern tailings storage facilities, other miscellaneous facilities, acquisition of properties for noise management and biodiversity offset and other noise mitigation measures. These incremental capital costs are estimated at in the order of $73M over the life of the Modification (i.e. operations from Year 10 to Year 20 [2014 to 2024] and decommissioning after Year 20).

**Annual Operating Costs of the Mine**

Incremental operating costs are associated with increased mining and ore processing from Year 10 to Year 17 (i.e. 2014 to 2021) and ore processing only from Year 18 to Year 20 (i.e. 2022 to 2024). Incremental operating costs include the management of the proposed biodiversity offsets and labour costs. Labour costs reflect the value of labour resources in their next best use. The incremental operating costs, average approximately $73M per annum over the operating life of the Modification (i.e. from Year 10 to Year 20). The incremental operating costs are greatest in the later years of the Modification.

While royalties are a cost to Barrick they are part of the overall net production benefit of the mining activity that is redistributed by government. Royalties are therefore not included in the calculation of the resource costs of operating the Modification. Nevertheless, it should be noted that the Modification would generate total royalties in the order of $25M ($14M present value).

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

**Decommissioning and Rehabilitation Costs**

With the Modification, the CGM would be decommissioned and rehabilitated in 2025 at an estimated cost of $14M.

**Economic Benefits**

**Avoided Decommissioning Costs**

The Modification extends the life of the base case CGM and hence the approximately $14M of decommissioning costs that would have been incurred in Year 16 (i.e. 2020) following cessation of the CGM are deferred until Year 20 (i.e. 2024). The avoided decommissioning cost in 2020 is an economic benefit of the Modification.

**Revenues**

Incremental revenues associated with the expected production profile are estimated at approximately $108M per annum (on average) over the operating life of the Modification (i.e. from Year 10 to Year 20). The incremental revenue is greatest in the later years of the Modification (i.e. when gold production associated with the approved CGM ramps down and ceases).

There is obviously considerable uncertainty around future gold prices and hence the value of CGM revenue has been subjected to sensitivity analysis (Section 2.6).
Residual Value at End of the Evaluation Period

At the end of the Modification, purchased capital equipment and land may have some residual value that could be realised by sale. For this analysis, capital equipment and land is assumed to have a residual value of $4.5M and $1.5M, respectively.

2.4.2 External Costs and Benefits

Greenhouse Gases

An estimate of greenhouse gas emissions for the Modification is provided in Appendix F of the EA.

The Modification is predicted to generate in the order 689,877 tonnes (t) incremental carbon dioxide equivalent (CO$_2$-e) emissions (Scope 1, 2 and 3) over the life of the Modification. To place an economic value on CO$_2$-e emissions, a shadow price of CO$_2$-e is required that reflects its global social costs. The global social cost of CO$_2$-e is the present value of additional economic damages now and in the future caused by an additional tonne of CO$_2$-e emissions. There is great uncertainty around the global social cost of CO$_2$-e with a wide range of estimated damage costs reported in the literature. An alternative method to trying to estimate the global damage costs of CO$_2$-e is to examine the price of CO$_2$-e credits/taxes. Again, however, there is a wide range of prices. For this analysis, a shadow price of $23 Australian Dollars per tonne (AUD$23/t) CO$_2$-e rising at 2.5% per year in real terms for 3 years and then remaining constant was used. Sensitivity testing assuming a shadow price from AUD$8/t CO$_2$-e to AUD$40/t CO$_2$-e was also undertaken (refer to Attachment 2).

This represents the global social cost of carbon i.e. the cost of carbon emissions to the population of the whole world. In the absence of any studies that have focused on the social damage cost of carbon emissions to Australians, 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 global Gross Domestic Product (around 1%). An alternative approach would be Australia’s share of world population which is considerably less than 1%.

Operational Noise

The CGM Development Consent (DA 14/98) includes noise limits at privately-owned receivers, as well as conditions regarding rights for relevant landowners to request acquisition and/or noise mitigation.

Potential noise impacts associated with the Modification have been predicted and are presented in Appendix E of the EA. No exceedance of the existing CGM Development Consent noise limits is predicted at any privately-owned receiver, with the exception of one receiver location, which has not been identified in previous noise assessments for the CGM.

Due to predicted noise impacts associated with the approved CGM, and subject to the conditions of the CGM Development Consent (DA 14/98), three privately-owned properties have acquisition rights (i.e. where exceedances of greater than 5 A-weighted decibels (dBA) above applicable noise criteria were predicted). These properties have not been acquired to date. For the Modification, it is predicted that one privately-owned property (with existing acquisition rights) would experience noise impacts greater than 5 dBA above applicable noise criteria.

Notwithstanding, it has been assumed that the three privately-owned properties with existing acquisition rights would be acquired by Barrick during the life of the Modification and the impact on these properties has conservatively been attributed to the Modification. Instead of incorporating the partial property value impact on these properties, conservatively, the full cost of acquiring them has been incorporated into the capital costs of the Modification (Section 2.4.1).
In addition, an allowance in the capital costs of the Modification (Section 2.4.1) for noise mitigation works at seven privately-owned properties has been made for potential at receiver mitigation (i.e. for receivers with predicted impacts between 1 to 5 dBA above the applicable noise criteria for either the approved CGM and/or for the Modification). It is recognised that to the extent that any residual noise impacts occur after mitigation, operational noise costs of the Modification included in the BCA for receivers with predicted impacts between 1 to 5 dBA above the applicable noise criteria will be understated. However, it is unlikely that any residual impacts would be material from an aggregate economic welfare perspective.

Road Transport

The Modification would not increase the existing workforce or traffic generation by the CGM and no significant road capacity or road safety issues would arise as a result of the Modification (Section 4.10.1 of the EA). Hence, no economic effects have been identified in the BCA with respect to road transport movements.

Road Transport Noise

No exceedance of the NSW Road Noise Policy daytime criteria of 60 dBA equivalent continuous noise level ($L_{eq[15\text{hour}]}$) and night-time criteria of 55 dBA $L_{eq[9\text{hour}]}$ is predicted at any relevant receiver adjacent to the preferred mine access route (Appendix E of the EA). Hence, no material economic effects have been identified in the BCA with respect to road traffic noise.

Blasting

Blasting at the CGM has the potential to cause structural damage or human discomfort at properties surrounding the CGM. The assessment of potential impacts of blast overpressure and vibration associated with the extension to the open pit for the Modification (Appendix E to the EA) concluded that, consistent with existing operations, the Modification could operate in compliance with relevant building damage and human comfort criteria at all nearby private receivers. Hence, no material economic effects have been identified in the BCA with respect to blasting impacts.

Air Quality

Potential air quality impacts may occur at nearby residences as a result of dust generation at the Modification from activities such as ore and waste rock handling, emissions from stockpiles, haul roads, and blasting. The assessment of potential air quality impacts for the Modification (Appendix F of the EA) indicates that, consistent with existing operations, no nearby private receiver would experience exceedances of relevant air quality criteria. Hence, no material economic effects have been identified in the BCA with respect to air quality effects.

Groundwater

The potential impacts of the Modification during operation and post closure have been considered in the Hydrogeological Assessment (Appendix A of the EA).

The Modification would not change currently approved daily or annual rates of licensed extraction of groundwater or existing groundwater contingency measures. In addition, no material change to pit inflows is predicted (Appendix A of the EA).
Groundwater drawdown due to open pit mining and dewatering would generally remain within ML 1535. The equivalent average annual groundwater take from 2013 to the end of mine life is approximately 200 megalitres (ML) per annum (Appendix A of the EA) and would continue to be licensed. Groundwater quality would not change significantly during the operation of the CGM (incorporating the Modification) or post-closure, with the open pit continuing to act as a localised groundwater sink (Appendix A of the EA).

As the existing Groundwater Contingency Strategy, developed in consultation with the NSW Office of Water and other groundwater users, would be maintained for the Modification, and given there would be no change to currently approved daily or annual extraction limits from the Bland Creek Palaeochannel Borefield, no additional impacts to other users of the Bland Creek Palaeochannel are predicted (Appendix A of the EA).

As no additional groundwater impacts are expected due to the Modification, there is considered to be no groundwater impacts as a result of the Modification that are sufficiently significant they would warrant inclusion in the BCA.

Notwithstanding, Barrick holds 3,650 ML per annum in water access licenses (WALs) associated with use of the Bland Creek Palaeochannel Borefield. The Modification extends the CGM life by 5 years and hence these WALs would need to be held for additional years under the Modification. There is an opportunity cost associated with the holding of these licences for an additional 5 years. For the purpose of this analysis these WALs are assumed to have an economic value of $2,000 per ML.

**Surface Water**

The extension of the CGM open pit for the Modification has been designed to maintain appropriate offset distances to the existing lake isolation system. As such, the extension to the CGM open pit would not change the existing lake isolation system that currently separates the CGM open pit from Lake Cowal (Appendix B of the EA).

A revised site water balance for the CGM incorporating the Modification has been prepared and considered the changes in catchment areas associated with the Modification (e.g. for the expanded waste rock emplacements) and proposed changes to the CGM water management infrastructure (e.g. D5, D10 and the eastern pump station) (Appendix B of the EA). No spills from contained water storages were predicted for the revised site water balance (Appendix B of the EA), including for contained water storages D1 and D4, which capture runoff from the outer batters of the northern and southern waste rock emplacements (Appendix B of the EA).

No causal link between the existing operations at the CGM and water quality in Lake Cowal has been identified (Appendix B of the EA). The Modification would not change the existing lake isolation system, or design objectives of the Internal Catchment Drainage System and Up-catchment Diversion System. The soil stockpile located in the north of ML 1535 would have a dedicated sediment control system. Given the above, no impacts to surface water quality are predicted due to the Modification (Appendix B of the EA).

In comparison to the existing CGM, the only change to the existing catchment of Lake Cowal would be associated with the soil stockpile area located in the north of ML 1535. The catchment of the soil stockpile area is approximately 0.33 square kilometres (km²), which is 0.003% of the 9,500 km² catchment area of Bland Creek (i.e. the main tributary to Lake Cowal) (Appendix B of the EA). Runoff from the soil stockpile area would be released into local drainages ultimately reporting to Lake Cowal following settling of sediment in a sediment basin (Appendix B of the EA). Therefore, negligible impacts to the catchment or hydrology of Lake Cowal are predicted due to the Modification (Appendix B of the EA).
As no additional surface water impacts are expected due to the Modification, there is considered to be no surface water impacts as a result of the Modification that are sufficiently significant they would warrant inclusion in the BCA.

Notwithstanding, CGM water demand would continue to be met (in part) by sourcing water from the Lachlan River regulated flows. Barrick currently holds 80 ML per annum in high security WALs for the for surface water extraction from the Lachlan River (assuming a 1 ML unit share). The Modification extends the CGM life by 5 years and hence these WALs would need to be held for additional years under the Modification. There is an opportunity cost associated with the holding of these licences for an additional 5 years. For the purpose of this analysis these WALs are assumed to have an economic value of $2,000 per ML.

**Biodiversity**

The Modification would result in the direct disturbance of approximately 122 ha of land associated with the northern waste emplacement extension, the D10 water storage and soil stockpiles (Appendix D of the EA), including 2.5 ha of an endangered ecological community (EEC) (Myall Woodland) mapped to be within ML 1535 (Appendix D of the EA).

Refinements to the Modification layout were made to avoid additional potential impacts to the Myall Woodland EEC. The additional northern and southern stockpiles and D10 were redesigned to avoid clearance of patches of the Myall Woodland EEC mapped to be within ML 1535 (Appendix D of the EA).

A biodiversity offset area of approximately 230 ha is proposed for the Modification. Land opportunity costs and operational expenditure associated with the biodiversity offset areas (and potential loss of agricultural production) have been included in the capital and operating costs of the Modification (Section 2.4.1).

The impacted vegetation, and associated fauna, is likely to have non-use values to the community that would be lost as a result of the Modification. These values could potentially be estimated using non-market valuation methods. Similarly, the provision of offsets is also likely to have non-use values to the community that would be gained as a result of the Modification.

Provided the values held by the community for the offsets are equal or greater than values that would be lost then no additional economic costs warrant inclusion in the BCA.

In this respect, it is noted that the biodiversity offset is required to improve or at least maintain biodiversity values.

It is recognised that to the extent that any residual biodiversity impacts occur after mitigation, biodiversity costs of the Modification included in the BCA will be understated. However, it is unlikely that any residual impacts would be material from an aggregate economic welfare perspective.

**Agricultural Production**

As no agricultural activities are conducted within ML 1535, additional disturbance within ML 1535 associated with the Modification would not impact agricultural production (Section 4.7.2 of the EA).

The proposed 230 ha biodiversity offset area is located on Barrick-owned land and forms part of an area of approximately 1,000 ha of Barrick-owned land that is periodically used for sheep grazing.
There is an opportunity cost associated with using this land for the biodiversity offset instead of continued sheep grazing. This opportunity cost is reflected in land prices, which in turn reflects, among other things, the present value of foregone agricultural production. This opportunity cost has been included in the capital costs of the Modification.

Nevertheless, an indication of the foregone agriculture production is provided by a typical farm budget for sheep production which indicates a gross margin per dry sheep equivalent (DSE) of between $22.07 and $27.01⁴. Assuming an indicative carrying capacity of 2.5 DSE per ha, the gross margin per ha from the offset land ranges from $13,000 to $16,000. Using a 7% discount rate the present value of foregone agriculture from the offset land, in perpetuity, is $181,000 to $222,000.

From an aggregate economic efficiency perspective, these agricultural impacts are not considered to be material.

**Aquatic Ecology**

To date there have been no detectable adverse impacts on the ecology (vertebrates, invertebrates and flora) of Lake Cowal attributed to the CGM, based on long-term wetland bird monitoring and other fauna surveys such as fish monitoring (Appendix D of the EA).

Surface water monitoring indicates that site water is not affecting Lake Cowal and that there is also no obvious causal link between the mining operations and water quality in Lake Cowal (Appendix B of the EA).

Given the above, there are considered to be no aquatic ecology impacts as a result of the Modification that are sufficiently significant that they would warrant inclusion in the BCA.

**Aboriginal Heritage**

An Aboriginal Cultural Heritage Assessment (ACHA) was prepared for the Modification (Appendix G of the EA).

The Modification has the potential to impact Aboriginal heritage sites in the Modification surface disturbance area (Appendix G of the EA). The Modification layout has been designed such that any additional disturbance would avoid or minimise potential impacts to Aboriginal heritage (Section 4.4 of the EA).

Barrick has obtained permits and consents under sections 87 and 90 of the NSW *National Parks and Wildlife Act, 1974* for the management of Aboriginal heritage at the approved CGM.

These permits and consents include the following (Appendix G of the EA):

- Permit 1468 authorising certain archaeological works in the ML 1535 area, water pipeline area and borefield area.
- Consent 1467 authorising the destruction of Aboriginal objects in the ML 1535 area, water pipeline area and borefield area.

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⁴ For example, NSW Department of Primary Industries (DPI) Sheep Gross Margins Merino Ewes (20 micron) – Terminal Rams, NSW DPI Sheep Gross Margins Merino Ewes (20 micron) – Merino Rams, NSW DPI Sheep Gross Margins Merino Wethers (20 micron).
Previously registered sites B, C and E and Wamboyne Back Plains Site 1 are located within the Modification surface disturbance area and would therefore be subject to direct disturbance associated with mining activities as a result of the Modification (Appendix G of the EA). These sites are subject to the existing Consent 1467, which authorises the destruction of Aboriginal objects in the ML 1535 area, water pipeline area and borefield area (Appendix G of the EA).

It is noted that comments provided by Aboriginal representatives (during the consultation process for the ACHA) indicated that while cultural significance is difficult to rate, the sites and objects identified were considered to be typical of such settings and what had been collected previously (Appendix G of the EA).

It is also considered that there is very little potential for physical damage to individual in situ lithic artefacts not associated with the above sites (i.e. artefacts that are part of the background distribution) (Appendix G of the EA).

Salvage, excavation, monitoring and management measures relevant to Aboriginal heritage would continue to be conducted in accordance with the existing Indigenous Archaeology and Cultural Heritage Management Plan and permits and consents. This would include the collection and storage (in the Temporary Keeping Place) of the large weathered flake north-east of Wamboyne Back Plains Site 2 (Appendix G of the EA).

Given that the Modification would not require any changes to existing salvage, excavation, monitoring and management measures relevant to Aboriginal heritage, no economic impacts associated with Aboriginal heritage have been included in the BCA.

Notwithstanding, Barrick makes annual contributions to the Wiradjuri Study Centre located in Condobolin, and in accordance with the Native Title Agreement with the Wiradjuri people, Barrick has agreed to support the Wiradjuri community in the areas of environmental and cultural heritage, employment, training and education and business development. These costs are included in the operating costs for the Modification.

It is recognised that to the extent that any residual Aboriginal heritage impacts occur after mitigation, Aboriginal heritage costs of the Modification will be understated. However, it is unlikely that any residual impacts would be material from an aggregate economic welfare perspective.

**Non-Aboriginal Heritage**

The Modification would not impact any items of non-Aboriginal heritage and hence no impacts are included in the BCA (Section 4.10.5 of the EA).

**Visual Impacts**

Locations with potential views of the Modification landforms primarily include those that already have views of the CGM mine landforms (e.g. northern and southern waste rock emplacement).

Visual impacts of the Modification would be associated with the change to existing visual landscape (which includes the existing CGM) due to the expansion of CGM landforms, as well as continued use of night-lighting.

Visual impacts associated with mine landforms would decrease over time due the rehabilitation of the CGM with native grass, shrub and/or tree species consistent with those found in other elevated landforms in the region (i.e. which would reduce visual contrast with the surrounding landforms). The use of night-lighting would cease at mine closure.
Visual impacts would be most appreciable at the nearest privately-owned dwellings with views of the Modification waste rock emplacements and tailings storage facilities.

The potential impacts at the nearest private dwellings have been assessed as being low to moderate during the later years of the Modification and following rehabilitation residual impacts would be low (Section 4.8 of the EA). Given this, there are considered to be no visual impacts that are sufficiently significant that they would warrant inclusion in the BCA.

It is recognised that to the extent that any residual visual impacts occur after mitigation, visual impacts of the Modification will be understated. However, it is unlikely that any residual impacts would be material from an aggregate economic welfare perspective.

**Social and Economic Value of Employment**

The Modification would provide for continuation of employment for the existing on-site CGM workforce of approximately 357 people with employment levels tapering off over the additional 5 years of operation provided by the Modification.

Historically employment benefits of projects has tended to be omitted from BCA on the implicit assumption that labour resources used in a project would otherwise be employed elsewhere.

Where this is not the case and labour resources would otherwise be unemployed for some period of time, Streeting and Hamilton (1991) and Bennett (1996) outline that otherwise unemployed labour resources used in a project should be valued in a BCA at their opportunity cost (wages less social security payments and income tax) rather than the wage rate which has the effect of increasing the net production benefits of the Modification. In addition, there may be social costs of unemployment that require the estimation of people’s willingness to pay to avoid the trauma created by unemployment. These are non-market values.

It has also been recognised that the broader community may hold non-environmental, non-market values (Portney, 1994) for social outcomes such as employment (Johnson and Desvouges, 1997) and the viability of rural communities (Bennett et al., 2004). Gillespie Economics (2008) estimated the value the community hold for the 23 years that the Metropolitan Colliery provides 320 jobs, at $756M (present value). Gillespie Economics (2009) estimated the value the community hold for the 30 years that the Bulli Seam Operations provides 1,170 jobs, at $870M (present value).

The Modification would provide an additional 5 years of employment at the CGM. Using the more conservative Bulli Seam Operation employment value gives an estimated $27M for the employment benefits of the Modification. This value has been included in the BCA. Sensitivity testing includes omission of employment benefits from the BCA.

### 2.5 CONSOLIDATION OF VALUE ESTIMATES

#### 2.5.1 Aggregate Costs and Benefits

The present value of costs and benefits, using a 7% discount rate, is provided in Table 2.2. The main decision criterion for assessing the economic desirability of a project to society is its net present value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the project, because the community as a whole would obtain net benefits from the project.
The Modification is estimated to have total net production benefits of $131M. Assuming 100% foreign ownership, $50M of these net production benefits would accrue to Australia. The estimated net production benefits that accrue to Australia can be used as a threshold value or reference value against which the relative value of the residual environmental impacts of the Modification, after mitigation, may be assessed. This threshold value is the opportunity cost to society of not proceeding with the Modification. The threshold value indicates the price that the community must value any residual environmental impacts of the Modification (be willing to pay) to justify in economic efficiency terms the no development option.

For the Modification to be questionable from an economic efficiency perspective, all incremental residual environmental impacts from the Modification, that impact Australia\(^5\), would need to be valued by the community at greater than the estimate of the Australian net production benefits i.e. greater than $50M. This is equivalent to each household in the Lachlan Statistical Area Level 3 (SA3) i.e. Local Government Areas (LGAs) of Bland, Cowra, Forbes, Lachlan, Parkes and Weddin, valuing residual environmental impacts at $2,170. The equivalent figure for NSW and Australian households is $19 and $6, respectively.

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. From Section 2.4 it is evident that the main potential impacts of the Modification are internalised into the production costs of the Modification through mitigation measures, offsets and compensation costs. Other costs not already included in the production costs of the Modification include those associated with opportunity cost of water and greenhouse gas costs, although from Table 2.2 it is evident that these impacts to Australia are small, considerably less than the estimated net production benefits of the Modification to Australia. There may also be non-market benefits from the employment provided by the Modification.

Overall, the Modification is estimated to have net social benefits to Australia of between $49M (i.e. excluding employment benefits) and $75M (i.e. including employment benefits) 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 Modification BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $49M and $75M for the Modification to be questionable from an Australian economic efficiency perspective.

\(^5\) Consistent with the approach to considering net production benefits, environmental impacts that occur outside Australia would be excluded from the analysis. This is mainly relevant to the consideration of greenhouse gas impacts.
<table>
<thead>
<tr>
<th>COSTS</th>
<th>BENEFITS</th>
<th>SM*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunity cost of land</td>
<td>Delayed decommissioning costs</td>
<td>$8</td>
</tr>
<tr>
<td>Opportunity cost of capital</td>
<td>Revenue</td>
<td>$647</td>
</tr>
<tr>
<td>Capital costs</td>
<td>Residual value of land</td>
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</tr>
<tr>
<td>Operating costs</td>
<td>Residual value of capital</td>
<td>$2</td>
</tr>
<tr>
<td>Decommissioning costs</td>
<td></td>
<td>$6</td>
</tr>
<tr>
<td><strong>Production Sub-total</strong></td>
<td></td>
<td><strong>$658</strong></td>
</tr>
<tr>
<td><strong>Net Production Benefits</strong></td>
<td></td>
<td><strong>$131 ($50)</strong></td>
</tr>
<tr>
<td>Greenhouse gas emissions</td>
<td>$10 ($0.1)</td>
<td>Economic and social benefits of employment</td>
</tr>
<tr>
<td>Operational noise</td>
<td>Included in capital costs</td>
<td>-</td>
</tr>
<tr>
<td>Road transport</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Road transport noise</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Blasting</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Air quality</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Surface water and groundwater</td>
<td>$1</td>
<td>-</td>
</tr>
<tr>
<td>Flora and fauna</td>
<td>Some loss of values but offset, Cost of offset included in capital costs and operating costs</td>
<td>-</td>
</tr>
<tr>
<td>Aquatic ecology</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Aboriginal heritage</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Non-Aboriginal heritage</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td>Visual impacts</td>
<td>Negligible*</td>
<td>-</td>
</tr>
<tr>
<td><strong>Externalities sub-total</strong></td>
<td>$11</td>
<td><strong>$26</strong></td>
</tr>
</tbody>
</table>

**NET BENEFITS (including employment benefits)** $146 ($75)

**NET BENEFITS (excluding employment benefits)** $120 ($49)

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1 Production costs and benefits in accordance with data provided by Barrick.

* From an aggregate economic efficiency perspective

** Totals may have minor discrepancies due to rounding.

*** When impacts accrue globally the numbers in brackets relates to the level of impact estimated to accrue to Australia
2.5.2 Distribution of Impacts

_Intra-generational_

The distribution of incremental benefits and costs associated with the Modification is shown in Table 2.3. While Barrick would initially bear the production costs and receive the financial production benefits of the Modification, the net production benefits would be distributed between a number of stakeholders including:

- Barrick and its shareholders in the form of after tax profits.
- The Commonwealth Government in the form of Company tax payable from the Modification (estimated at $36M, present value), which is subsequently used to fund provision of government infrastructure and services across Australia and NSW, including the region.
- The NSW Government via royalties (estimated at $14M, present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the region.
- The local community in the form of financial sponsorship and in-kind support to a variety of local schools, sporting groups, annual events, charity groups and community groups. A description of Barrick’s community initiatives and contributions is provided in Section 1.5 of the EA.

The environmental, cultural and social impacts of the Modification may potentially accrue to a number of different stakeholder groups at the local, State, National and global level, however, they are largely internalised into the production costs of Barrick.

Greenhouse gas costs will occur at the national and global level and will be compensated for via the payment of the Commonwealth Government’s carbon tax, if it continues. Noise impacts will occur at the local level and will be compensated for through the acquisition of significantly impacted properties and the provision of mitigation measures. The economic costs associated with the clearing of native vegetation will potentially occur at the State and National level and would be also be compensated for by the provision of the proposed biodiversity offset. Other potential environmental impacts would largely occur at the local level and were found to be negligible from an aggregate economic efficiency perspective. Non-market benefits associated with additional employment provided by the proposed modification would largely accrue at the local or State level. It has been acknowledged previously by Forbes and Bland Shire Councils that the CGM provides important economic and employment opportunities. These shire councils have also previously expressed their support for extension and continuation of the CGM (Bland Shire Council, 2008; Forbes Shire Council, 2008).

The incremental environmental, social and cultural costs of the Modification that are not already included in the calculation of net production benefits, and which accrue to NSW, are estimated at less than $1M. This is considerably less than the net production benefits that directly accrue to NSW through royalties ($14M). NSW will obtain additional benefits through infrastructure and services provided with a share of Commonwealth Government Company tax from the Modification. Consequently, as well as resulting in net social benefits to Australia the Modification would be expected to result in net social benefits to NSW.
### Table 2.3
Distribution of Benefits and Costs (Present Values at 7% Discount Rate)

<table>
<thead>
<tr>
<th>Value ($M)</th>
<th>Distribution</th>
<th>Local</th>
<th>State</th>
<th>National</th>
<th>Global</th>
</tr>
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<td><strong>Net Production Benefits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net production benefits to proponent</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Net production benefits to Commonwealth Government – Company tax</td>
<td>$36</td>
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</tr>
<tr>
<td>Net production benefits to NSW Government – Royalties</td>
<td>$14</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Net production benefits to local and regional community in the form of voluntary contributions</td>
<td>Unquantified</td>
<td>✓</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$131</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Non-market Costs and Benefits</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Benefits</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Non-market benefit of employment</td>
<td>$26</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$26</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
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<tr>
<td>Greenhouse gas emissions rest of the world</td>
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<td>-</td>
<td>✓</td>
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<td>Greenhouse gas emissions Australia</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Agricultural impacts</td>
<td>Included in opportunity cost of land and capital costs (land acquisitions)</td>
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<td>Operation noise impacts</td>
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<td>Road transport impacts</td>
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<td>-</td>
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<tr>
<td>Flora and fauna</td>
<td>Some loss of values but offset. Cost of offset included in capital costs and operating costs</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
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<td>Aquatic ecology</td>
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<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
<tr>
<td>Aboriginal heritage</td>
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<td>✓</td>
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<td>-</td>
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<tr>
<td>Non-Aboriginal heritage impacts</td>
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<td>✓</td>
<td>✓</td>
<td>-</td>
</tr>
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<td>Visual impacts</td>
<td>Negligible*</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Net Social Benefits</strong></td>
<td></td>
<td>$146</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* From an aggregate economic efficiency perspective.

Note: Totals may have minor discrepancies due to rounding.

**Inter-generational**

Some of the environmental, social and cultural impacts of the Modification may be felt by future generations. This is particularly the case for non-market environmental impacts. However, BCA is not concerned with distributional issues (Attachment 1). The consideration of intergenerational equity issues is therefore outside the scope of BCA.
Nevertheless, it should be noted that the costs and benefits in BCA are defined and valued based on the microeconomic underpinnings of BCA. They are based on the values held by individuals in the society. This reflects current generations as there is no way to measure the value that future generations hold for impacts of current day projects, as they are not here to express it.

Nevertheless, as identified by Boardman et al., (2001) this is not considered a serious problem for BCA because:

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

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

### 2.6 SENSITIVITY ANALYSIS

The NPV presented in Table 2.2 is based on a range of assumptions around which there is some level of uncertainty. Uncertainty in a BCA 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.

In this analysis, the BCA result was tested for changes to the following variables:

- opportunity cost of land;
- opportunity cost of capital;
- capital costs;
- operating costs;
- decommissioning costs;
- revenue;
- residual value of land;
- residual value of capital;
- social value of employment;
- value of greenhouse gas emissions; and
- value of surface water.

This analysis indicated (Attachment 2) that the results of the BCA are most sensitive to decreases in the revenue and increases in operating costs. Significant increases in the values used for external impact such as greenhouse gas costs and capital and operating costs associated with noise impacts and flora and fauna impacts had little impact on the overall economic desirability of the Modification.
3 REGIONAL ECONOMIC IMPACT ASSESSMENT

3.1 INTRODUCTION

The BCA in Section 2 is concerned with whether the incremental benefits of the Modification exceed the incremental costs and therefore whether the community would, in aggregate, be better off ‘with’ the Modification compared to ‘without’ it. In contrast, the focus of the regional economic impact assessment is quantifying the positive effect (impact) of the Modification on the economy in terms of a number of specific indicators of economic activity, such as gross regional output, value-added, income and employment.

These indicators are defined as follows:

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

The main impacting agent for the Modification is the continuation of operations at the CGM. This is shown on Figure 3.1, where the output from the Modification is higher than the output for the base case from 2017 to 2024.

The maximum total average annual regional economic impacts for the Modification would occur during the 8 year period (2014 to 2021) when both mining and ore processing would occur (Figure 3.1). As such, the economic impact assessment examines the average annual regional economic impacts for this 8 year period.

Following 2021, only the processing of stockpiled ore would occur for the Modification. Regional economic impacts for the Modification would reduce during this period of ore processing only in comparison to the 8 year period of mining and ore processing.

However, as indicated on Figure 3.1, the maximum incremental annual average regional economic impact for the Modification compared to the base case would occur in approximately 2020, when mining and ore processing is occurring for the Modification, and all operations for the approved CGM would have ceased (Figure 3.1). Incremental regional economic impacts would be lower in all other years of the Modification (when compared to those in 2020).
3.2 ECONOMIES

The economy on which the impact is measured can range from a township to the entire nation (Powell *et al.*, 1985). In selecting the appropriate economy, regard needs to be had to capturing the local expenditure and employment associated with the production scenarios, but not making the economy so large that the impact of the proposal becomes trivial (Powell and Chalmers, 1995).

Data on the residential location of current employees at CGM indicates that approximately 95% live in the Lachlan SA3 comprising Bland, Cowra, Forbes, Lachlan, Parkes and Weddin LGAs. The average annual economic impacts of mining and ore processing under the Modification have therefore been estimated on the Lachlan SA3, as well as individually for the Bland LGA (within which the CGM is located) and nearby Lachlan and Forbes LGAs.

3.3 METHOD OF ASSESSMENT

A range of methods can be used to examine the economic impacts of an activity on an economy including economic base theory, Keynesian multipliers, econometric models, mathematical programming models and input-output models (Powell *et al.*, 1985).
Economic base theory and Keynesian multipliers are relatively simple approaches that provide impact measurement only in aggregate terms. Mathematical programming models are especially useful in micro-level studies of firms and industries but become complex for whole economies.

Mathematical programming models are therefore sometimes used to estimate direct effects on an industry or sector with input-output analysis used to assess economy-wide effects. Econometric models, particularly those of the general equilibrium type, have the potential to measure economic impacts in a similar way to that of input-output models with relaxation of some of the limitations of input-output analysis (Powell et al., 1985).

Consistent with the DP&I’s Draft Guideline, this study uses input-output analysis. The input-output method is based on a number of assumptions that are outlined in Attachment 3 and provides an upper bound impact estimate.

One of the key simplifying assumptions of input-output analysis is that there is unlimited labour and capital available to the region at fixed prices and therefore regional economic activity does not face capacity constraints that would result in increases in prices and crowding-out of other economic activity. Crowding out would be most prevalent if the regional economy was at full employment and it was a closed economy with no potential to use labour and other resources that currently reside outside the region.

In this situation a proposal requiring labour and other resources would compete for them with existing activities. However, the Lachlan SA3 is not at full employment and is not a closed economy. It has potential access to employed and unemployed labour and capital resources from across the country and overseas. Even where a mining project uses already employed labour resources from inside the region, there is a filter effect where these jobs are filled by other employed or unemployed labour resources\(^6\), which creates vacancies that are then filled by other employed or unemployed labour resource\(^6\), with these employed and unemployed labour resources\(^6\) coming from both inside or outside the region.

The potential labour force to meet demand in a region is therefore considerably greater than just the labour force in the region. Consequently, for small open economies, crowding out of other economic activity is likely to be negligible. Furthermore, the Modification is for continuation of an existing activity at existing levels of operation and crowding out is less relevant.

While more complex models such as Computable General Equilibrium (CGE) modelling can conceptually deal with the positive economic activity impacts of a project and any partially offsetting negative economic activity impacts, for small regional economies, it is unlikely that these more complex models will surpass the simpler input-output model. Firstly, the small open economy condition minimises the need to address offsetting impacts. Secondly, given the considerable difficulties associated with estimating a large number of coefficients and parameters required for CGE models when there is virtually no local data available, many exogenous assumptions are required to be made by the modeller and so the increased ‘fuzziness’ is likely to more than offset the increase in model sophistication. Furthermore, CGE models are less capable of being adapted to single LGA regions. Consequently, CGE models are mostly used at the State and National level for large scale policy and projects (e.g. quantifying the impact of the introduction of the goods and services tax).

Input-output analysis essentially involves two steps:

- development of an appropriate input-output table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each sector of the economy; and

\(^6\) Including the continual addition to the labour force from school leavers, TAFE and University graduates and potentially those not currently seeking employment.
• identification of the initial impact or stimulus of the Modification in a form that is compatible with the input-output equations so that the input-output multipliers and flow-on effects can then be estimated (West, 1993).

A 2011 input-output table of the Lachlan SA3, Bland LGA, Lachlan LGA and Forbes LGA was developed using the Generation of Input-Output Tables (GRIT) procedure (Attachment 4) using a 2011 NSW input-output table (developed by the Centre for Agricultural and Regional Economics) as the parent table. The 111 sector input-output tables of the regional economies were aggregated to eight sectors for the purpose of describing the economies.

The economic structure of the Lachlan SA3 regional economy can be compared with that of NSW through a comparison of results from the input-output model (Figures 3.2 and 3.6). This indicates that in the Lachlan SA3 regional economy (Figure 3.2), the agriculture, forest and fishing sectors, mining sectors, manufacturing sectors, utilities sectors and public personal services sectors are of greater relative importance than they are in the NSW economy (Figure 3.6), while the building sectors, trade and accommodation sectors and business services sectors are of less relative importance than they are to the NSW economy.

Compared to the Lachlan SA3 regional economy (Figure 3.2), the Bland LGA (Figure 3.3) has a greater relative concentration of economic activity in the agriculture, forest and fishing sectors and mining sectors and a lower relative concentration of economic activity in all other sector groupings. The Forbes LGA (Figure 3.4) has a lower relative concentration of economic activity in the mining sectors and a greater relative concentration of economic activity in all other sector groupings apart from agricultural, forestry and fishing and utilities sectors which are of similar relative significance. The agricultural, forestry and fishing sectors and utilities sectors in the Lachlan LGA (Figure 3.5) are of greater relative importance than they are in the Lachlan SA3 economy while the mining sectors, building sectors, trade and accommodation sectors and business services sectors are of less relative importance.

Figure 3.2
Summary of Aggregated Sectors: Lachlan SA3 Economy (2011)
Figure 3.3
Summary of Aggregated Sectors: Bland LGA Economy (2011)

Figure 3.4
Figure 3.5
Summary of Aggregated Sectors: Lachlan LGA Economy (2011)

Figure 3.6
Summary of Aggregated Sectors: NSW Economy (2011)
3.4 REGIONAL ECONOMIC IMPACT OF THE MODIFICATION

3.4.1 Introduction

The main regional economic impact of the Modification is associated with the continuation and extension of operations at the CGM. The Modification would continue both mining and ore processing at CGM for an additional 4 years relative to the base case (Figure 3.1). The average annual impact of 8 years (i.e. 2014 to 2021) of mining and ore processing for the Modification is assessed in this section, as maximum average annual regional economic impacts for the Modification would occur during this period.

For the analysis of the Modification, a CGM sector reflecting the average annual production for 8 years was developed and inserted into the input-output table for the regions within which the CGM is located (i.e. Lachlan SA3 and Bland LGA). The revenue, expenditure and employment data for these sectors was obtained from financial information provided by the Barrick. For these new sectors:

- the estimated average annual gross revenue was allocated to the output row;
- the estimated wage bill of those residing in the regions was allocated to the household wages row with the remainder allocated to a separate household wages row that is not included in the calculation of flow-on effect;
- non-wage expenditure was initially allocated across the relevant intermediate sectors in the economy, imports and other value-added;
- allocation was then made between intermediate sectors in the regional economy and imports based on advice from the proponent and regional location quotients;
- purchase prices for expenditure in the each sector in the region were adjusted to basic values and margins and taxes and allocated to appropriate sectors using relationships in the National Input-Output Tables;
- the difference between average total revenue and average total costs was allocated to the other value-added row; and
- direct employment in the region provided by the Modification was allocated to the employment row.

The major difference between the sectors generated for Lachlan SA3 input-output table and the Bland LGA input-output table was the greater intermediate expenditure and wages that could be captured in the larger economy. The smaller the economy, the greater the reliance on imports.

To assess the regional economic impacts on the Forbes LGA and Lachlan LGA, a similar approach was used except instead of generating a new sector for insertion into the input-output table a new final demand profile was developed to represent intermediate expenditure and wages paid to employees who reside in these regions. The estimated total intermediate expenditure in these regions was allocated across intermediate sectors of the economies in proportion to the expenditure profile of the Modification in the Lachlan SA3. Adjustments were made for imports using location quotients and for margins and taxes using relationships in the national input-output tables.

The computer program IO7 was used to estimate the average annual direct and indirect output, value-added, income and employment impacts of the project for each of the economies.

---

7 Inflated to 2013
8 Regions that the CGM is not located in.
3.4.2 Impacts of the Modification on the Regional Economies

The total and disaggregated annual impacts of the Modification on the regional economies in terms of output, value-added, income and employment (in 2013 dollars) are shown in Tables 3.1 to 3.4.

Table 3.1
Annual Regional Economic Impacts of the Modification on the Lachlan SA3 Economy

<table>
<thead>
<tr>
<th></th>
<th>Direct Effect</th>
<th>Production Induced</th>
<th>Consumption Induced</th>
<th>Total Flow-on</th>
<th>TOTAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT ($'000)</td>
<td>369,989</td>
<td>31,013</td>
<td>31,165</td>
<td>62,178</td>
<td>432,167</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.08</td>
<td>0.08</td>
<td>0.17</td>
<td>1.17</td>
</tr>
<tr>
<td>VALUE-ADDED ($'000)</td>
<td>213,623</td>
<td>12,492</td>
<td>17,243</td>
<td>29,735</td>
<td>243,357</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.06</td>
<td>0.08</td>
<td>0.14</td>
<td>1.14</td>
</tr>
<tr>
<td>INCOME ($'000)</td>
<td>34,089</td>
<td>5,486</td>
<td>5,178</td>
<td>10,664</td>
<td>44,753</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.16</td>
<td>0.15</td>
<td>0.31</td>
<td>1.31</td>
</tr>
<tr>
<td>EMPLOYMENT (No.)</td>
<td>357</td>
<td>114</td>
<td>150</td>
<td>264</td>
<td>621</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.32</td>
<td>0.42</td>
<td>0.74</td>
<td>1.74</td>
</tr>
<tr>
<td>Employment Living in Region</td>
<td>339</td>
<td>110</td>
<td>144</td>
<td>254</td>
<td>593</td>
</tr>
<tr>
<td>Employment Living Outside Region</td>
<td>18</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Totals may have minor discrepancies due to rounding.

Table 3.2
Annual Regional Economic Impacts of the Modification on the Bland LGA Economy

<table>
<thead>
<tr>
<th></th>
<th>Direct Effect</th>
<th>Production Induced</th>
<th>Consumption Induced</th>
<th>Total Flow-on</th>
<th>TOTAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT ($'000)</td>
<td>369,989</td>
<td>15,941</td>
<td>14,260</td>
<td>30,202</td>
<td>400,191</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.04</td>
<td>0.04</td>
<td>0.08</td>
<td>1.08</td>
</tr>
<tr>
<td>VALUE-ADDED ($'000)</td>
<td>213,601</td>
<td>6,662</td>
<td>8,295</td>
<td>14,956</td>
<td>228,557</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.03</td>
<td>0.04</td>
<td>0.07</td>
<td>1.07</td>
</tr>
<tr>
<td>INCOME ($'000)</td>
<td>24,066</td>
<td>2,566</td>
<td>2,073</td>
<td>4,639</td>
<td>28,705</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.11</td>
<td>0.09</td>
<td>0.19</td>
<td>1.19</td>
</tr>
<tr>
<td>EMPLOYMENT (No.)</td>
<td>357</td>
<td>59</td>
<td>68</td>
<td>127</td>
<td>484</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.17</td>
<td>0.19</td>
<td>0.36</td>
<td>1.36</td>
</tr>
<tr>
<td>Employment Living in Region</td>
<td>239</td>
<td>56</td>
<td>64</td>
<td>120</td>
<td>359</td>
</tr>
<tr>
<td>Employment Living Outside Region</td>
<td>118</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>125</td>
</tr>
</tbody>
</table>

Note: Totals may have minor discrepancies due to rounding.
Table 3.3

Annual Regional Economic Impacts of the Modification on the Forbes LGA Economy

<table>
<thead>
<tr>
<th></th>
<th>Direct Effect</th>
<th>Production Induced</th>
<th>Consumption Induced</th>
<th>Total Flow-on</th>
<th>TOTAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT ($'000)</td>
<td>6,359</td>
<td>943</td>
<td>1,663</td>
<td>2,606</td>
<td>8,965</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.15</td>
<td>0.26</td>
<td>0.41</td>
<td>1.41</td>
</tr>
<tr>
<td>VALUE-ADDED ($'000)</td>
<td>4,407</td>
<td>410</td>
<td>961</td>
<td>1,370</td>
<td>5,777</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.09</td>
<td>0.22</td>
<td>0.31</td>
<td>1.31</td>
</tr>
<tr>
<td>INCOME ($'000)</td>
<td>530</td>
<td>147</td>
<td>262</td>
<td>409</td>
<td>939</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.28</td>
<td>0.49</td>
<td>0.77</td>
<td>1.77</td>
</tr>
<tr>
<td>EMPLOYMENT (No.)</td>
<td>16</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.23</td>
<td>0.53</td>
<td>0.76</td>
<td>1.76</td>
</tr>
<tr>
<td>Employment Living in Region</td>
<td>14</td>
<td>3</td>
<td>7</td>
<td>11</td>
<td>25</td>
</tr>
<tr>
<td>Employment Living Outside Region</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: Totals may have minor discrepancies due to rounding.

Table 3.4

Annual Regional Economic Impacts of the Modification on the Lachlan LGA Economy

<table>
<thead>
<tr>
<th></th>
<th>Direct Effect</th>
<th>Production Induced</th>
<th>Consumption Induced</th>
<th>Total Flow-on</th>
<th>TOTAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT ($'000)</td>
<td>1,679</td>
<td>165</td>
<td>147</td>
<td>312</td>
<td>1,991</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.10</td>
<td>0.09</td>
<td>0.19</td>
<td>1.19</td>
</tr>
<tr>
<td>VALUE-ADDED ($'000)</td>
<td>1,265</td>
<td>75</td>
<td>86</td>
<td>161</td>
<td>1,426</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.06</td>
<td>0.07</td>
<td>0.13</td>
<td>1.13</td>
</tr>
<tr>
<td>INCOME ($'000)</td>
<td>112</td>
<td>23</td>
<td>22</td>
<td>45</td>
<td>156</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.21</td>
<td>0.19</td>
<td>0.40</td>
<td>1.40</td>
</tr>
<tr>
<td>EMPLOYMENT (No.)</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.16</td>
<td>0.19</td>
<td>0.35</td>
<td>1.35</td>
</tr>
<tr>
<td>Employment Living in Region</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Employment Living Outside Region</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Totals may have minor discrepancies due to rounding.

Tables 3.1 to 3.4 indicate that the greatest regional economic impacts of the Modification would occur in the Lachlan SA3 and Bland LGA economies (i.e. the regions that the CGM is located within).

In summary, using input-output analysis it is estimated that the Modification would make up to the following direct and indirect average total annual contributions to the Lachlan SA3 regional economy (Table 3.1):

- $432M in annual direct and indirect regional output or business turnover;
- $243M in annual direct and indirect regional value-added;
- $45M in annual direct and indirect household income; and
- 621 direct and indirect jobs.
In addition, the Modification would make up to the following direct and indirect average total annual contributions to the Bland LGA regional economy:

- $400M in annual direct and indirect regional output or business turnover;
- $229M in annual direct and indirect regional value-added;
- $29M in annual direct and indirect household income; and
- 484 direct and indirect jobs.

This level of total contribution to the regional economies would occur for approximately 8 years (i.e. 2014 to 2021) with lesser impacts in 2022 to 2024 of the Modification when the mining ceases and ore processing is the only economic activity.

This level of total annual regional economic impact is also indicative of the maximum incremental impact of the Modification in comparison to the base case (i.e. approved CGM), and this maximum incremental impact would occur in approximately 2020, with lesser incremental impacts in other years.

3.4.3 Multipliers

For all regions, the Type 11A ratio multipliers for the Modification are smaller for output and value-added than they are for employment and income.

Capital intensive industries tend to have a high level of linkages with other sectors in an economy thus contributing substantial flow-on employment while at the same time only having a lower level of direct employment and income (relative to output levels). This tends to lead to relatively high ratio multipliers for employment and income. Capital intensive mining projects also typically have a relatively low ratio multiplier for value-added, reflecting the relatively high direct value-added for the projects compared to that in flow-on sectors. The low output ratio multiplier largely reflects the high direct output value of the projects compared to the sectors that experience flow-on effects.

3.4.4 Main Sectors Affected in the Lachlan SA3 and Bland LGA

Flow-on impacts from the Modification are likely to affect a number of different sectors of the Lachlan SA3 and Bland LGA regional economies. The sectors most impacted by output, value-added and income flow-ons are likely to be the:

- exploration and mining support services sector;
- other repair and maintenance sector;
- retail and wholesale trade sectors;
- specialised and other machinery and equipment manufacturing sector;
- road transport sector;
- professional, scientific and technical services sector;
- food and beverage services sector; and
- education and training sector.

Examination of the estimated direct and flow-on employment impacts gives an indication of the sectors in which employment would continue to be generated by the Modification (Table 3.5).
### Table 3.5

*Sectoral Distribution of Total Regional Employment Impacts*

<table>
<thead>
<tr>
<th>Sector</th>
<th>Lachlan SA3 Regional Economy</th>
<th>Bland LGA Regional Economy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Direct Effects</td>
<td>Production Induced</td>
</tr>
<tr>
<td>Primary</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mining</td>
<td>357</td>
<td>30</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Utilities</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Building</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Trade and Accommodation</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Transport</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Business services</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Public and Personal Services</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>357</td>
<td>114</td>
</tr>
</tbody>
</table>

Note: Totals may have minor discrepancies due to rounding.

Table 3.5 indicates that direct, production-induced and consumption-induced employment impacts of the Modification on the Lachlan SA3 and Bland LGA regional economies are likely to have different distributions across sectors.

Production-induced employment impacts (including contractors) would mainly occur in the mining sectors, public and personal services sectors and manufacturing sectors. Consumption-induced employment flow-ons would mainly occur in the trade and accommodation sectors and the public and personal services sectors.

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

### 3.5 STATE ECONOMIC IMPACTS OF THE MODIFICATION

#### 3.5.1 Introduction

The State economic impacts of the Modification operation were assessed in the same manner as for estimation of the regional impacts. A new CGM sector was inserted into a 2013 NSW input-output table in the same manner described in Section 3.4.1. The primary difference from the CGM sector identified for the regional economies was that a greater level of expenditure would be captured by the NSW economy compared to the regional economies.

#### 3.5.2 Impacts of the Modification on NSW

The total and disaggregated average annual impacts of mining and ore processing phase of the Modification on the NSW economy in terms of output, value-added, income and employment (in 2013 dollars) are shown in Table 3.6.
Table 3.6  
Annual State Economic Impacts of the Modification

<table>
<thead>
<tr>
<th></th>
<th>Direct Effect</th>
<th>Production Induced</th>
<th>Consumption Induced</th>
<th>Total Flow-on</th>
<th>TOTAL EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OUTPUT ($’000)</td>
<td>369,989</td>
<td>261,056</td>
<td>165,668</td>
<td>426,723</td>
<td>796,712</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.71</td>
<td>0.45</td>
<td>1.15</td>
<td>2.15</td>
</tr>
<tr>
<td>VALUE-ADDED ($’000)</td>
<td>216,611</td>
<td>102,456</td>
<td>88,772</td>
<td>191,228</td>
<td>407,839</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>0.47</td>
<td>0.41</td>
<td>0.88</td>
<td>1.88</td>
</tr>
<tr>
<td>INCOME ($’000)</td>
<td>35,883</td>
<td>55,710</td>
<td>41,107</td>
<td>96,817</td>
<td>132,700</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>1.55</td>
<td>1.15</td>
<td>2.70</td>
<td>3.70</td>
</tr>
<tr>
<td>EMPLOYMENT (No.)</td>
<td>357</td>
<td>773</td>
<td>628</td>
<td>1,401</td>
<td>1,758</td>
</tr>
<tr>
<td>Type 11A Ratio</td>
<td>1.00</td>
<td>2.17</td>
<td>1.76</td>
<td>3.92</td>
<td>4.92</td>
</tr>
</tbody>
</table>

Ratios have been rounded to the nearest two decimal places.

The Modification is estimated to make the following average annual contribution to the NSW economy for a period of 8 years (Table 3.6):

- $797M in annual direct and indirect output or business turnover;
- $408M in annual direct and indirect value-added;
- $133M in annual household income; and
- 1,758 direct and indirect jobs.

The estimated Modification impacts on the NSW economy are substantially greater than for the regional economies, as the NSW economy is able to capture more mine and household expenditure, and there is a greater level of intersectoral linkages in the larger NSW economy. The total impact of the Modification on the NSW economy will decline in Years 9 to 11 of the Modification as expenditures decrease.

3.6 MODIFICATION CESSATION

The continuation and expansion of operations at the CGM would stimulate demand in the regional and NSW economy leading to increased business turnover in a range of sectors and increased employment opportunities. Conversely, cessation of the mining operations at completion of the Modification would result in a contraction in regional economic activity.

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

- the movements of workers and their families;
- alternative development opportunities; and
- economic structure and trends in the regional economy at the time.
Ignoring all other influences, the impact of Modification cessation would depend on whether the workers and their families affected would leave the region. If it is assumed that some or all of the workers remain in the region, then the impacts of Modification cessation would not be as severe compared to a greater proportion of employees leaving the region. This is because the consumption-induced flow-ons of the decline would be reduced through the continued consumption expenditure of those who stay (Economic and Planning Impact Consultants, 1989). Under this assumption the regional economic impacts of Modification cessation would approximate the direct and production-induced effects in Tables 3.1 to 3.4. However, if displaced workers and their families leave the region then impacts would be greater and begin to approximate the total effects in Tables 3.1 to 3.4.

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

To the extent that alternative development opportunities arise in the regional economy, the regional economic impacts associated with Modification closure that arise through reduced production and employment expenditure can be substantially ameliorated and absorbed by the growth of the region. One key factor in the growth potential of a region is a region’s capacity to expand its factors of productions by attracting investment and labour from outside the region (Bureau of Industry Economics, 1994). This in turn can depend on a region’s natural endowments.

If new mining resource developments occur in the future this would help broaden the region’s economic base and buffer against impacts of the cessation of individual activities. The Lachlan fold belt is prospective in that a number of metalliferous exploration and mining projects are located in the region including the Northparkes Mine, Peak Hill Gold Mine, Mineral Hill and the CGM.

Ultimately, the significance of the economic impacts of cessation of the Modification would depend on the economic structure and trends in the regional economy at the time. For example, if Modification cessation takes place in a declining economy, the impacts might be significant. Alternatively, if Modification cessation takes place in a growing diversified economy where there are other development opportunities, the ultimate cessation of the Modification may not be a cause for concern.

Nevertheless, given the uncertainty about the future complementary mining activity in the region it is not possible to foresee the likely circumstances within which Modification cessation would occur. It is therefore important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Modification would maintain in the region.

Consistent with the existing Development Consent, it is recommended that prior to closure of the CGM Barrick should work with local shire councils and the community to prepare a workforce phase-out plan to minimise disruption associated with CGM employment cessation.

The Modification would extend the operation of the CGM by 5 years and hence delay the impacts of cessation.
4 EMPLOYMENT, POPULATION AND COMMUNITY INFRASTRUCTURE ASSESSMENT

Changes in the workforce and population of a region may well have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. This may include the number of services that are available to be used and the accessibility of the population to these services.

Employment that is directly generated by the continuation and extension of a mine may be sourced from:

- the local region either from:
  - the unemployment pool; or
  - workers from other industries; and/or
- in-migration or commuters.

Sourcing labour from the local region has minimal direct impact on local community infrastructure and services since it results in no changes to the regional population and hence demand for services. It may, however, have an indirect impact on some local community infrastructure and services where changes in employment status or income result in changes in demand for some particular services (e.g. health services).

Whether local labour is sourced from the unemployment pool or from other industries, it can reduce unemployment levels - directly in the case of employing unemployed people and indirectly via the filter effect9 where labour is sourced from other industries.

The impact of commuter workers will depend on the extent to which they integrate into the regional communities, however, is likely to be modest.

In-migration, resulting in population change is likely to have the greatest potential impact on demand for community services and infrastructure with this impact dependent on the new residential location of the migrating workforce and their families and the capacity of the local region to provide the services required.

As well as direct employment and population changes, mining projects may also generate indirect labour demand through expenditure by employees in the local region and expenditure by mines in the local region on other inputs to production. This induced demand for labour may also have consequences for population change and demand for community infrastructure and services.

While the CGM Modification would continue to provide employment for the existing 357 employees that work at the mine, no additional direct employment is proposed and hence no additional direct demand on housing or community infrastructure would occur. With some increase in the operational expenditure associated with the Modification relative to the base case there may be some modest additional flow-on employment as a result of the Modification. However, if this flow-on employment is filled by existing residents of the region then there would be little impact on community infrastructure demand. Community infrastructure impacts associated with changes in demand are only likely to arise from migration into the region (i.e. population change). However, any potential population change should be considered within the context of recent population changes to the Lachlan SA3 region and in particular the Bland LGA (Table 4.1).

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9 The filter effect refers to the situation where labour is sourced from other industries in the region making jobs available in those industries which are subsequently filled by people either from the unemployment pool or other industries with the latter making jobs available in that industry.
Table 4.1
Lachlan Statistical Area Level 3 and LGA Population Change

<table>
<thead>
<tr>
<th>Local Government Area</th>
<th>2001 no.</th>
<th>2011pr no.</th>
<th>2001-2011pr %</th>
<th>2001-2011pr(a) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bland (A)</td>
<td>6655</td>
<td>6018</td>
<td>-9.6</td>
<td>-637</td>
</tr>
<tr>
<td>Cowra (A)</td>
<td>13094</td>
<td>12526</td>
<td>-4.3</td>
<td>-568</td>
</tr>
<tr>
<td>Forbes (A)</td>
<td>10143</td>
<td>9471</td>
<td>-6.6</td>
<td>-672</td>
</tr>
<tr>
<td>Lachlan (A)</td>
<td>7560</td>
<td>6758</td>
<td>-10.6</td>
<td>-802</td>
</tr>
<tr>
<td>Parkes (A)</td>
<td>15047</td>
<td>15084</td>
<td>0.2</td>
<td>37</td>
</tr>
<tr>
<td>Weddin (A)</td>
<td>3857</td>
<td>3734</td>
<td>-3.2</td>
<td>-123</td>
</tr>
<tr>
<td><strong>Region Total</strong></td>
<td>56,356</td>
<td>53,591</td>
<td>-4.9</td>
<td>-2,765</td>
</tr>
</tbody>
</table>


The Lachlan SA3 and all LGAs within it have been experiencing long-term population decline, or in the case of Parkes a static population (Table 4.1), which is likely to have resulted in some spare capacity in community infrastructure and services. Consequently, any additional minor population gain in the region is unlikely to place any strain on existing community infrastructure. In contrast, extending the life of the approved CGM may slow the decline of the regional population and hence slow any overall decline in the provision of community infrastructure and services to the region.
5 CONCLUSION

A BCA of the Modification indicated that it would have incremental net production benefits to Australia of $50M. Provided the residual environmental, social and cultural impacts of the Modification that accrue to Australia are considered to be valued at less than $50M, the Modification can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

Instead of leaving the environmental, cultural and social impacts unquantified, an attempt was made to quantify them. The main quantifiable environmental impacts of the Modification, which have not already been incorporated into the estimate of net production benefits, relate to greenhouse gas emissions and water licences. These incremental impacts to Australia are estimated at $1M, considerably less than the estimated net production benefits of the Modification. There may also be some non-market benefits of employment provided by the Modification which are estimated to be in the order of $26M.

Overall, the Modification is estimated to have incremental net benefits to Australia of between $49M (excluding employment benefits) and $75M (including employment benefits) and hence is desirable and justified from an economic efficiency perspective.

While the main environmental, cultural and social impacts have been quantified and included in the Modification BCA, any other residual environmental, cultural or social impacts that remain unquantified would need to be valued at greater than between $49M and $75M for the Modification to be questionable from an Australian economic efficiency perspective.

An economic impact analysis, using input-output analysis estimated that the Modification would make up to the following direct and indirect total annual average contributions to the Lachlan SA3 regional economy:

- $432M in annual direct and indirect regional output or business turnover;
- $243M in annual direct and indirect regional value-added;
- $45M in annual direct and indirect household income; and
- 621 direct and indirect jobs.

In addition, the Modification would make up to the following direct and indirect a total annual average contributions to the Bland LGA regional economy:

- $400M in annual direct and indirect regional output or business turnover;
- $229M in annual direct and indirect regional value-added;
- $29M in annual direct and indirect household income; and
- 484 direct and indirect jobs.

These total annual average contributions to the Lachlan SA3 and Bland LGA regional economies would be greatest during 8 year period (2014 to 2021) of both mining and ore processing during the life of the Modification, and would reduce towards the end of the Modification when mining ceases and only the processing of stockpiled ore would occur.

These total annual average contributions to the Lachlan SA3 and Bland LGA are also indicative of the maximum incremental contribution of the Modification in comparison to the approved CGM, with this maximum incremental contribution occurring in approximately 2020.

The Modification would also contribute economic activity to the Forbes and Lachlan LGAs.
Any changes in the workforce and populations of regions and towns may have implications in relation to access to community infrastructure and human services, which includes for example housing, health and education facilities. However, there is not expected to be any additional direct workforce for the Modification compared to the existing CGM. While there may be some additional flow-on employment in the region as a result of the increased operational expenditure of the CGM in the region, this is likely to be modest and in the context of long-term population decline in the region is unlikely to place any strain on existing community infrastructure. In contrast, extending the life of the approved CGM may slow the decline of the regional population and hence slow any overall decline in the provision of community infrastructure and services to the region.

The Modification will delay cessation of mining and ore processing at the CGM by 5 years. Cessation of the CGM will lead to a reduction in economic activity in the region and NSW. The significance of these cessation impacts would depend on:

- The degree to which any displaced workers and their families remain within the region, even if they remain unemployed. This is because continued expenditure by these people in the regional economy (even at reduced levels) contributes to final demand.
- The economic structure and trends in the regional economy at the time. For example, if Modification cessation takes place in a declining economy the impacts might be felt more greatly than if it takes place in a growing diversified economy.
- Whether other mining developments or other opportunities in the region arise that allow employment of displaced workers.

Given these uncertainties it is not possible to foresee the likely circumstances within which Modification cessation would occur. It is therefore important for regional authorities and leaders to take every advantage from the stimulation to regional economic activity and skills and expertise that the Modification brings to the region, to strengthen and broaden the region’s economic base.

Consistent with the existing CGM Development Consent (DA 14/98), it is recommended that prior to closure of the CGM, Barrick should work with local shire councils and the community to prepare a workforce phase-out plan to minimise disruption associated with CGM employment cessation.
6 REFERENCES

Date Accessed: 5 August 2013.


ATTACHMENT 1 - BENEFIT COST ANALYSIS
Introduction to BCA

Benefit Cost Analysis (BCA) 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 (2007). BCA applications within the NSW environmental assessment framework are further guided by the NSW Department of Planning and Infrastructure Draft Guidelines for Economic Effects and Evaluation in EIA (James and Gillespie, 2002) and the NSW Government (2012) Draft Guidelines for the use of Cost Benefit Analysis in mining and coal seam gas proposals.

BCA is concerned with a single objective of the NSW 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 BCA. 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 BCA can provide qualitative and quantitative information on how costs and benefits are distributed, welfare economics and BCA 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 are therefore left to decision-makers.

Similarly BCA 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 BCA, alongside the performance of a project in meeting other conflicting goals and objectives of the EP&A Act and government.

Definition of Society

BCA 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, BCA can potentially be applied across different definitions of society such as a local area, state, nation or the world. However, most applications of BCA 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 BCA 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 benefits to foreign owners.

BCA at a sub-national perspective is not recommended as it results in a range of costs and benefits from a project being excluded, making BCA a less valuable tool for decision-makers (Boardman et al., 2001).
BCAs of mining projects are therefore often undertaken from a global perspective, 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 BCA 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 coal mining projects, typically only the costs and benefits from mining the coal and delivering it to Port or domestic users, are relevant.

Coal is an intermediate good, that is, it is an input to other production processes such as production of electricity and steel making. However, these other production processes themselves require approval and, in BCA, would be assessed as separate projects.

**Net Production Benefits**

BCA of mining proposals invariably involves a trade-off between:

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

Net production benefits can be estimated based on market data on the projected financial value of coal less the capital 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 BCA 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, BCA 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.

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10 In limited cases the financial value may not reflect the economic value and therefore it is necessary to determine a shadow price for the coal.
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 BCA (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 includes accounting for costs aimed at mitigating, offsetting or compensating for the main environmental, social and cultural impacts. This includes the costs of purchasing properties adversely affected by noise and dust, providing mitigation measures for properties moderately impacted by noise and dust, 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\(^\text{11}\) 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.

**REFERENCES**


Date Accessed: 7 February 2013.

\(^{11}\) Including potential impacts that were unknown at the time of the preparation of the relevant assessment document or arise during the Environmental Assessment process due to differences in technical opinions.
ATTACHMENT 2 – BENEFIT COST ANALYSIS SENSITIVITY TESTING
### Table A2.1
Net Social Benefits to Australia Sensitivity Testing Modification Net Present Value ($Millions)

<table>
<thead>
<tr>
<th></th>
<th>Core Analysis</th>
<th>4% Discount Rate</th>
<th>7% Discount Rate</th>
<th>10% Discount Rate</th>
</tr>
</thead>
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<tr>
<td>INCREASE 20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunity cost of land</td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Opportunity cost of capital</td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Capital costs</td>
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<td>$55</td>
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<tr>
<td>Operating costs</td>
<td>$63</td>
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<td>$35</td>
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<tr>
<td>Decommissioning costs</td>
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<td>$75</td>
<td>$58</td>
<td></td>
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<tr>
<td>Revenue</td>
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<td></td>
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<td>Residual value of land</td>
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<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Residual value of capital</td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Value of surface water</td>
<td>$98</td>
<td>$74</td>
<td>$57</td>
<td></td>
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<tr>
<td>Social value of employment</td>
<td>$103</td>
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<tr>
<td><strong>GREENHOUSE COSTS @ $40/TONNE (T)</strong></td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
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<table>
<thead>
<tr>
<th></th>
<th>Core Analysis</th>
<th>4% Discount Rate</th>
<th>7% Discount Rate</th>
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<tr>
<td>DECREASE 20%</td>
<td></td>
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</tr>
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<td>Opportunity cost of land</td>
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<td>$75</td>
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<tr>
<td>Opportunity cost of capital</td>
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<tr>
<td>Operating costs</td>
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<td>$103</td>
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<td>Decommissioning costs</td>
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<td>Revenue</td>
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</tr>
<tr>
<td>Residual value of capital</td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Value of surface water</td>
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<td>$75</td>
<td>$58</td>
<td></td>
</tr>
<tr>
<td>Social value of employment</td>
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<tr>
<td><strong>GREENHOUSE COSTS @ $8/T</strong></td>
<td>$98</td>
<td>$75</td>
<td>$58</td>
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</tbody>
</table>

Note: % = Percent.
ATTACHMENT 3 - UNDERLYING ASSUMPTIONS AND INTERPRETATION OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS
1. “The basic assumptions in input-output analysis include the following:
   
   - there is a fixed input structure in each industry, described by fixed technological coefficients (evidence from comparisons between input-output tables for the same country over time have indicated that material input requirements tend to be stable and change slowly; however, requirements for primary factors of production, that is labour and capital, are probably less constant);
   
   - all products of an industry are identical or are made in fixed proportions to each other;
   
   - each industry exhibits constant returns to scale in production;
   
   - unlimited labour and capital are available at fixed prices; that is, any change in the demand for productive factors will not induce any change in their cost (in reality, constraints such as limited skilled labour or investment funds lead to competition for resources among industries, which in turn raises the prices of these scarce factors of production and of industry output generally in the face of strong demand); and
   
   - there are no other constraints, such as the balance of payments or the actions of government, on the response of each industry to a stimulus.

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

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

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

5. The multipliers also do not account for some important pre-existing conditions. This is especially true of Type 2 multipliers in which employment generated and income earned induce further increases in demand. The implicit assumption is that those taken into employment were previously unemployed and were previously consuming nothing. In reality, however, not all ‘new’ employment would be drawn from the ranks of the unemployed; and to the extent that it was, those previously unemployed would presumably have consumed out of income support measures and personal savings. Employment, output and income responses are therefore overstated by the multipliers for these additional reasons.

6. The most appropriate interpretation of multipliers is that they provide a relative measure (to be compared with other industries) of the interdependence between one industry and the rest of the economy which arises solely from purchases and sales of industry output based on estimates of transactions occurring over a (recent) historical period. Progressive departure from these conditions would progressively reduce the precision of multipliers as predictive devices” (Australian Bureau of Statistics [ABS], 1995).
Multipliers indicate the total impact of changes in demand for the output of any one industry on all industries in an economy (ABS, 1995). Conventional output, employment, value-added and income multipliers show the output, employment, value-added and income responses to an initial output stimulus (Jensen and West, 1986).

Components of the conventional output multiplier are as follows:

- **Initial effect** - which is the initial output stimulus, usually a $1 change in output from a particular industry (Powell and Chalmers, 1995; ABS, 1995).
- **First round effects** - the amount of output from all intermediate sectors of the economy required to produce the initial $1 change in output from the particular industry (Powell and Chalmers, 1995; ABS, 1995).
- **Industrial support effects** - the subsequent or induced extra output from intermediate sectors arising from the first round effects (Powell and Chalmers, 1995; ABS, 1995).
- **Production induced effects** - the sum of the first round effects and industrial support effects, i.e. the total amount of output from all industries in the economy required to produce the initial $1 change in output (Powell and Chalmers, 1995; ABS, 1995).
- **Consumption induced effects** - the spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries (Powell and Chalmers, 1995; ABS, 1995).
- The **simple multiplier** is the initial effect plus the production induced effects.
- The **total multiplier** is the sum of the initial effect plus the production induced effect and consumption induced effect.

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

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

A description of the different ratio multipliers is given below (Centre for Farm Planning and Land Management, 1989).

<table>
<thead>
<tr>
<th>Ratio Multiplier Type</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1A Ratio Multiplier</td>
<td>$\frac{\text{Initial} + \text{First Round Effects}}{\text{Initial Effects}}$</td>
</tr>
<tr>
<td>Type 1B Ratio Multiplier</td>
<td>$\frac{\text{Initial} + \text{Production Induced Effects}}{\text{Initial Effects}}$</td>
</tr>
<tr>
<td>Type 1I A Ratio Multiplier</td>
<td>$\frac{\text{Initial} + \text{Production Induced} + \text{Consumption Induced Effects}}{\text{Initial Effects}}$</td>
</tr>
<tr>
<td>Type 1I B Ratio Multiplier</td>
<td>$\frac{\text{Flow-on Effects}}{\text{Initial Effects}}$</td>
</tr>
</tbody>
</table>
REFERENCES


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


ATTACHMENT 4 - THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES
"The Generation of Regional Input-Output Tables (GRIT) system was designed to:

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

The resultant GRIT procedure has a number of well-defined steps. Of particular significance are those that involve the analyst incorporating region-specific data and information specific to the objectives of the study. The analyst has to be satisfied about the accuracy of the information used for the important sectors. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study. It also means that the method should be used by an analyst who is familiar with the economy being modelled, or at least someone with that familiarity should be consulted.

An important characteristic of GRIT-produced tables relates to their accuracy. In the past, survey-based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). That means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A4.1" (Powell and Chalmers, 1995).
Table A4.1  
The GRIT Method

<table>
<thead>
<tr>
<th>Phase</th>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>Selection of national input-output table (109 sector table with direct allocation of all imports, in basic values).</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Adjustment of national table for updating.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Adjustment for international trade.</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Calculation of ‘non-existent’ sectors.</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Calculation of remaining imports.</td>
</tr>
<tr>
<td>III</td>
<td>6</td>
<td>Insertion of disaggregated superior data.</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Aggregation of sectors.</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Insertion of aggregated superior data.</td>
</tr>
<tr>
<td>IV</td>
<td>9</td>
<td>Derivation of transactions values.</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Adjustments to complete the prototype tables.</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>Derivation of inverses and multipliers for prototype tables.</td>
</tr>
<tr>
<td>V</td>
<td>12</td>
<td>Final superior data insertions and other adjustments.</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>Derivation of final transactions tables.</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>Derivation of inverses and multipliers for final tables.</td>
</tr>
</tbody>
</table>

Source: Bayne and West (1988).

REFERENCES

