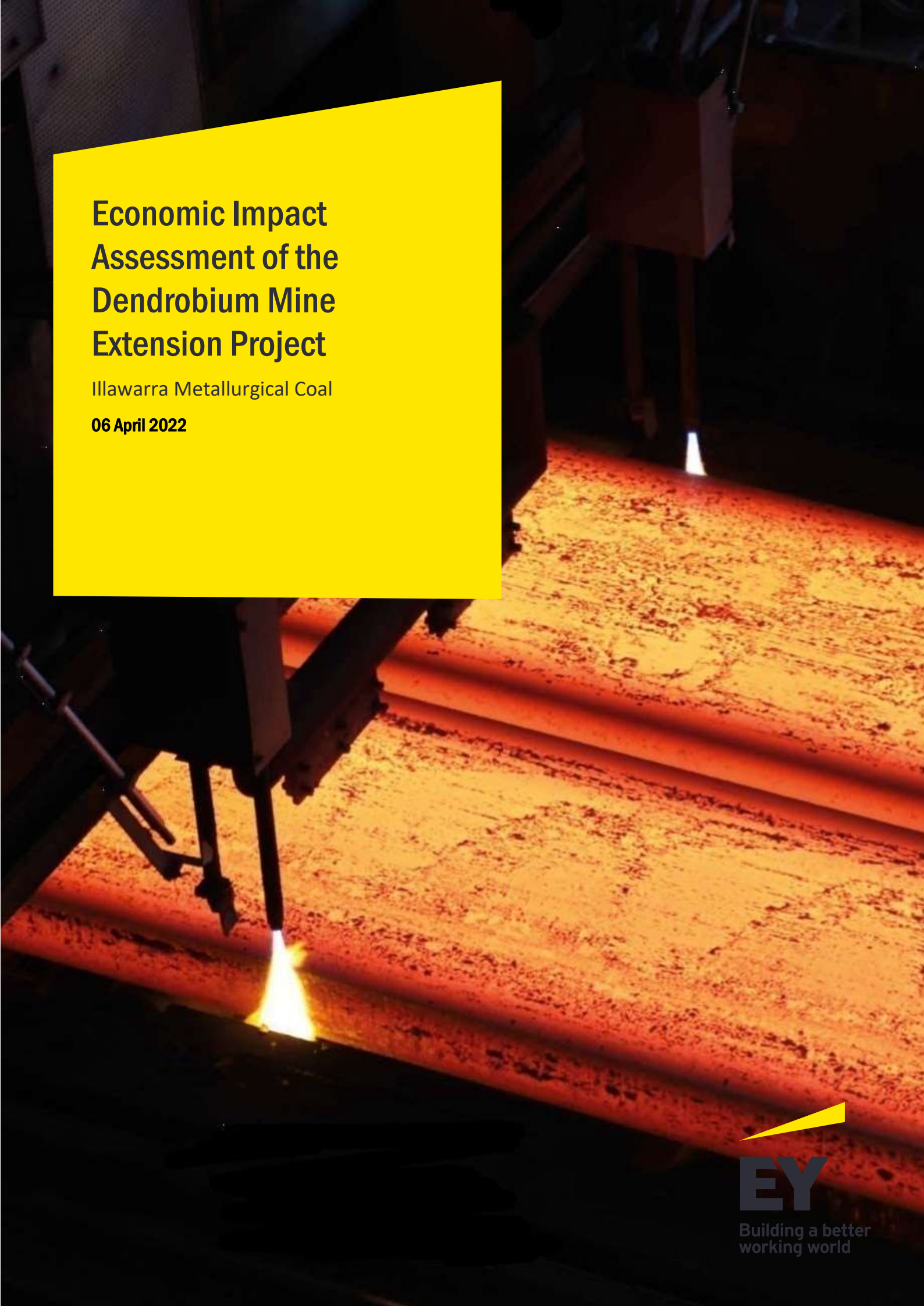
APPENDIX L

Economic Assessment



Economic Impact Assessment of the Dendrobium Mine Extension Project

Illawarra Metallurgical Coal

06 April 2022

Building a better working world

Release Notice

Ernst & Young ("EY") was engaged on the instructions of Illawarra Coal Holdings Pty Ltd ("Client") to perform an economic impact assessment in relation to the proposed life of mine extension to the Dendrobium Mine ("Project"), in accordance with the proposal dated 19 March 2021 and master services agreement, including the General Terms and Conditions ("the Engagement Agreement").

The results of Ernst & Young's work, including the assumptions and qualifications made in preparing the report, are set out in Ernst & Young's report dated 06 April 2022 ("Report"). The Report should be read in its entirety including the transmittal letter, the applicable scope of the work and any limitations. A reference to the Report includes any part of the Report. No further work has been undertaken by Ernst & Young since the date of the Report to update it.

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Table of contents

Executive Summary

Illawarra Coal Holdings Pty Ltd (Illawarra Metallurgical Coal [IMC]), a wholly owned subsidiary of South32 Limited (South32), is the owner and operator of the Dendrobium Mine. The Dendrobium Mine, nearby Appin Mine and supporting operations are managed by IMC. IMC is seeking approval[1] for the Dendrobium Mine Extension Project (the Project), which would support the extraction of approximately 31 million tonnes (Mt) of Run of Mine (ROM) coal from Area 5, within Consolidated Coal Lease 768. The life of the Project includes longwall mining in Area 5 up to approximately 31 December 2034, and ongoing use of existing surface facilities for handling of Area 3C ROM coal until 2041.

Existing approved underground operations at the Dendrobium Mine extracts coal within approved areas designated as Area 1, Area 2, Area 3A, Area 3B and the yet to be mined Area 3C. Current mining operations in Area 3B, are independent from the Project and are included in the economic baseline.

The yet to be mined Area 3C accounts for a total of 16.4 Mt of ROM coal. There is uncertainty regarding the ability to mine the remaining reserves in the approved Area 3C and the timing, which is contingent on IMC's ability to effectively drain gas from the seam to achieve levels which facilitate safe extraction of the resource. Area 3C would be mined under Development Consent DA 60-03-2001. As the approved mine life of the Dendrobium Mine under Development Consent DA 60-03-2001 is 31 December 2030, the necessary extension to the operational life of the Dendrobium Mine under Development Consent DA 60-03-2001 to allow mining in the majority Area 3C (i.e., areas where there is currently high gas content) after 31 December 2030 would be subject to a separate application for approval.

The Project would minimise discontinuity of mining at the Dendrobium Mine, as Area 5 could be mined while gas drainage at Area 3C occurs. To be conservative, the Economic Impact Assessment (EIA) has limited the net benefits of the Project exclusively to Area 5. However, an assessment of the net economic benefits of mining Area 5 and Area 3C has been presented in **Appendix C**. This would mean that while mining in Area 5 finishes at the end of 2034, there will be ongoing use of existing surface facilities for handling of Area 3 ROM coal until 2041.

The analysis

This report provides an EIA for the Project and follows the economic assessment framework set out in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines) released by the New South Wales (NSW) Government in December 2015.[2]

To estimate the environmental, social and transport-related costs generated by the Project as required by the Guidelines, the EIA uses the methods outlined in the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.[3]

Consistent with these Guidelines, the EIA includes a Cost Benefit Analysis (CBA) and a Local Effects Analysis (LEA). The CBA provides an estimate of the net benefits of the proposed development to NSW. The LEA is based on analysis for the Dapto – Port Kembla local region (as defined by the Australian Bureau of Statistics SA3 10701 region).

In addition, we have included the results of assessing economy-wide impacts of the Project to both the local region of Dapto-Port Kembla and to NSW. The economic modelling is undertaken using our inhouse Computable General Equilibrium (CGE) model.

Results of the CBA

IMC is seeking approval for a State Significant Infrastructure Application for the Project to extract an additional 31.4 Mt of ROM coal from Area 5 over the period 2024 to 2034, at an extraction rate of up to approximately 5.2 Mt of ROM coal per annum. The Project would produce 27.2 Mt of saleable coal, comprised of 23.7 Mt of high-quality metallurgical coal, 0.01 Mt thermal coal and 3.4 Mt of Pulverised Coal Injection (PCI) coal.

The Project is estimated to provide a net benefit to NSW of $649.2 million in Net Present Value (NPV)[4] terms, as shown in Figure 1. The estimated gross benefit is comprised of $293.3 million and $364.1 million in direct and indirect benefits respectively. Incremental indirect costs are estimated at $8.1 million in NPV terms.

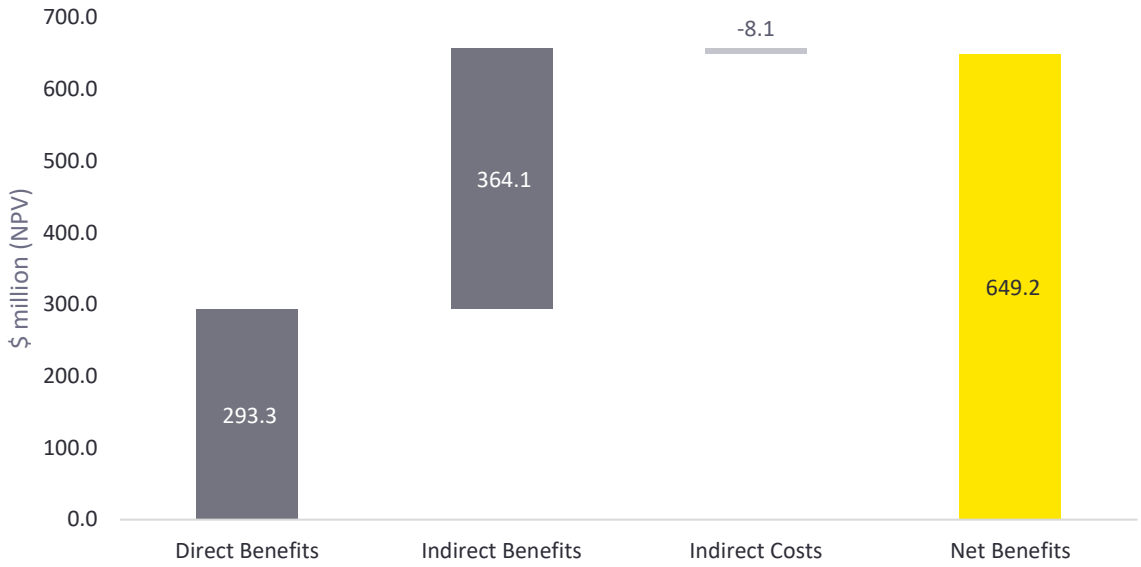
[1] IMC is seeking approval for a State Significant Infrastructure Application the Project under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

[2] Department of Planning and Environment (2015) Guideline for the economic assessment of mining and coal seam gas proposals

[3] Department of Planning and Environment (2018)

[4] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated)

Figure 1: Net benefits to NSW under central case assumptions (NPV*, $ million)



*Source: EY estimated based on information from various sources. *NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

These estimates are based on central case assumptions in relation to the proposed mine development and capital expenditure of $551.5 million in NPV terms and average realised coal price of $177.3 per tonne for metallurgical coal, $88.6 for thermal coal and $123.5 for PCI[5]. This capital expenditure profile does not include capitalised underground expenditure, and therefore does not reconcile with the Project Capital Investment Value estimate as shown in Attachment 13 of the EIS.[6]

The ***direct benefits*** of the Project are a function of the profitability of the proposed development which, in turn, depends on the prevailing coal price and the mines' cost structure. The analysis shows that the combination of relatively high value of metallurgical coal and relatively low capital (e.g., through the use of existing infrastructure), extraction and processing costs underpins the economic viability of the Project. This results in the Project generating:

- An overall net producer surplus of $159.4 million in NPV terms for Australia, of which 22 per cent,[7] or $35.1 million is attributed to NSW.
- Total corporate taxes of $255.1 million in NPV terms for Australia, of which $81.6 million is attributed to NSW.
- Other government revenue for NSW of $176.6 million in NPV terms, the largest component of this being royalties of $148.2 million (based on a royalty rate of 6.2 per cent of revenue taking into account a discount of $3.5 per ROM tonne applied for coal wash), plus payroll taxes of $24.9 million and council rates of $3.5 million.

The ***indirect benefits*** of the Project are related to the linkages that the proposed development has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $364.1 million in NPV terms of indirect benefits:

- Worker benefits are $231.1 million in NPV terms attributable to the Project's employees, due to higher average wages paid to employees at the Dendrobium Mine relative to average wages paid to similar occupations outside the mining sector in NSW (see **Appendix E**).
- Supplier benefits are $132.9 million in NPV terms, representing direct value add generated by NSW suppliers providing goods and services to the Project, based on NSW-based operational expenditure over the life of the Project of $1,335.9 million.

The ***indirect costs*** of the Project are related to the costs borne on the NSW community through the generation of externalities by the Project which have not been offset by investments by IMC. These costs include:

- Greenhouse gas emissions costs of $0.148 million in NPV terms.[8]

[5] All coal prices are in real 2021 Australian dollars

[6] For the purposes of the EIA, these expenditure figures were classified as operational expenditure

[7] NSW-based shareholders in the 2022 South32 shareholder register

[8] Additional sensitivity analysis on the cost and apportionment method of the greenhouse gas externality is presented in Appendix F.

► Air quality impacts of $8.0 million in NPV terms.

Sensitivity analysis

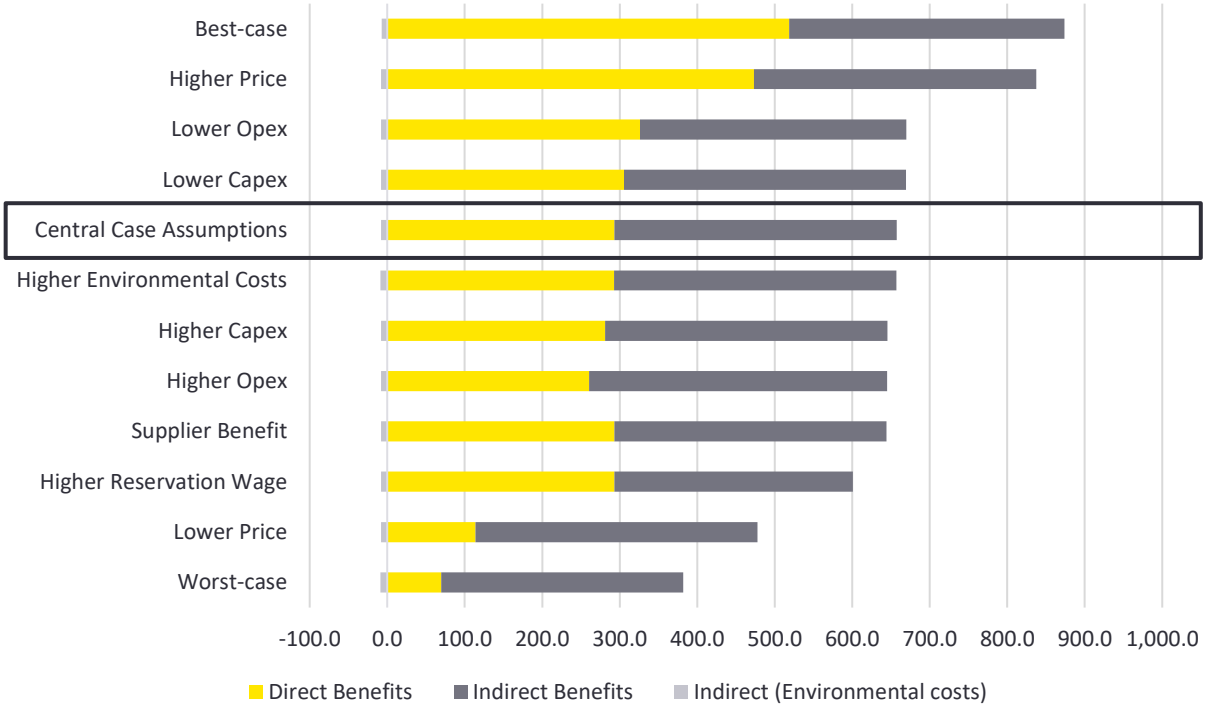
Consistent with the Guidelines, a systematic sensitivity analysis of the estimated net benefits is undertaken in this report (see **Appendix B**). This sensitivity analysis shows that the estimated net benefits are ***robust*** in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis.

In isolation, the estimated net benefit of the proposed development is most sensitive to the coal price assumptions underpinning the analysis. For example, assuming coal prices are 25 per cent lower than the central case assumptions, the net benefits to NSW are estimated to be $469.6 million in NPV terms (a 27.7 per cent reduction in net benefit), as shown in Figure 2.

The lower bound estimate of net benefits, which takes the most pessimistic assumptions around coal prices, capital expenditure, operational expenditure, worker and supplier benefits as well as indirect costs, yields an estimated net benefit to NSW of $373.3 million in NPV terms. The upper bound estimate, based on the most optimistic assumptions, is $866.3 million in NPV terms.

The results are sensitive to the choice of discount rate chosen due to the relatively long timeframe of the proposed development. The NPV of the estimated net benefits to NSW range from between $489.9 million and $866 million under real discount rates of 10 and 4 per cent, respectively.

Figure 2: Systematic sensitivity analysis of the results of the CBA to key assumptions (NPV*, $ million)



*Source: EY estimated based on information from various sources. * NPV in real 2021 Australian dollars based on a 7 per cent real discount rate.*

In addition, the sensitivity analysis has been extended to test the impact of a full range of worker and supplier benefits, (see E.5 for full results). In the case where worker benefits are reduced to 25% of the full estimate, the Project still yields a net benefit of $475.9 million in NPV terms, while reducing supplier benefits by 25% has the impact of reducing the benefit of the Project to $549.5 million in NPV terms. Assuming that the indirect benefits to workers were estimated as zero, the net benefits of the Project remain at $418.7 million in NPV terms.

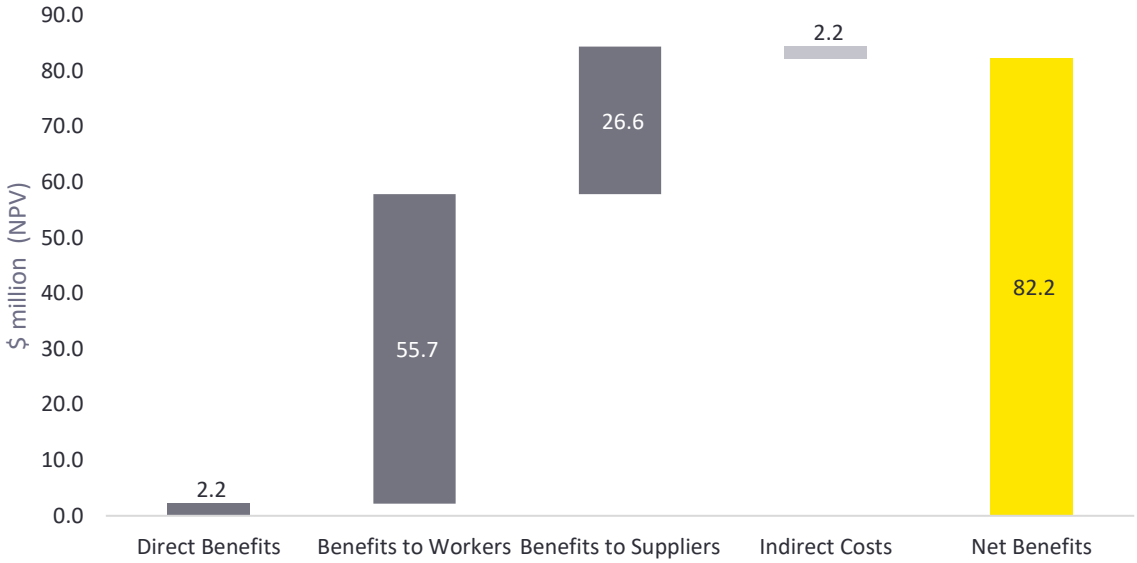
Results of the LEA

The LEA considers the costs and benefits of the proposed development on residents of the Dapto – Port Kembla SA3 region of NSW. The analysis shows an estimated net benefit of $82.2 million to the Dapto Port Kembla region in NPV terms (see Figure 3). This is driven by:

► Benefits to local workers of $55.7 million in NPV terms, currently 21.7 per cent of Dendrobium Mine employees are sourced from the Dapto-Port Kembla region.

- Benefits to local suppliers of $26.6 million in NPV terms, based on the assumption that 15 per cent of the inputs to production are from the region.
- Payment of local council rates of $2.2 million in NPV terms over the life of the Project.

Figure 3: LEA summary for the Dapto – Port Kembla SA3 region of Project net benefits under central case assumptions, (NPV*, $ million)



*Source: EY estimated based on information from various sources. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

This assessment demonstrates that the estimated local effects are ***robust*** under the sensitivity analysis conducted (see **Appendix B**) with a lower bound estimate of net benefits to the Dapto-Port Kembla region of $71.3 million and upper bound estimate of $86.3 million in NPV terms.

Economy-wide modelling of the proposed development

To corroborate these findings, the economy-wide impacts of the Project are assessed based on our inhouse CGE model. EY General Equilibrium Model (EYGEM) is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the Dapto – Port Kembla SA3 and the NSW economy.

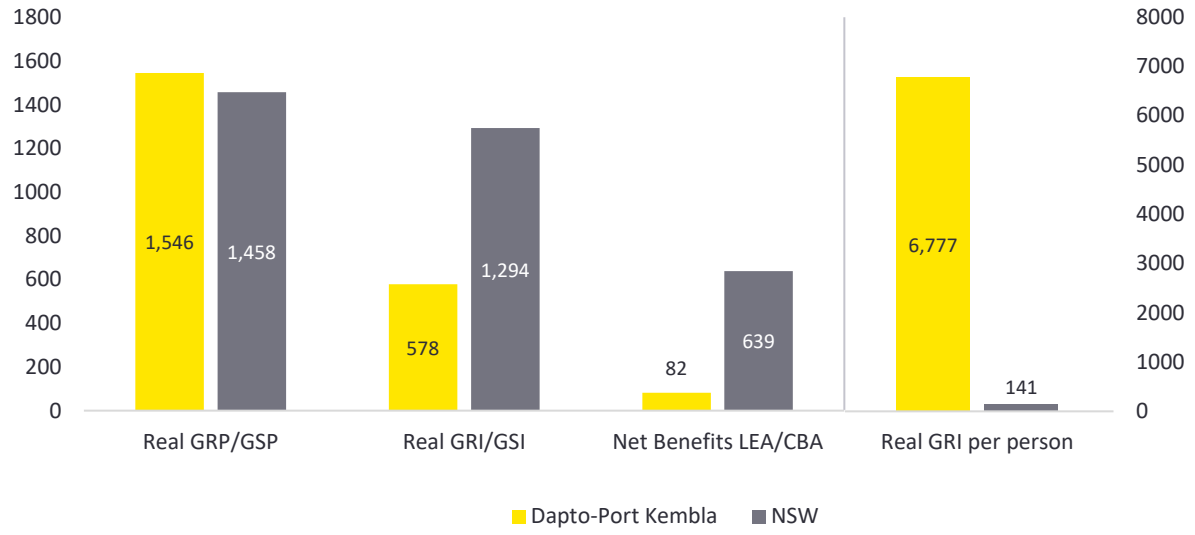
CGE modelling is the preferred technique to assess the impacts of large investments, such as the Project, as it is based on a more detailed representation of the economy, including the complex interactions between different sectors of the economy.

EYGEM projects change in macroeconomic aggregates such as real gross state product (real GSP) which is an output measure of the NSW economy and real gross state income (real GSI) which is a welfare measure for NSW residents. At a regional level, the model projects change in real gross regional product (real GRP) and real gross regional income (real GRI). The model also projects state-wide and regional employment, taking into account employment in supplier industries and any crowding out effects.

The Project is projected to provide significant positive economy-wide impacts to both the local region of Dapto-Port Kembla and to NSW. In the Dapto-Port Kembla region, the Project is projected to increase GRP by $1,546.1 million in NPV terms, as outlined in Figure 4. For NSW, the projected increase in GSP is $1,458 million in NPV terms.

GRI, or regional welfare, is projected to increase by $578.4 million in NPV terms. The projected increase in GRI is significant to the relatively small region of Dapto-Port Kembla, which represents an uplift in absolute GRI to the region of 3.9% over the lifetime of the Project. In total, the Project is projected to increase welfare for each person in Dapto-Port Kembla by $6,777 in NPV terms. GSI is projected to increase by $1,293.8 million, or $141 per person in NPV terms.

Figure 4: Economy-wide impacts of the Project utilising CGE analysis, (base case) (NPV*, $ million (left) and Dollars (right))



*Source: EY Computable General Equilibrium (CGE) modelling. * NPV in real 2021 Australian dollars based on a 7 per cent real discount rate.*

The relative size of the local region and the NSW economy-wide impacts is reflective of how each region is impacted by the Project. As outlined in Section 4, the CGE modelling takes into account the capital expenditure, the coal output, the migration of workers into the region, the payment of royalties from Dapto-Port Kembla into NSW and the repatriation of profits and uses the same input assumptions as the CBA assessment outlined in this report.

1. Introduction

EY was commissioned by Illawarra Coal Holdings Pty Ltd (Illawarra Metallurgical Coal [IMC]) to undertake an Economic Impact Assessment (EIA) for the Dendrobium Mine Extension Project (the Project).

This EIA is based on a cost benefit analysis (CBA) and local effects analysis (LEA) prepared under the framework established in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines) released by the New South Wales (NSW) Government in December 2015.[9] The CBA requires an assessment of the net benefits that accrue to the proponent, government, workers, and suppliers of the Project.

In addition, the Guidelines require an estimate of the potential costs generated by the Project. These costs may include residual public infrastructure costs and environmental, social and transport-related costs. To estimate the environmental, social and transport-related costs, we have incorporated into our analysis relevant requirements of the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.[10]

1.1 Description of existing operations

The Dendrobium Mine is an underground coal mine situated in the Southern Coalfield of New South Wales (NSW) approximately 8 kilometres (km) west of Wollongong (Figure 5).

IMC, a wholly owned subsidiary of South32 Limited (South32), is the owner and operator of the Dendrobium Mine. The Dendrobium Mine, nearby Appin Mine and supporting operations are managed by IMC.

Development Consent DA 60-03-2001 for the Dendrobium Mine was granted by the NSW Minister for Urban Affairs and Planning under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) in November 2001.

The Dendrobium Mine extracts coal from the Wongawilli Seam (also known as the No 3 Seam) within Consolidated Coal Lease (CCL) 768 using underground longwall mining methods. The Dendrobium Mine includes five approved underground mining domains, named Areas 1, 2, 3A, 3B and 3C. Longwall mining is currently being undertaken in Area 3B, with extraction largely complete in Areas 1, 2 and 3A (Figure 5).

The Dendrobium Mine has an approved operational capacity of up to 5.2 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 31 December 2030.

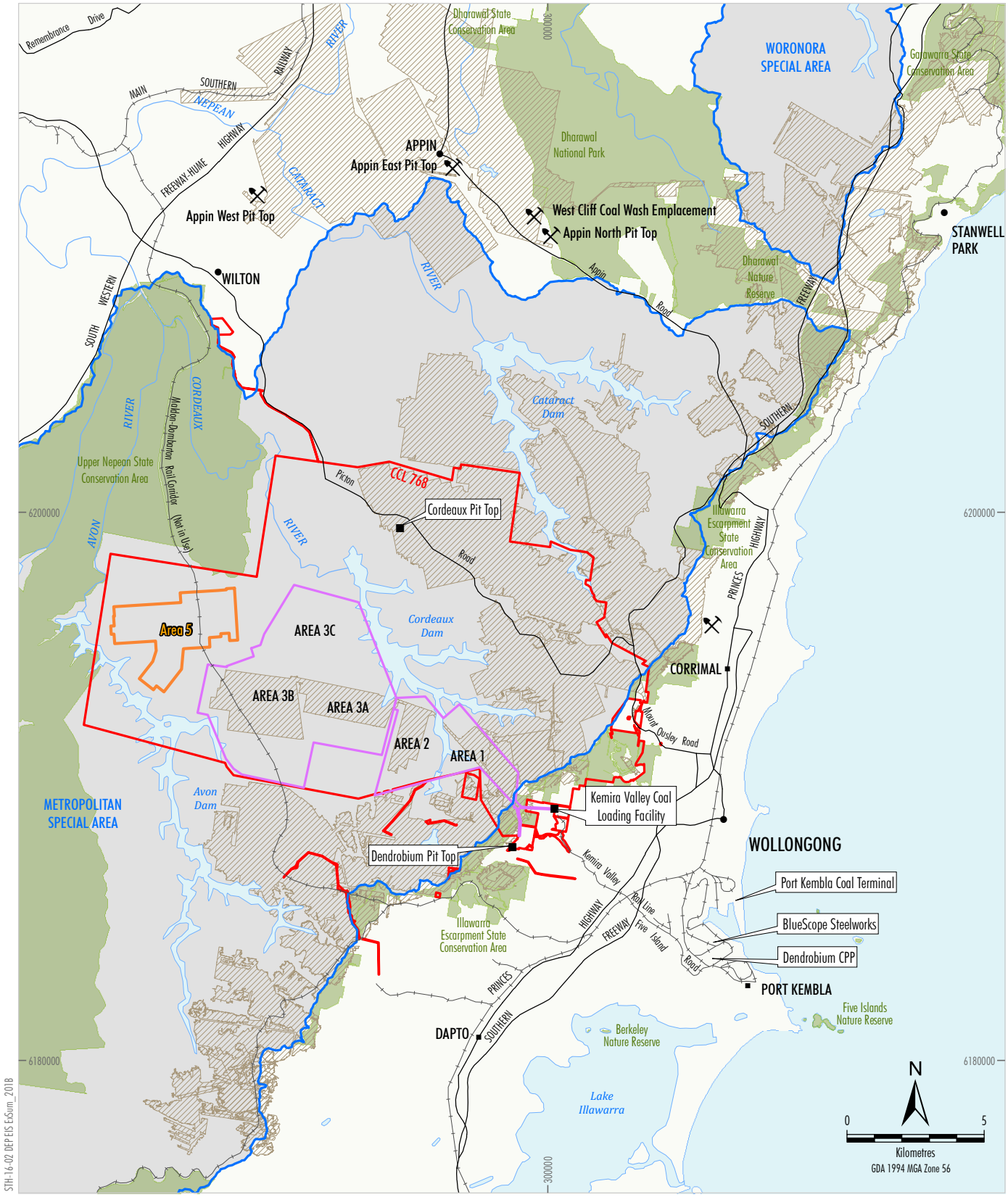
1.2 Description of the Project

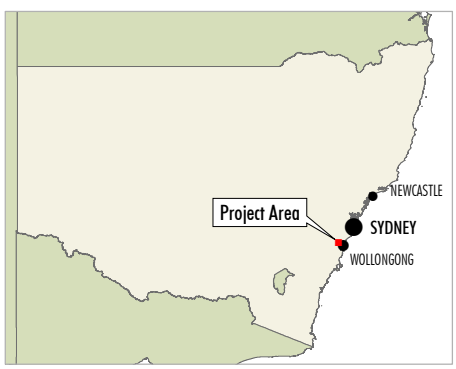
IMC is currently preparing a State Significant Infrastructure (SSI) Application in accordance with Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project would support the extraction of approximately 31 million tonnes (Mt) of ROM coal from Area 5 (Figure 5), within CCL 768. The life of the Project includes longwall mining in Area 5 up to approximately 31 December 2034, and ongoing use of existing surface facilities for handling of Area 3C ROM coal until 2041.[11]

[9] Department of Planning and Environment (2015).

[10] Department of Planning and Environment (2018)

[11] The Project does not include approved underground mining operations in the Wongawilli Seam in Areas 1, 2, 3A, 3B and 3C at the Dendrobium Mine and associated surface activities (such as monitoring and remediation). These activities will continue to operate in accordance with Development Consent DA 60-03-2001 (as modified).





LEGEND

- Dendrobium Mining Lease
- Road
- Railway
- National Park, Nature Reserve and State Conservation Area
- Historic Mine Workings
- Declared Catchment Area
- Dendrobium Underground Mining Area - Existing Mine (DA 60-03-2001)
- Dendrobium Underground Mining Area - Extension Project

Source: Geoscience Australia, (2006); Department of Industry (2018); Department Finance, Services & Innovation (2018);

SOUTH32
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DENDROBIUM MINE

Regional Location

Figure 5

The Project would include the following activities:

- longwall mining of the Bulli Seam in a new underground mining area (Area 5);
- development of underground roadways from the existing Dendrobium Mine underground areas (namely Area 3) to Area 5;
- use of existing Dendrobium Mine underground roadways and drifts for personnel and materials access, ventilation, dewatering and other ancillary activities related to Area 5;
- development of new surface infrastructure associated with mine ventilation and gas management and abatement, water management and other ancillary infrastructure;
- handling and processing of up to 5.2 million tonnes per annum (Mtpa) of ROM coal (no change from the approved Dendrobium Mine);
- extension of underground mining operations within Area 5 until approximately 2035;
- use of the existing Dendrobium Pit Top, Kemira Valley Coal Loading Facility, Dendrobium CPP and Dendrobium Shafts with minor upgrades and extensions until approximately 2041;
- transport of ROM coal from the Kemira Valley Coal Loading Facility to the Dendrobium CPP via the Kemira Valley Rail Line;
- handling and processing of coal from the Dendrobium Mine (including the Project) and IMC's Appin Mine (if required) at the Dendrobium CPP to 2041;
- delivery of coal from the Dendrobium CPP to Port Kembla for domestic use at the Port Kembla Steelworks and Liberty Primary Steel Whyalla Steelworks or export through the PKCT;
- transport of coal wash by road to customers for engineering purposes (e.g., civil construction fill) for other beneficial uses and/or for emplacement at the West Cliff Stage 3 and/or Stage 4 Coal Wash Emplacement;
- continued use of the Cordeaux Pit Top for mining support activities such as exploration, environmental monitoring, survey, rehabilitation, administration and other ancillary activities;
- progressive development of sumps, pumps, pipelines, water storages and other water management infrastructure;
- controlled release of excess water in accordance with the conditions of Environmental Protection Licence (EPL) 3241 and beneficial use;
- monitoring, rehabilitation and remediation of subsidence and other mining effects; and
- other associated infrastructure, plant, equipment and activities.

A summary of the key elements of the Project are presented in Table 1. Project new mine development capital expenditure of $494.4 million (NPV terms) is required with an additional $57.0 million (NPV terms) of replacement and sustaining capital during the operating life of the mine[12]. The proposed development is expected to produce an additional 31.4 Mt of ROM output, yielding a total of 27.2 Mt of saleable coal. This saleable coal is comprised of 23.7 Mt metallurgical hard coking coal,0.01 Mt thermal coal and 3.4 Mt Pulverised Coal Injection (PCI) coal.

[12] The capital expenditure profile does not include capitalised underground expenditure, and therefore does not reconcile with the Project Capital Investment Value estimate as shown in Attachment 13.

Table 1: Summary of operations under the Project

	Description of operations
ROM	31.4 Mt
Product Coal	27.2 Mt
Metallurgical Coal	23.7 Mt
Thermal Coal	0.01 Mt
PCI	3.4 Mt
New mine development capital*	$494.4 million
Replacement and sustaining capital*	$57.0 million
Mining Methods	Underground extraction using longwall mining methods
Mining Rate	Maximum annual ROM of 5.2 Mt (in 2030)
Life of Project	To 31 December 2041[1]
Operational Workforce^	Average incremental 333 FTE^^ over the life of the Project, 557 FTE (in 2028)

*Source: EY estimates based on information provided by IMC. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*
^ Excluding on-site contractors, ^^ full time equivalent (or FTE).

[1] To facilitate processing of coal from approved Area 3C (not part of the Project baseline). Extraction of Area 5 would be completed in approximately 2035 (noting this may change due to mine sequencing)

IMC has provided EY with the information required to complete an economic impact assessment of the Project, including environmental studies, project financial data, project physicals and operation requirements such as employment (see **Appendix A**). Information from IMC is combined with our own research based on publicly available information such as data from the Australian Bureau of Statistics (ABS) and KPMG *Coal Price and FX Market Forecasts* (see **Appendix A**).

The information underpinning this assessment therefore is a combination of publicly available information and commissioned expert studies assessing the Project financials and environmental impacts. EY has not verified the information in the studies provided as they have been prepared by relevant experts in the field. Where there is uncertainty around key assumptions, such as the coal price, sensitivity analysis has been conducted to test the robustness of the assessment to these key inputs.

The CBA is presented in Section 2 and measures the net benefits of the Project. The LEA, which focusses on the benefits accruing to the Dapto – Port Kembla (SA3) region is presented in Section 3.

In addition to the CBA and LEA, the report also contains an assessment of the economic impacts of the proposed development on the Dapto – Port Kembla region and the State of NSW based on computable general equilibrium (CGE) modelling. This modelling is presented in Section 4.

The list of Appendices is as follows:

- **Appendix A** details information underpinning this EIA, including a list of information provided by IMC and a list of publicly available information used by EY.
- **Appendix B** provides an account of the year-on-year production, output and prices for the Project scenario, and provides details on the sensitivity analysis to both the CBA and the LEA.
- **Appendix C** provides a CBA of an alternative scenario with Area 3C, where the proposed operations in (the currently approved) Area 3C are included.
- **Appendix D** provides details on environment and other external costs of the Project.
- **Appendix E** outlines the methodology for determining worker and supplier benefits of the Project.
- **Appendix F** includes further sensitivity analysis around the apportionment of the greenhouse gas externality.
- **Appendix G** References.

2. Cost-Benefit Analysis

The Guidelines released by the NSW Government in December 2015 set out the CBA framework to measure the net benefits of a proposed mining project to the NSW community. This approach has been adopted in the economic analysis outlined in this report. Table 2 provides a summary of how these net benefits are measured.

Table 2: Cost Benefit Analysis framework as defined in the Guidelines

Direct Benefits	Indirect Benefits	Indirect Costs
The net benefits that accrue to NSW from the direct operations of the proposed Project	The net benefits that are generated for parties that economically interact with the proposed Project	Social costs generated by the proposed Project, borne by the NSW community
Includes: ► Net producer surplus attributable to NSW ► Royalties payable ► Company tax attributable to NSW	Includes: ► Net economic benefits to landowners ► Net economics benefits to NSW employees ► Net economic benefits to NSW suppliers	Includes: ► Net environmental, social and transport-related costs ► Net public infrastructure costs ► Loss of surplus to other industries

Source: NSW Government (2015).

The direct benefits are those that accrue to the Project proponent and payments made to government. The indirect benefits are those that accrue to economic agents that engage with the Project proponent. These include employees, suppliers, and landowners. The indirect costs are the costs borne by the community of NSW, through environmental and social impacts or public infrastructure costs.

A major emphasis of the Guidelines is on transparency of assumptions made. The remainder of this section describes in detail the assumptions underpinning the CBA.

The costs and benefits outlined in this report include the costs and benefits from the operation of the Project only. It does not include the costs and benefits of the use of coal output in NSW.

These benefits may include the output and employment in sectors like the iron smelting and steel manufacturing industries that use metallurgical coal and PCI as key inputs to the manufacturing process. Various mines in the Illawarra region, including IMC's operations, supply coal to the BlueScope Steelworks at Port Kembla.

In addition, the analysis does not include any of the costs associated with coal use in NSW, including the scope 3 greenhouse gas emissions that would be generated from coal combustion.

2.1 Baseline

The starting point for any CBA is the baseline, or counterfactual. This scenario considers all costs and benefits if the proposed development does not proceed. The Dendrobium Mine currently has approved operations within Area 3B (currently occurring) and Area 3C (not yet commenced). As such, the economic benefits and costs associated with extraction of coal within these areas have been included in the baseline, however, have been excluded for the purposes of assessing the incremental net benefits of the Project. The baseline includes closure costs associated with decommissioning the currently approved site infrastructure and undertaking rehabilitation. If the Project is approved, these costs would be delayed into the future, representing a saving in NPV terms.

There is uncertainty regarding the ability to mine the remaining reserves in the approved Area 3C and the timing, which is contingent on IMC's ability to effectively drain gas from the seam to achieve levels which facilitate safe extraction of the resource. Area 3C would be mined under Development Consent DA 60-03-201. As the approved mine life of the Dendrobium Mine under Development Consent DA 60-03-2001 is 31 December 2030, the necessary extension to the operational life of the Dendrobium Mine under Development Consent DA 60-03-2001 to allow mining in the majority Area 3C (i.e., areas where there is currently high gas content) after 31 December 2030 would be subject to a separate application for approval. Therefore, the proposed Project mining of Area 5 would facilitate the progressive and safe gas drainage of the majority of Area 3C, avoiding potential mining discontinuity. Notwithstanding, it is noted that, we have made the conservative assumption that Area 3C is also included in the baseline.

The remainder of Sections 2 and 3, considers the net incremental impacts of the Project (or mining within the new Area 5 only) with the net benefits of mining in Area 3B and 3C included in the baseline.

In addition, **Appendix C** provides the net benefits of including Area 3C within the Project case. As outlined above, without the Project there may be longwall discontinuity between Area 3B and Area 3C due to IMC's ability to effectively drain gas from Area 3C, with the associated longwall discontinuity affecting the viability of operations (due to the costs of closing and re-opening mining operations). The short analysis in **Appendix C** provides the induced net benefits of including Area 3C as part of the Project (subject to IMC obtaining an extension to the life of Development Consent DA 60-03-2001).[13]

2.2 Cost-Benefit Analysis results

Consistent with the Guidelines, the CBA is based on comparing the net direct and indirect benefits and subtracting the indirect costs of the proposed development compared against the baseline scenario where the proposed development does not occur. The results are summarised in Table 3.

Based on the CBA methodology outlined in the Guidelines, and information provided by IMC, the proposed development is estimated to provide a net benefit to NSW. This net benefit is estimated to be $639.1 million in NPV[14] terms. This is comprised of $293.3 million and $364.1 million in direct and indirect benefits respectively and estimated incremental indirect costs of $8.1 million in NPV terms.

Table 3: Central case - estimated net benefits of the proposed development ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW	$35.1		
Royalties, payroll tax and Council rates	$176.6		
Company income tax apportioned to NSW	$81.6		
Total direct benefits	$293.3	Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	$8.0
Net economic benefit to NSW workers	$231.1	Greenhouse gas emissions^^	$0.148
Net economic benefit to NSW suppliers	$132.9	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	-
		Biodiversity impact^^	-
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	$364.1	Indirect costs	$23.6
Total economic benefit of Project	$657.3	Total incremental cost of Project	$8.1
NPV of Project - ($m)	$649.2		

*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Management and mitigation costs are included in the operating and capital costs.*

The ***direct benefits*** of the Project are a function of the profitability of the proposed development which, in turn, depends on the prevailing coal price. This results in:

- An overall net producer surplus of $159.4 million in NPV terms for Australia, of which 22 per cent, or $35.1 million is attributable to NSW.

[13] Mining in Area 3C is approved under Development Consent DA 60-03-2001 from 31 December 2030 to 31 December 2040.

[14] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated).

- Total corporate taxes of $255.1 million in NPV terms for Australia, of which $81.6 million is attributed to NSW (apportioned based on the population of NSW to Australia).

- $176.6 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $148.2 million, with payroll taxes contributing $24.9 million.

The ***indirect benefits*** of the Project are related to the linkages that the proposed development has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $364.1 million in estimated indirect benefits:

- Worker benefits are $231.1 million in NPV terms attributable to an average direct employment of 333 FTE workers[15] over the period of the Project and due to higher average wages paid to Project employees than average wages paid to similar occupations outside the mining sector in NSW (see **Appendix E**).

- Supplier benefits are $132.9 in NPV terms, representing direct value add generated by NSW suppliers providing goods and services to the Project, based on NSW-based procurement for the proposed development of $1,335.9 million.

The ***indirect costs*** of the Project are related to the costs borne on the NSW community through the generation of externalities by the Project. These costs include:

- GHG emissions costs of $0.1 million in NPV terms (based on population).

- Air quality impacts of $8.0 million in NPV terms (based on $PM_{2.5}$ emissions).

2.3 Proposed development – central case assumptions

The following analysis sets out the financial assumptions underpinning the Project, including the capital expenditure, the output and price assumptions and the operating cost assumptions, including labour input costs and intermediate inputs. These assumptions are used to estimate the direct and indirect benefits to NSW and form the basis of the LEA presented later in the report.

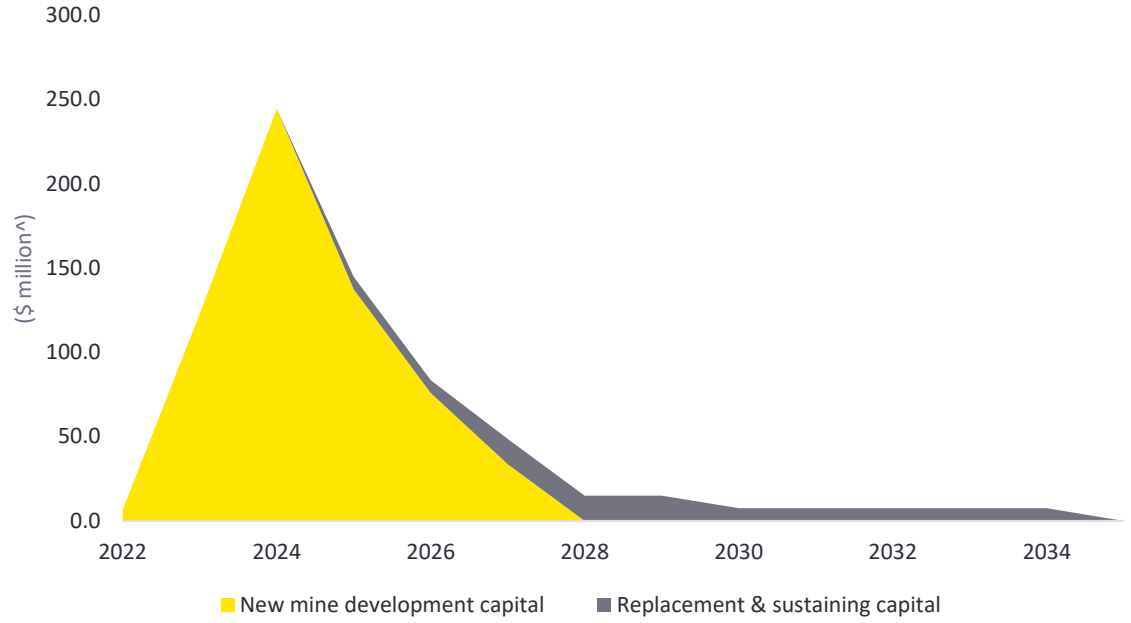
2.3.1 Capital costs

IMC provided EY with the capital expenditure profile of the proposed development which is summarised in the figure below.

Figure 6 shows the new mine development capital is planned to take place from 2022 to 2027 and the replacement and sustaining capital from 2025 to 2034, reflecting Area 5 longwall development and longwall production timelines.

[15] The workforce associated with Area 3C is excluded from worker benefit estimates.

Figure 6: Profile of capital expenditure under the Project ($ million^)



Source: IMC. ^ Real 2021 Australian dollars

In total the Project requires $551.5 million in NPV terms of capital expenditure. This includes new mine development capital expenditure of $494.4 million in NPV terms, and replacement and sustaining capital expenditure of $57.0 million in NPV terms.

2.3.2 Production assumptions

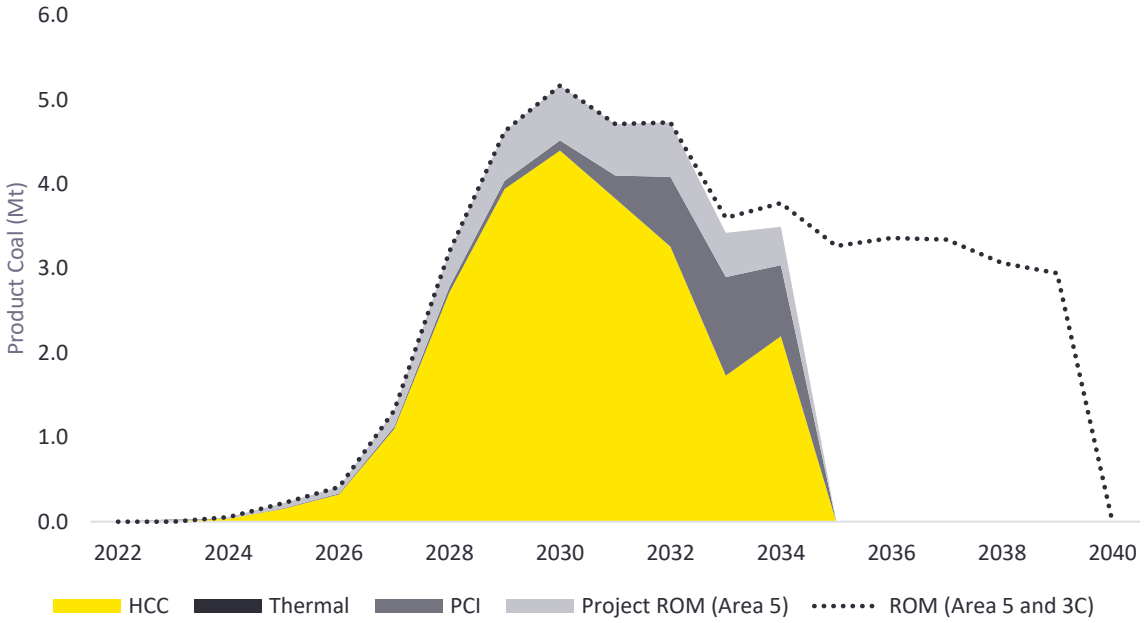
IMC provided EY with the projected production figures for the Project which are summarised in the figure below. The Project would extract an additional 31.4 Mt of ROM in Area 5 over the 13-year period 2022 to 2034, under the optimised mine plan. Longwall (roadway) development in Area 5 is expected to take place over the period 2022 to 2026 with extraction rates of between 0.1 Mt and 0.4 Mt of ROM per year. Once Area 5 longwall panels are established, starting in around 2027, extraction rates increase substantially to peak in 2030 at 5.2 Mt of ROM. Mining in Area 5 ceases in late 2034.

The proposed development produces largely metallurgical coal. Over the life of the Project, metallurgical coal is expected to account for 23.7 Mt of the saleable coal output, with PCI coal accounting for 3.4 Mt and thermal coal 0.01 Mt.

Figure 7 outlines the total ROM coal extracted including Area 3C, this includes the longwall development works and longwall extraction from 2034 to 2040. Production of ROM between 2035 and 2040 is related to (the currently approved) Area 3C and is not included in the Project baseline. [16]

[16] Alternative scenario including Area 5 and Area 3C extracts 39.4 Mt of metallurgical coal, 3.4 Mt of PCI coal and 3.6 Mt of thermal coal, and the consequent economic impact of this development is shown in the appendix as a scenario.

Figure 7: Key Dendrobium mine production figures (Mt)



Source: IMC

2.3.3 Price assumptions

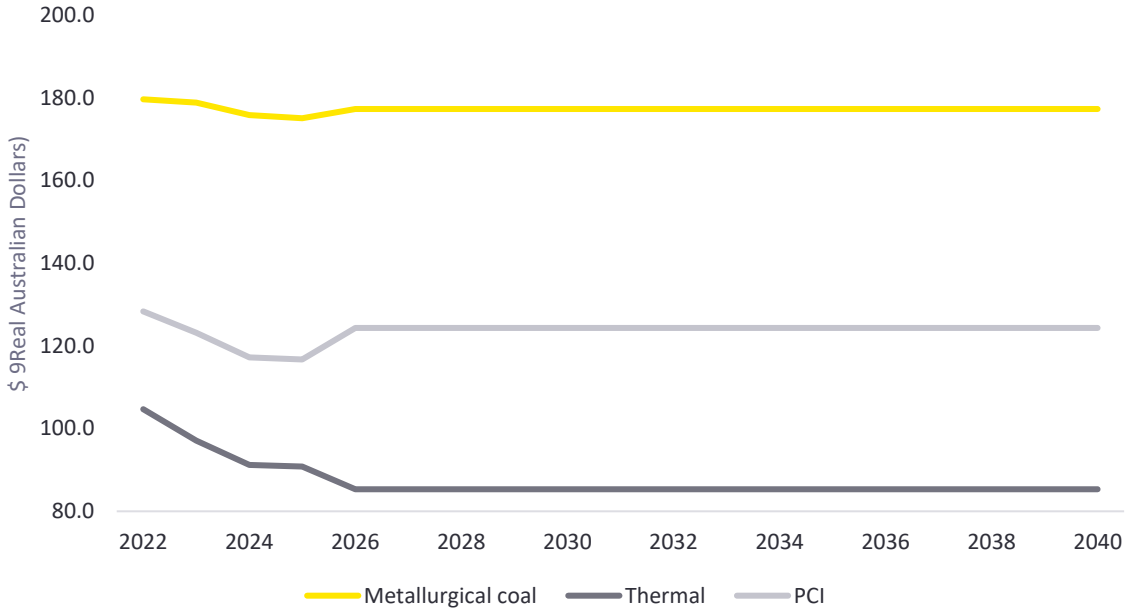
The price assumptions used for this analysis come from several sources, including IMC, KPMG, the Office of Chief Economist and other information sources as outlined below.

IMC did not provide EY with its internal price forecasts for metallurgical coal, PCI and thermal coal (which is typical for mining companies undertaking this process) but did provide guidance on the relative quality of the coal extracted at the Dendrobium Mine to those published in benchmark prices.

Coal price assumptions are estimated based on information from KPMG published *Coal Price and FX consensus forecasts September/October*. KPMG publishes metallurgical coal, thermal and PCI price forecasts in nominal US dollars out to 2025. The price forecasts are converted to nominal Australian dollars using the exchange rate forecasts from the KPMG report. The exchange rate varies between $0.75 and $0.78 US dollars per AUD until 2025 and then is fixed long term at $0.75 US dollars per AUD. All nominal coal price forecasts are converted into real 2021 AUD using Office of the Chief Economist *Resources and Quarterly March 2021* inflation rate forecast.

Taking IMC guidance on coal quality adjustments and KPMG coal price assumptions into account, the Project metallurgical coal price in real 2021 Australian dollars ranges from $179.7 per tonne in 2022 to $177.3 per tonne from 2026 onwards, as shown in Figure 8, below. Over the life of the Project, the average price for Project PCI coal is estimated to be $123.5 per tonne (real 2021 Australian dollars) and $88.6 per tonne (real 2021 Australian dollars) for Project thermal coal.

Figure 8: Metallurgical, PCI and thermal coal price assumptions (real 2021 Australian dollars)



Source: EY estimates based on KPMG published Coal Price and FX consensus forecasts September/October 21

2.4 Projected revenue and project financials

Based on the production assumptions outlined in Figure 7, and the real price assumptions in Figure 8, the proposed development is expected to generate revenues of $4,632.1 million over 12 years in undiscounted real 2021 Australian dollars. This equates to $2,447.4 million revenue in NPV terms based on 7 per cent real discount rate as shown in Table 4 (this table shows selected years; full results are presented in Appendix B). In the context of this analysis, these are deemed to be central case assumptions, and subject to sensitivity analysis later in this report.

Table 4: Central case assumptions – coal production, real prices^, total revenue (selected years)

	Total	2022	2026	2030	2034
Production (Mt)					
Metallurgical Coal (Mt)	23.7	0.0	0.3	4.4	2.2
Thermal coal (Mt)	0.0	0.0	0.01	0.0	0.0
PCI coal (Mt)	3.4	0.0	0.0	0.1	0.8
Real price^					
Metallurgical Coal (Mt)		179.7	177.3	177.3	177.3
Thermal coal (Mt)		104.7	85.3	85.3	85.3
PCI coal (Mt)		128.4	124.4	124.4	124.4
Total Sales Revenue	4,632.1	0.0	59.1	794.8	494.5
Total Sales Revenue – NPV*	2,447.4				

*Source: IMC and EY estimates ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

Based on information provided by IMC, the operating costs for the proposed development are summarised in Table 5. In addition to operating revenue of $2,447.4 million in NPV terms, asset sales associated with Area 5 at the end of the Dendrobium life of mine are expected to yield $77.8 million (undiscounted in 2040), or $21.5 million in NPV terms. This results in total revenue from the proposed development of $2,468.9 in NPV terms.

Operating costs including savings to decommissioning costs are estimated to be $1,335.9 million in NPV terms. Mitigation and management costs are estimated to be $15.4 million in NPV terms (or $22.7 million in undiscounted real 2021 Australian dollars), which includes costs associated with reducing the environmental impacts of the Project operations, as discussed in the Introduction.

In terms of other costs:

- Depreciation is calculated using the diminishing value method.
- Royalties are based on standard NSW Government royalty rates of 6.2 per cent *ad valorem* for underground mines below 400 metres (m). A discount of $3.50 per ROM tonne is applied for washing as is allowed by the NSW Government.

These are deemed to be ***central case assumptions***, and subject to sensitivity analysis later in this report.

Table 5: Central case assumptions – project financials (selected years, $ million^)

	NPV*	2022	2026	2030	2034
Revenue					
Revenue from coal sales	2,447.4	0.0	59.1	794.8	494.5
Residual value of capital	21.5	0.0	0.0	0.0	0.0
Total Revenue	2,468.9	0.0	59.1	794.8	494.5
Costs					
Operating costs (incl. closure costs) ^^	1,335.9	0.0	6.0	323.5	295.2
Mitigation and management costs	15.4	3.2	0.6	0.9	1.2
Depreciation	372.8	0.9	63.5	44.3	28.3
Royalties	148.2	0.0	3.6	48.2	29.9
Council rates and land tax	3.5	0.4	0.4	0.4	0.4
Total Costs	1,875.8	4.5	74.0	417.2	354.9
Operating Profit	593.1	-4.5	-15.0	377.6	139.6

Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars.
*^^ Includes intermediate inputs, labour costs and payroll taxes paid * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5 Direct benefits

Based on the Guidelines, the direct benefits to NSW of the proposed development are derived from three sources:

- The net producer surplus (profits) generated by the Project that is attributable to NSW
- The share of company tax payments that are attributable to NSW.
- Other tax payments such as royalties and payroll tax that are paid to the NSW and local government.

2.5.1 Summary of direct benefits to NSW

Based on the central case assumptions, the Project is estimated to generate $293.3 million in total direct benefits to NSW in NPV terms, as outlined in Table 6.

Table 6: Central case - summary of direct benefits of the Project to NSW ($ million^)

Direct benefits to NSW	NPV*
Net producer surplus attributable to NSW	35.1
Company income tax attributable to NSW	81.6
Payments to the NSW and local Government	176.6
Total financial benefit attributable to NSW	293.3

*Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

These benefits are comprised of $35.1 million of net producer surplus attributable to NSW, $81.6 million in company tax attributable to NSW and $176.6 million in NPV terms paid to the NSW and local governments, in the way of coal royalties, payroll tax, council rates and land taxes.

2.5.2 Net producer surplus attributable to NSW

Consistent with the Guidelines, the net producer surplus of the proposed development represents the private benefit, or operating surplus, generated that is attributable to NSW.

The Project is estimated to generate an operating surplus of $414.4 million in NPV terms, see Table 7. The operating surplus is estimated using cash earnings and cash costs (cash costs are made up of both capital expenditure and operating costs, excluding depreciation). $255.1 million in NPV terms is payable in the form of corporate taxes, levied on accrued Project profits.

In total, the Project generates a net producer surplus of $159.4 million in NPV terms. Of this, 22 per cent, or $35.1 million is payable to NSW-based shareholders.

Table 7: Central case - estimate of net producer surplus attributable to NSW ($ million^)

Key Data	NPV*
Total Revenue	2,468.9
Cash Costs	
Operating costs (incl. closure costs)	1,335.9
Mitigation and management costs	15.4
Capital	551.5
Royalties	148.2
Council rates and land tax	3.5
Total Costs	2,054.5
Net Producer Surplus before Tax	414.4
Company Tax^^	255.1
Net Producer Surplus	159.4
NSW share of Project ownership	22.0%
Value of net producer surplus attributable to NSW	35.1

Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars.
*^^ Based on a 30 per cent company tax rate. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5.3 Company tax attributable to NSW

Consistent with the Guidelines, the company tax payments made to the Australian Government are levied on the profits generated under the proposed development as summarised in Table 6. A company tax rate of 30 per cent is used to estimate the tax payments made to the Australian Government under the assumption that all the profit generated by the Project is subject to company tax in Australia (for example, ignoring financing costs). Consistent with the Guidelines, company tax is attributable to NSW based on the State's share of population which is 32 per cent.

As summarised in Table 8, it is estimated the proposed development will generate $593.1 million in taxable profit in NPV terms (this is an estimate of the accounting profit from which company taxes are calculated). At a company tax rate of 30 per cent, the company tax estimate is $255.1 million in NPV terms, of which $81.6 million is attributable to NSW.

Company taxes are estimated based on operating profits, which is on an accrued basis and recognises yearly depreciation costs rather than the full capital costs upfront. Operating profit is generally higher than operating surplus (the basis for estimating net producer surplus), which is on a cash basis and thus recognises the full capital costs upfront

Table 8: Central case - company income tax attributable to NSW ($ million^)

Company tax attributable to NSW	NPV*
Total Revenue[17]	2,468.9
Total Costs	1,875.8
Operating Profit	593.1

[17] Total Revenue includes the sale of product coal and any residual value of capital remaining at the end of life of the Project.

Company tax attributable to NSW	NPV*
Company Tax^^	255.1
NSW share^^^	81.6

Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars.
*^^ Based on a 30 per cent company tax rate. ^^^ Based on a 32 per cent population share. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5.4 Payments to the State and the local Council

Under the proposed development, various payments will be made to NSW Government and the Wollongong, Wingecarribee and Wollondilly Council to extract and process coal in the State.

These are made up of three types of payments: coal mining royalties and payroll tax paid to the NSW Government, council rates and NSW land tax. Over the life of the proposed development, a total of $176.6 million in payments are made in NPV terms (Table 9). This is made up of $148.2 million of royalty payments and $24.9 million in payroll tax to the State of NSW and $3.5 million in council rates and land taxes, in NPV terms. For the estimation of royalties paid, only the total revenue arising from the sale of coal is considered.

Table 9: Central case - total payments to State Government and local Council ($ million^)

Project payments to NSW	NPV*
Coal sales revenue	2,447.4
Total Royalties paid	148.2
Payroll taxes	24.9
Council rates and land tax	3.5
Total Payments	176.6

*Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.6 Indirect Benefits to NSW

Based on the Guidelines, the indirect benefits to NSW of the proposed development are derived from three sources (see **Appendix E** for detailed methodology):

- The net economic benefit to workers in NSW.
- The net economic benefit to suppliers in NSW.
- Any landowner premiums attributable to the Project.

2.6.1 Summary of indirect benefits to NSW

Consistent with the Guidelines, the indirect benefits of the proposed development that accrue to workers, suppliers and landowners are summarised in

Table 10. The total indirect benefits are estimated to be $364.1 million in NPV terms. The main source of these benefits is $231.1 million to workers and $132.9 million to suppliers in NPV terms. There are no anticipated benefits to landowners as a result of the Project due to its location in the Metropolitan Special Area.

Table 10: Central case - summary of indirect benefits of the Project to NSW ($ million^)

Indirect benefits to NSW	NPV*
Net economic benefit to workers	231.1
Net economic benefit to suppliers	132.9
Landowner premiums (land sales made above market rates)	0.0
Total indirect benefit	364.1

*Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.6.2 Benefit to workers

Consistent with the Guidelines, a key factor in determining the benefit to workers are defined as the:

- Wages earned in the Dendrobium Mine.
- Minus the opportunity cost of labour for working in the mining sector, that is compared to working in non-mining sectors (or being unemployed).
- Minus the wage difference due to skills and the disutility to work in the mining industry.

IMC provided EY with incremental FTE employment under the Project, as well as average wages paid per employee.

Over the period of 2022 to 2034, IMC advises that the Project would employ an average of 333 FTE workers. During this period, employment increases up to 557 FTEs in 2028, as outlined in Table 11. It should be noted that worker numbers are calculated by excluding the employment generated by mining of approved Area 3C. In practice, the development and operation of mining activities in Area 3C would be integrated with the Project mining activities in Area 5.

There are currently approximately 650 personnel employed at the Dendrobium Mine. The Project would support the continuation of employment for the existing workforce, noting that longwall mining in Area 3 is scheduled to continue until approximately 2026 prior to Project longwall mining in Area 5 commencing in approximately 2027.

In advance of longwall mining in Area 5, the Project would require an approximate 100 additional personnel for construction activities for the Area 5 surface facilities (e.g., the ventilation shaft), and an additional 50 operational personnel for underground development. These 100 construction and 50 operational workers would be additional to the existing Dendrobium Mine workforce.

Once longwall mining in Area 5 commences, existing Dendrobium Mine personnel would transition to Project-specific mining activities. Other existing Dendrobium Mine jobs would continue, for example employment at the surface facilities to handle and process coal from Area 5.

The employment profile for the Project considers only the estimated incremental jobs required to mine and process coal from Area 5. As such, the peak employment considered in this assessment is lower than the peak employment at the Dendrobium Mine over the life of the Project, which is considered conservative for the purposes of estimating employment benefits for the Project only. For example, it does not consider continuing roles such as truck delivery of product coal to BlueScope, Port Kembla Coal Terminal and coal wash delivery to West Cliff Emplacement, IMC coordinating managers and staff, Mine Extension Project Team Managers, Dendrobium Environmental Field Team and Exploration Team etc.

IMC has advised EY of an average pre-tax wage (including leave entitlements and superannuation) for an FTE employee at the Dendrobium Mine upon commencement of the Project (and is assumed to remain fixed over the period). This was used to calculate estimated Total wages paid for the Project.

Total wages paid to employees is estimated at $457.6 million in NPV terms. To measure the opportunity cost compared to working in the non-mining sector, the average wage earned by workers at the Dendrobium Mine is compared to the likely wages that would be earned by employees in other sections if the Project does not proceed.

The reservation wage is constructed as a weighted average of the wages paid to occupations not in the mining sector in NSW. The weights are given by the occupational distribution of those found working in the coal mining sector. Additionally, the reservation wage is adjusted upwards to account for the differential in hours worked between those in the coal mining sector and those employed in the wider economy. This implies that, should the proposed development not go ahead, those who would have been employed at Dendrobium Mine would instead find alternative work at the average wage afforded to their occupation in NSW. The weighted average ***reservation wage*** is estimated to be $94,425.2 per annum in real 2021 Australian dollars (Table 11).

Table 11: Central case – estimated NSW worker benefit (selected years)

Indirect benefits - workers	NPV*	2022	2026	2030	2034
Reservation wage	226.4	0.0	22.7	50.0	34.4
Mining wages at Dendrobium Mine	457.6	0.0	45.8	101.1	69.4
Estimated worker benefit ($ million^)	231.1	0.0	23.1	51.0	35.1

*Note: Area 3C workforce has been excluded from the analysis. Source: IMC, ABS (Table W17) Census (2016) Occupational Total Personal Income (Weekly) by Hours Worked and EY estimates. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

As shown, there is a significant premium incorporated in mining wages compared with the average wage paid in NSW. There are a number of likely reasons for this premium that might be explained by relative skill and productivity levels. In relation to the latter, mining employees are more productive than workers in other industries as they operate with higher levels of capital (for example, based on capital stock figures produced by the ABS, miners work with over 10 times the amount of capital than average employees across Australia).

A further consideration is whether workers would experience more or less disutility being employed at the Dendrobium Mine compared with any alternate employment. In this context, as the assumption is made that any worker employed at the Dendrobium Mine would find alternative employment if the Project did not go ahead, it is the relative disutility of mine work versus non-mine work that is a key consideration. However, any metrics around the disutility of working in mining are very difficult to ascertain in both an absolute (mining specific) or relative (compared with other industries) manner.

One reasonable approximation for the mining specific levels of disutility are the hardship allowances paid to employees. For example, the Black Coal Mining Industry Award 2010[18] provides for the payment of an underground allowance at 0.23 per cent per day above the standard rate/reimbursement to an adult employee who works underground in any shift. These rates appear to be non-material in comparison to the differences in wages paid to workers not in the mining industry. Furthermore, in assessing the safety of the mining sector relative to comparable industries, we find that according to statistics gathered by Safe Work Australia[19], the mining sector has recently outperformed on a claims per million hour basis relative to comparable industries such as construction, agriculture and manufacturing. Thus, it is unclear whether there is any significant disutility incurred from working in the mining sector relative to other industries.

Given these minor allowances for working in a coal mine and the measurement difficulties associated with measuring these disutilities, generally, EY have assumed that the disutility for workers at the Dendrobium Mine is zero. This implies, effectively, that those workers employed at the Dendrobium Mine experience no additional disutility from working in the Dendrobium Mine compared with any alternative employment they would have secured in the absence of the Project.

Based on these assumptions, estimated ***worker benefit*** is $231.1 million in NPV terms.

2.6.3 Benefit to suppliers

Consistent with the Guidelines, the economic benefit to suppliers is estimated as a producer surplus generated for NSW firms that provide goods and services to the proposed development. As summarised in Table 12, based on the input cost data provided by IMC, the proposed development is estimated to use $658.8 million in intermediate inputs supplied from NSW over its life-cycle in NPV terms. Currently, 75 per cent of the Dendrobium Mine inputs used are supplied from NSW-based businesses and it is assumed this would also be the case with the Project.

The estimated economic benefit to suppliers (producer surplus) is based on the EY Regional Input-Output Model. This model was customised to generate an NSW-specific Input-Output table and to not include benefits generated in other Australian states.

The producer surplus estimates are based on Type I multipliers which limit the benefit to direct value added generated by NSW suppliers. This methodology does not account for second round, nor induced consumption, effects, that are captured within the CGE modelling. Using this relatively conservative technique, the total supplier benefits are estimated to be $132.9 million in NPV terms.

Table 12: Central case – estimated supplier benefits

Indirect benefits - suppliers	NPV*
Total intermediate inputs ($ million^)	878.4
Share from NSW (Per cent)	75.0
Total intermediate inputs supplied from NSW ($ million^)	658.8
Gross operating surplus ratio	0.2
Total benefits to suppliers (NPV*)	132.9

*Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

[18] Fair Work Ombudsman, Black Coal Mining Industry Award 2010

[19] Safe Work Australia National Data Set for Compensation-based Statistics (NDS).

2.7 Indirect costs to NSW

Consistent with the Guidelines, the Project's indirect costs cover a range of net environmental, social and transport-related costs as well as the net public infrastructure costs as well as the estimated loss of surplus to other industries (listed in Table 13).

Consideration of these costs are based on a range of assessments undertaken by specialised consultants for the Project such as an Air Quality and Greenhouse Gas Assessment and Groundwater Assessment. A detailed list of specialised assessments considered is provided in **Appendix A**.

This section outlines the calculation of both the total indirect costs, as well as the incremental costs of the Project. It is the calculation of incremental costs that are accounted for in the CBA.

The incremental costs are those attributable by the Project that are not already included in the Project financials (and therefore already accounted for in the CBA). The total indirect incremental costs for the Project are $8.1 million. **Appendix D** provides more detail on how the indirect environmental costs have been assessed based on the relevant environmental assessments provided.

In addition, there are several environmental costs that are internalised by IMC, of which the company would spend $15.4 million in NPV terms over the life of the operation. These costs include:

- Subsidence remediation works.
- Rail noise investigation and reduction measures.
- Purchasing requisite water rights.
- Surface water offsets.
- Implementing a biodiversity offset strategy.
- Other environmental management and mitigation costs.

These costs are classified as indirect costs of the Project, however, to avoid double counting, are excluded from the incremental costs as they are already included in the operational costs of the Project. IMC provided EY with the year-on-year cost estimates for each of the environmental mitigation and management measures. Several of these anticipated costs are subject to commercial negotiation and therefore have been aggregated into mitigation and management costs and included in the total Project costs. Table 13 provides a summary of the assessment methods used for calculating the Project's indirect costs. In total the Project is estimated to generate $8.1 million in NPV terms of incremental indirect costs (comprised of the incremental costs associated with greenhouse gas (GHG) emissions, impacts to surface water, groundwater impacts and air quality impacts). Material incremental costs include:

- GHG emissions costs of $0.148 million in NPV terms (based on population).
- Air quality impacts of $8.0 million in NPV terms (based on $PM_{2.5}$ emissions).

GHG emissions costs are based on the Life-of-Mine GHG emissions (Scope 1 and Scope 2 emissions), per ROM tonne, taken from the Air Quality and Greenhouse Gas Assessment. The year-on-year emissions are multiplied by the $16.94[20] per tCO_2-e carbon price to estimate the total estimated global GHG cost of $137.4 million in NPV terms. Attributing the GHG costs based on the NSW population to the world, consistent with the Guidelines, results in an attributed GHG cost of $0.148 million to NSW in NPV terms.

To quantify the potential impact of the Project on air quality, the economic assessment uses the methodology as prescribed in Methodology for Valuing the Health Impacts of Changes in Particle Emissions, published by the NSW Environmental Protection Authority (EPA, 2013). The EPA report uses a damage cost approach for each of the Significant Urban Areas (SUA) in NSW, as measured cost per tonne of $PM_{2.5}$ emissions. Based on a total production of 31.4 Mt of Project ROM coal, and predicted total $PM_{2.5}$ emission of 125.1 tonnes, the Project would generate an incremental unit damage cost of $8.1 million in NPV terms.

[20] http://www.cleanenergyregulator.gov.au/ERF/auctions-results/october-2021, Accessed 01/03/2022

Table 13: Summary of indirect costs impacts ($ million^)

Scope of environmental costs	Assessment type	NPV*
Indirect costs		
Greenhouse gas emissions	Quantitative	0.148
Air quality impacts	Quantitative	8.0
Loss of surplus to other industries	Quantitative	0.0
Net public infrastructure costs	Quantitative	0.0
Residual value of land	Quantitative	0.0
Transport/ traffic impacts	Quantitative	0.0
Visual amenity	Quantitative	0.0
Mitigation and management cost		
Aboriginal cultural heritage and historical heritage	Quantitative	^^
Ambient noise impacts	Quantitative	^^
Biodiversity impacts	Quantitative	^^
Greenhouse gas emissions	Quantitative	^^
Subsidence impacts	Quantitative	^^
Water impact (offsets) - including surface and ground water	Quantitative	^^
Total mitigation and management costs		20.7
Indirect costs		8.1

*Source: EY estimates based on information provided from IMC and relevant environmental assessments for the Project. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Confidential, included in the total internalised costs.*

2.8 Net benefits – sensitivity analysis

Consistent with the Guidelines, this section outlines a summary of the systematic sensitivity analysis undertaken for the proposed development. The sensitivity analysis considers all key areas of the CBA, particularly coal prices, key costs (both capital expenditure and operating costs) as well as worker benefits. Where there are considered to be higher levels of potential uncertainty with the figures, a range of plus/minus 25 per cent is used. In areas where the figures are deemed more certain, a range of plus/minus 10 per cent is used. The sensitivity analysis is comprised of the following:

- Revenue sensitivity
  - Higher/lower price assumptions, where coal prices are increased/decreased by 25 per cent based on the central case assumptions over the life of the Project[21].
- Cost-base sensitivity
  - Higher/lower operational expenditure (increase/decrease by 10 per cent based on the central case).
  - Higher/lower capital expenditure (increase/decrease by 10 per cent based on the central case).
- Worker and supplier assumptions
  - Increased disutility of mining wage premium by 25 per cent on central case assumptions.
  - Reduced supplier benefits of 10 per cent from central case assumptions.
- Higher environmental costs (increased by 10 per cent).
- Discount rate sensitivity, using a 4 per cent and a 10 per cent real discount rate (see **Appendix C**).

[21] According to the World Bank (March 2022), most recent coal prices are estimated at around $263 per tonne, representing an uplift of around 85% relative to the higher price sensitivity

In addition, upper and lower bound estimates are undertaken which assume:

- ***'Worst-case' scenario***, the coal price is reduced by 25 per cent, operational and capital expenditure are increased by 10 per cent, the disutility of the mining wage premium is set to 25 per cent and supplier benefits are lowered by 10 per cent compared with central case assumptions.

- ***'Best case' scenario***, the coal price is increased by 25 per cent, operational and capital expenditure are decreased by 10 per cent, the disutility of the mining wage premium is set to zero and supplier benefits are increased by 10 per cent compared with central case assumptions.

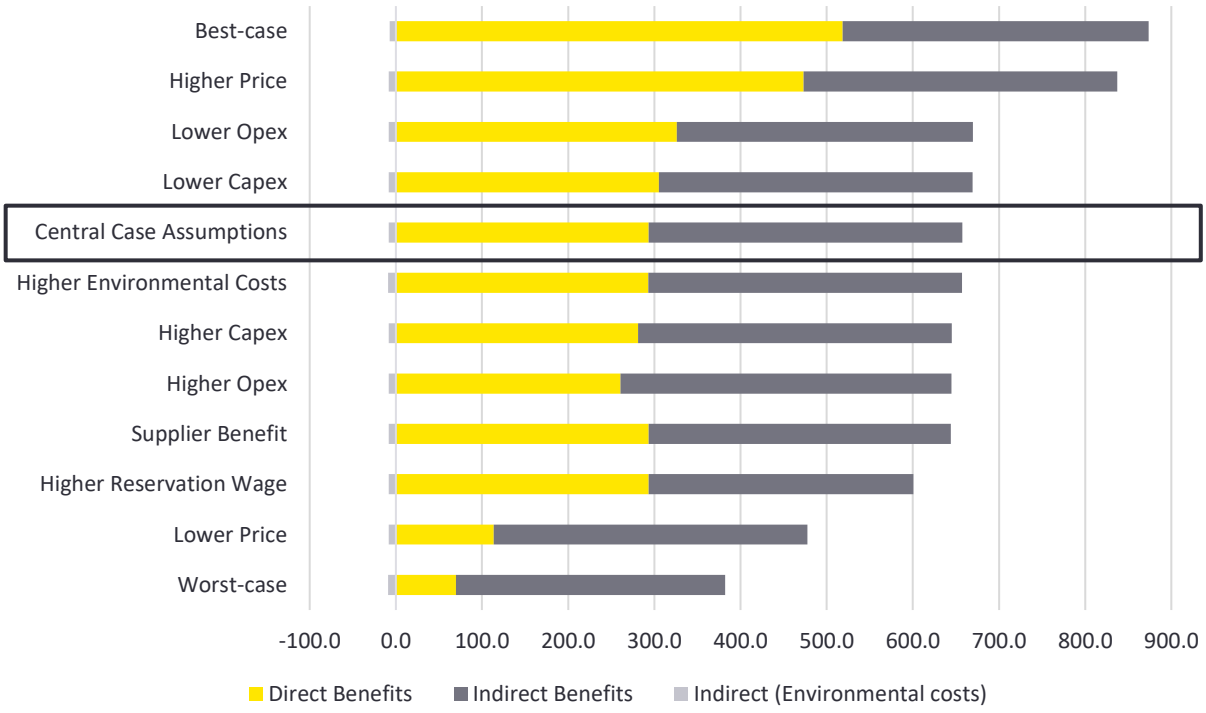
2.8.1 Results of sensitivity analysis

The results of the systematic sensitivity analysis are summarised in Figure 9. This sensitivity analysis shows that the estimated net benefits are ***robust*** in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis.

In isolation, the estimated net benefit of the proposed development is most sensitive to the coal price assumptions underpinning the analysis, but even assuming coal prices are 25 per cent lower than under the central case assumptions the net benefits are estimated to be $469.6 million in NPV terms, a reduction of 27.7 per cent from the central case assumptions.

The lower bound, or worst-case, estimate of net benefits, which takes the combined assumptions around coal prices, capital expenditure, operational expenditure as well as worker, environmental impacts and supplier benefits, yields an estimated net benefit of $373.2 million in NPV terms. The upper bound, or best-case, estimate, based on the combined optimistic assumptions, is $866.3 million in NPV terms.

Figure 9: Systematic sensitivity analysis of the CBA to key assumptions (NPV*, $ million)



*Source: EY estimated based on information from various sources. * NPV in real 2021 Australian dollars based on a 7 per cent real discount rate.*

It can also be inferred from the sensitivity analysis how large the non-quantified negative externalities would need to be before the proposed development would no longer represent a net benefit to the NSW community. Using the most conservative estimate, the worst-case assumptions, these externalities would need to be $373.2 million in NPV terms before the proposed development would represent a net negative return to NSW.

Given the timeframe of the Project longwall mining (2022 to 2034) the net benefits are sensitive to the discount rate used for the analysis. Under central case assumptions, the proposed development is expected to generate $649.2 million of net benefit using a 7 per cent discount rate. Using a 4 per cent discount rate increases the net benefit to $866 million; conversely a 10 per cent discount decreases the net benefit to $489.9 million.

In addition, the sensitivity analysis has been extended to test the impact of a full range of worker and supplier benefits, (see **E.5** for full results). In the case where we reduce worker benefits to 25% of the full estimate, the Project still yields a net benefit of $475.9 million in NPV terms, while reducing supplier benefits by 25% has the impact of reducing the benefit of the Project to $549.5 million in NPV terms.

Appendix B provides a detailed account of the direct and indirect benefits and the indirect costs for each of the sensitivities conducted. The analysis shows that the net benefits of the Project remain ***robust*** under various assumptions. In addition, if conservatively the indirect benefits were all set to zero, that is suppliers were assumed to gain no benefit and workers reservation wages are equal to those earned in the Dendrobium Mine, the net benefits to NSW would remain positive.

3. Local Effects Analysis

Consistent with the Guidelines, the LEA uses a similar framework to the CBA presented in the previous section but is focussed on the net economic impacts to the local community. The Guidelines refer to the local area as being consistent with the relevant SA3 as defined by the Australia Bureau of Statistics. In the case of this Project the Dapto – Port Kembla SA3 area is used for the LEA.

3.1 The Dapto – Port Kembla region

As shown in Figure 10, the Dapto – Port Kembla region is located to the south west of Wollongong. In 2020 the Dapto – Port Kembla SA3 had a population of approximately 80,235 (ABS, 2021). The region is home to several coal mines and the Port Kembla steel works. Port Kembla is also home to port facilities, exporting coal from the Southern Coalfield.

Figure 10: Dapto – Port Kembla SA3

Source: Australian Bureau of Statistics (2018B), MapData Services, stat.abs.gov.au/itt/r.jsp?ABSMaps

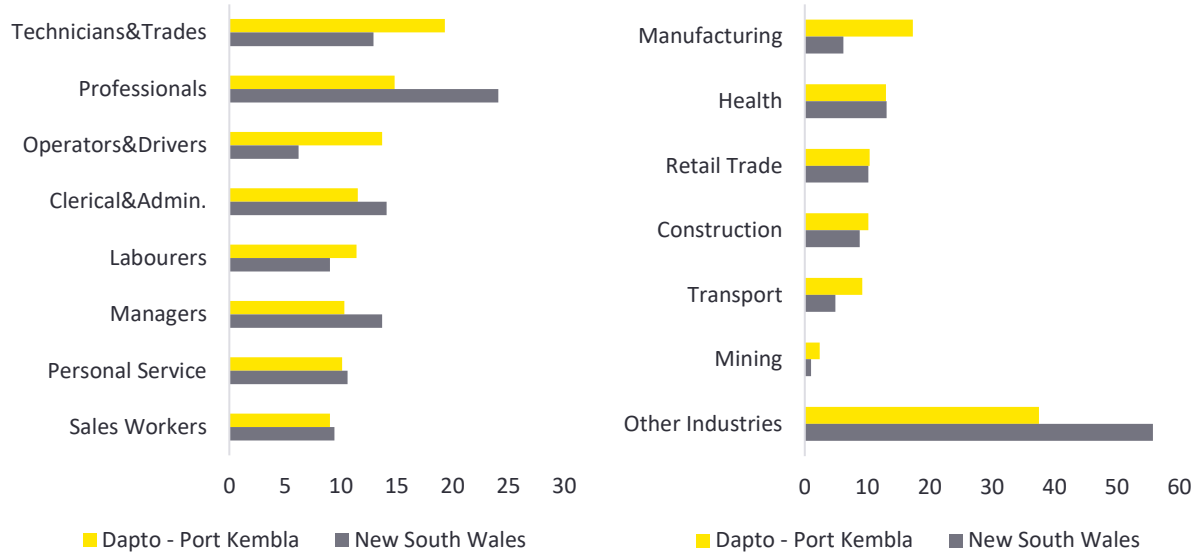
The Dendrobium Mine, Dendrobium Pit Top and access areas are located in the northern part of the SA3, adjacent to Kembla Heights, where the coal processing facilities are located in Port Kembla along the eastern shoreline of the SA3.

The underground operations are located within the Illawarra Catchment Reserve (SA3 – 10702), this SA3 has no population and does not have an industrial base. The Illawarra Catchment Reserve is home to number of other coal mines including the Cordeaux Mine and the underground operations for the Russell Vale Colliery.

3.1.1 Regional characteristics

Figure 11 and Figure 12 describe the employment and education characteristics of persons who reside within the Dapto – Port Kembla SA3 region. The region can generally be classified as being highly industrial with a high proportion of trades workers, machinery operators and drivers.

Figure 11: Employment shares by occupation (left) and by industry (right, top 5 and mining), per cent of total employed



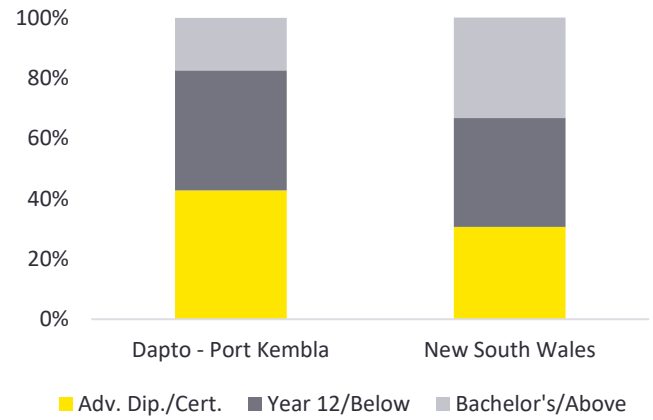
Source: 2016 Census General Community Profile, Dapto – Port Kembla SA3, New South Wales and Australia, Australian Bureau of Statistics cat. no. 2001.0

The region is a major producer of steel products and port services, with approximately 17.3 per cent of workers in the region employed in the manufacturing sector and a further 9.2 per cent within the transport sector. The manufacturing share in the Dapto-Port Kembla SA3 region is almost three times higher than the NSW average and transport's share is almost twice as high as the NSW average.

Mining employment accounts for a relatively small share of employment for Dapto – Port Kembla-based employees, with 2.4 per cent of workers.

Technicians and trade workers account for 19.3 per cent of the workforce in the region, compared to 12.9 per cent for NSW. Similarly, machinery operators and drivers account for 13.7 per cent, more than double the state-wide average of 6.2 per cent.

Figure 12: Education attainment in each region, per cent



Source: 2016 Census General Community Profile, Dapto – Port Kembla SA3, New South Wales and Australia, Australian Bureau of Statistics cat. no. 2001.0

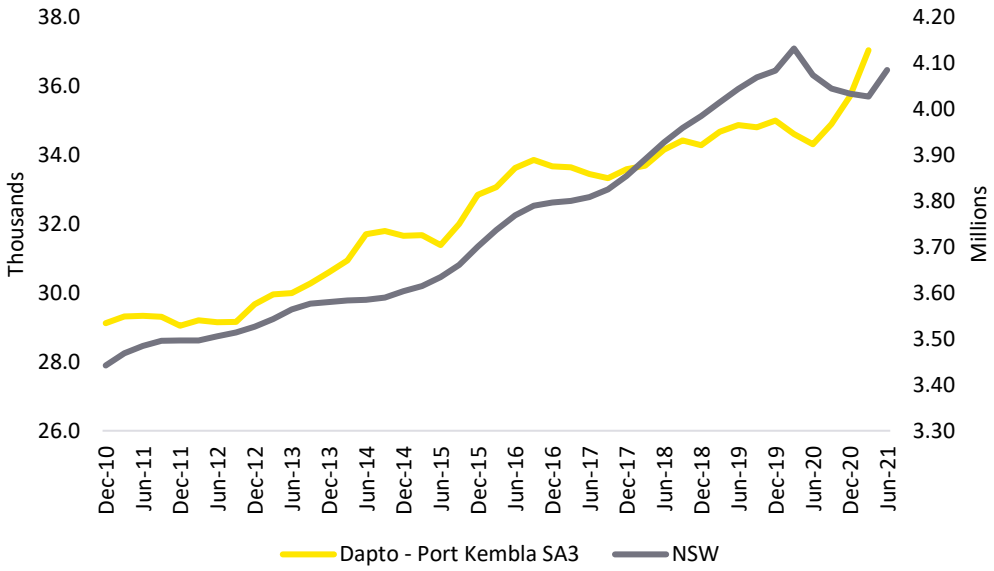
The region's workforce also has a relatively high proportion of workers with a Certificate III and IV attainment. Workers with Certificate III and IV account for 42.7 per cent of the region's workers, compared to 30.6 per cent for NSW.

Both the educational attainment and occupational structure is a result of the high share of manufacturing, transportation, and construction workers in the region.

3.1.2 Employment outcomes

Figure 13 shows total employment in the Dapto – Port Kembla SA3 region and the NSW economy, from December 2010 to June 2021. Employment in the region has been growing since July 2020, remaining relatively strong despite the labour market impacts of COVID-19. Employment in the region currently stands at just over 37,500 workers.

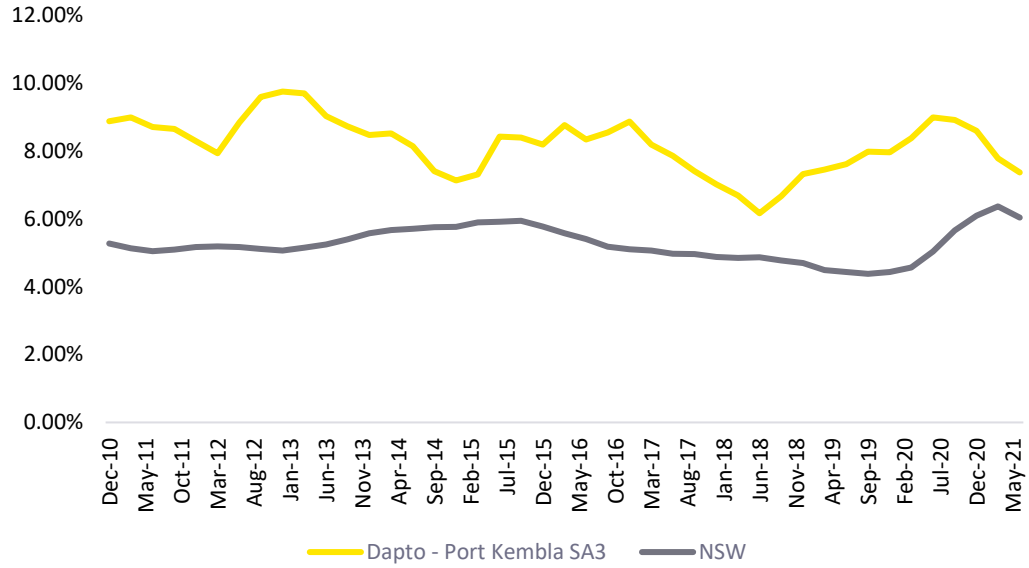
Figure 13: Employment, Dapto – Port Kembla SA3 and New South Wales



Source: Department of Jobs and Small Business, *SA2 Data tables – Small Area Labour Markets – June quarter 2021* (September 2021)

As shown in Figure 14, unemployment in the region has been consistently higher than NSW. Throughout 2020, the region experienced an unemployment rate at between 8.5 per cent and 9 per cent.

Figure 14: Unemployment rate (per cent), Dapto – Port Kembla SA3 and New South Wales



Source: Department of Jobs and Small Business, SA2 Data tables – Small Area Labour Markets – June quarter 2021 (September 2021)

3.2 Local Effects Analysis results

The LEA accounts for the economic benefits to the Dapto – Port Kembla region only. It does not include any economic benefits that may accrue to the major regional centres that are located adjacent, including the wider Illawarra region and Sydney.

Given the nature of coal operations and the export port located in Port Kembla, many of the inputs may be supplied from the broader Illawarra. In addition, analysis from IMC indicates over the life of the proposed development only a proportion of the inputs will be supplied from the Dapto – Port Kembla region and most employees are sourced from the wider region. As a result, this Project would generate economic benefits to these regions; for example, those supplies that are sourced from the wider Wollongong region, Sydney and regional communities to the south and the west of the proposed development.

Underpinning the LEA are the assumptions that:

- Local rates, of $2.2 million in NPV terms are paid to the City of Wollongong Local Government Area.
- No net producer surplus accrues to the region (conservative assumptions).
- No company income tax accrues to the Dapto – Port Kembla SA3 region (conservative assumptions).
- Based on information provided by IMC, 21.7 per cent of the workforce requirement of the proposed development come from the SA3 region.
- 32 per cent of suppliers are located within the Illawarra region, which includes Wollongong, Wollondilly, Campbelltown and Camden. It is assumed that 15 per cent of intermediate inputs will be supplied from the smaller SA3 region.
- Indirect costs associated with air quality have been apportioned to the smaller Dapto-Port Kembla SA3 region in proportion to the Wollongong SUA region, while the indirect costs associated with GHG have been apportioned to the NSW population.

As a result of these assumptions, it is expected the proposed development will generate indirect benefits to local suppliers and employees of $26.6 million and $55.7 million respectively in NPV terms over the no Project case (i.e., baseline case) as outlined in Table 14. The incremental indirect costs associated with the Project are allocated to the SA3 region. The proposed development is estimated to confer a net benefit on the Dapto – Port Kembla SA3 region of $82.2 million in NPV terms.

Table 14: Estimated Local Effects Analysis of the proposed development ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW			
Royalties, payroll tax and Council rates	2.2		
Company income tax apportioned to NSW			
Total direct benefits	2.2	Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	2.2
Net economic benefit to NSW workers	55.7	Greenhouse gas emissions^^	0.001
Net economic benefit to NSW suppliers	26.6	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	-
		Biodiversity impact^^	-
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	82.3	Indirect Costs	2.2
Total Project economic benefit	84.4	Total incremental cost of project	2.2
NPV of project - ($m)	82.2		

*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Incorporated in operational costs.*

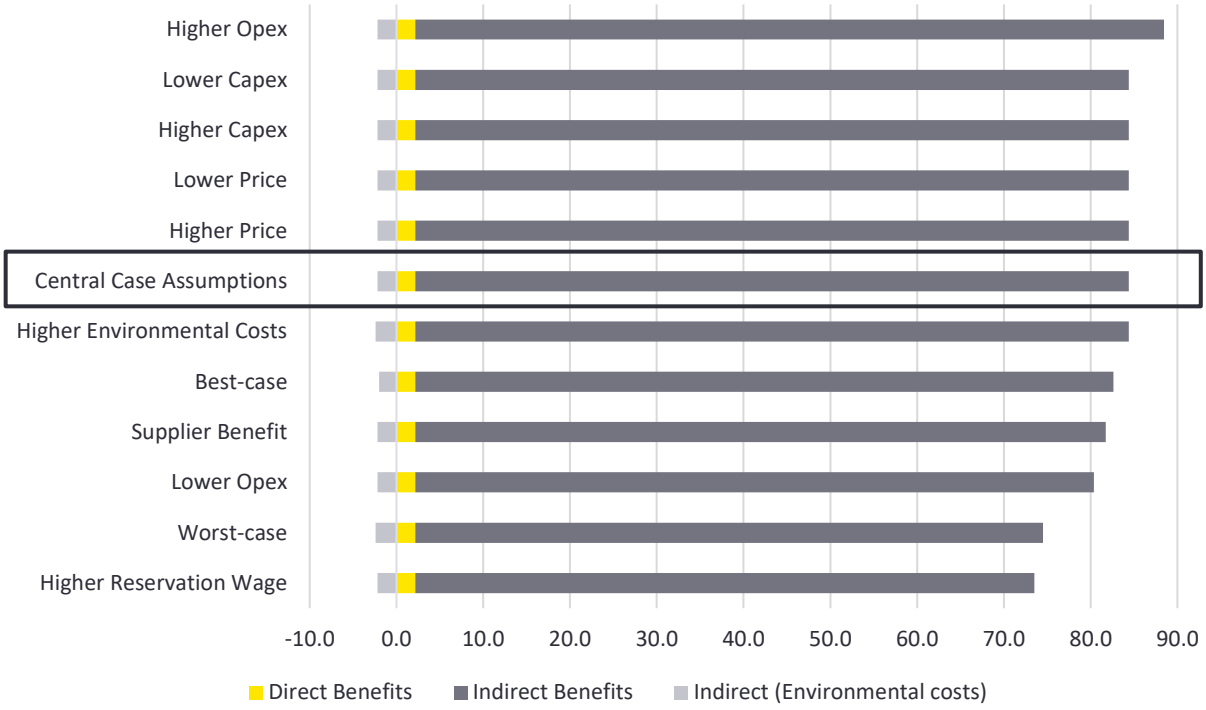
3.3 Sensitivity analysis

As outlined above the LEA relies on a number of modelling assumptions. Consistent with the Guidelines, this assessment provides a summary of the systematic sensitivity analysis undertaken for the proposed development. The sensitivity analysis tests the same assumptions outlined in the CBA.

The main drivers for the regional impact are the supplier and employee benefits. Those sensitivities that change the supplier benefits through lower operational costs, lower supplier benefit or employee benefit have the greatest impact on the regional net benefit.

The results of the systematic sensitivity analysis are summarised in Figure 15. This sensitivity analysis shows that the estimated net benefits are ***robust*** in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis. Full details of the sensitivity analysis are presented in **Appendix B**. The lower bound, or worst-case, estimate of net benefits, which takes the most pessimistic assumptions around coal prices, capital expenditure, operational expenditure as well as worker and supplier benefits, yields an estimated net benefit of $72.1 million in NPV terms. The upper bound, or best-case, estimate, based on the most optimistic assumptions, is $80.6 million in NPV terms.

Figure 15: Systematic sensitivity analysis of the LEA to key assumptions (NPV*, $ million^)



*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

Given the timeframe of the Project longwall mining (2022 to 2034) the net benefits are sensitive to the discount rate used for the analysis. Under the central case assumptions, the proposed development is expected to generate $82.2 million of net benefit using a 7 per cent discount rate. Using a 4 per cent discount rate increases the net benefit to $105.3 million; conversely a 10 per cent discount decreases the net benefit to $64.9 million.

3.4 Wider local region area assessment

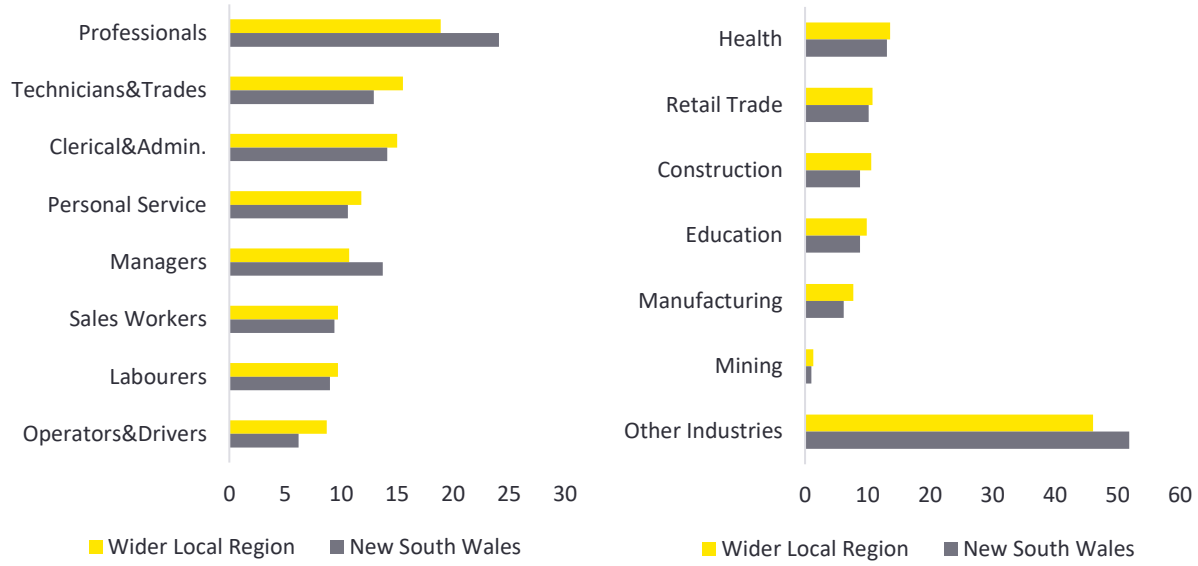
As outlined above, 21.7 per cent of workers in the Dendrobium Mine are sourced from the Dapto-Port Kembla SA3 region. A high proportion of workers, 91.6 per cent, are sourced from the wider region, that includes, Wollongong (including the local government areas of Kiama, Shellharbour, Wollongong City) and Wollondilly, Campbelltown and Camden. The wider region has a population of approximately 532,647 (ABS, 2021).

3.4.1 Regional characteristics

Figure 16 and Figure 17 outlines the education and employment characteristics of persons who reside within the wider regional area. Workers in the region are generally employed in similar industries to those workers in the rest of NSW.

In the wider region, employment in the manufacturing and transportation sectors is similar in proportion to those in NSW. Professionals and technicians and trade workers account for 18.9 per cent and 15.5 per cent of the workforce in the region, respectively, compared to 24.1 per cent and 12.9 per cent for NSW.

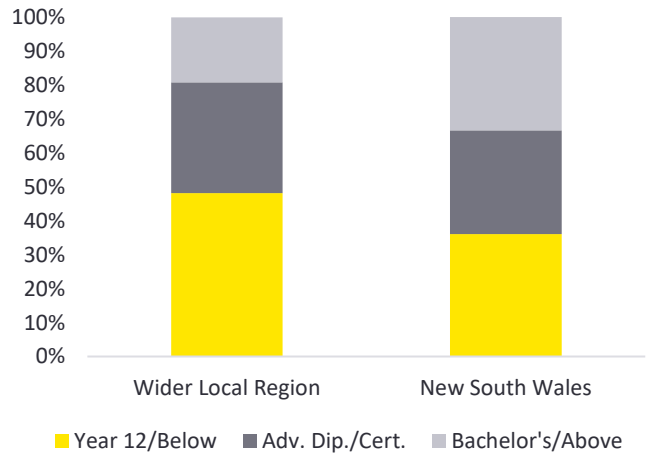
Figure 16: Employment shares by occupation (left) and by industry (right, top 5 and mining), per cent of total employed for the wider local region



Source: 2016 Census General Community Profile, Australian Bureau of Statistics cat. no. 2001.0

The wider region's workforce has a relatively high proportion of workers with secondary educational attainment, accounting for 48.2 per cent of the region's workers, compared to 36.1 per cent for NSW.

Figure 17: Education attainment in each region, per cent within the wider local region



Source: 2016 Census General Community Profile, Australian Bureau of Statistics cat. no. 2001.0

Supplier information from IMC suggests that 32 per cent of supplies are from the region that includes Wollongong, Wollondilly, Campbelltown and Camden.

The LEA, as outlined above, does not include the potential total net benefits to the wider regional area, and therefore likely understates the potential regional benefits.

Table 15 provides an account of the potential benefits of the Project to this wider regional area.

Underpinning the wider area effects analysis, are the assumptions that:

- Local rates, of $2.4 million in NPV terms are paid to the City of Wollongong and the Wollondilly local governments.
- No net producer surplus accrues to the wider area (conservative assumption).
- No company income tax accrues to the wider area (conservative assumption).

- Based on information provided by IMC, 91.6 per cent of the workforce requirement of the proposed development come from the wider area.
- 32 per cent of suppliers are located within the Illawarra region that includes, Wollongong, Wollondilly, Campbelltown and Camden.
- The costs associated with air quality and GHG are the same as those in the full CBA.

As a result of these assumptions, it is expected the proposed development will generate indirect benefits to employees and local suppliers of $211.6 million and $56.7 million respectively in NPV terms over the baseline case. The proposed development is estimated to confer a net benefit on the region of $263.7 million in NPV terms.

Table 15: Estimated Wider Area Effects Analysis of the proposed development ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW			
Royalties, payroll tax and Council rates	3.5		
Company income tax apportioned to NSW			
Total direct benefits	3.5	Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	8.0
Net economic benefit to NSW workers	211.6	Greenhouse gas emissions^^	0.1
Net economic benefit to NSW suppliers	56.7	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	-
		Biodiversity impact^^	-
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	268.4	Indirect Costs	8.1
Total Project economic benefit	271.9	Total incremental cost of project	8.1
NPV of project - ($m)	263.7		

*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Incorporated in operational costs.*

4. CGE Modelling Framework

The economy-wide impacts of the proposed development have been undertaken using a CGE model of the regional and NSW economy.

The aim of an EIA study based on applied CGE modelling is to estimate the net benefit of the proposed development on economic activity and the living standards of those residing within the Dapto – Port Kembla SA3, the same region used for the LEA analysis, and in NSW.

CGE modelling is the preferred technique to assess the impacts of large projects as they are based on a more detailed representation of the economy, including the complex interactions between different sectors of the economy.[22] A CGE model is able to analyse the impacts of the proposed development in a comprehensive, economy-wide framework meaning the modelling captures:

- ***Direct increases in demand*** associated with the proposed development (short term construction activity) as well as the assumed increases output attributable to increased coal production.
- ***Indirect increases in demand***, or flow-on effects associated with increased economic activity relating to both the construction phase of development and additional coal production.
- ***Labour market displacement*** caused by the direct increase in demand from a project of this nature (and the associated investment) on other sectors of the economy bidding up wages and 'crowding out' other sectors of the economy.
- ***Revenue leakage*** associated with the expropriation of profits from the Project to overseas interests (in this case, IMC).

4.1 About the EY CGE model

Economy-wide impacts of the Project are assessed based on the EY General Equilibrium Model (EYGEM). EYGEM is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the Dapto – Port Kembla SA3 and the NSW economy. EYGEM is based on a substantial body of accepted microeconomic theory.

The model projects change in macroeconomic aggregates such as real gross state product (real GSP) which is an output measure of the NSW economy and real gross state income (real GSI) which is a welfare measure for NSW residents. At a regional level the model projects change in real gross regional product (real GRP) and real gross regional income (real GRI). The model also projects state-wide and regional employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced. A brief description of the model is presented in Box 1.

Importantly, in terms of interpreting the results as well as for consistency with the CBA analysis, real GSI represents the preferable welfare measure to the commonly reported change in real GSP (a measure of production). As a measure of income, Pant et al (2000) show how the change in real GSI is a good approximation to the ***equivalent variation*** welfare measure in global CGE models such as EYGEM. This measure is widely used by practitioners and can also be decomposed into various components to assist in the analysis of results. Real GSI is computationally more convenient than (say) an equivalent variation, and a more familiar concept to explain to decision makers (Layman, 2004).

As noted by Pant et al (2000), in considering welfare results in global CGE such as EYGEM, the main components are the change in: output (measured by real GSP), terms of trade and payments to foreigners. Of relevance in the discussion around estimating the net benefits of the proposed development are the terms of trade effects. These can be closely linked to changes in labour market conditions because any increase in real wages as a result of higher levels of coal exports will result in an improvement in the terms of trade and, hence, welfare.

Box 1: An overview of EYGEM

The EY General Equilibrium Model (EYGEM) is a multi-commodity, multi-region, dynamic model of the world economy. Like all economic models, EYGEM is based on a range of assumptions, parameters and data that constitute an approximation to the working structure of an economy. Its construction has drawn on the key features of other economic models such as the global economic framework underpinning models, such as GTAP and GTEM, with state and regional modelling frameworks such as Monash-MMRF and TERM.

[22] See for example the Policy & Guidelines Paper produced by the NSW Treasury (2009).

Labour, capital, land and a natural resource comprise the four factors of production. On a year-by-year basis, capital and labour are mobile between sectors, while land is mobile across agriculture. The natural resource is specific to mining and is not mobile. A representative household in each region owns all factors of production. This representative household receives all factor payments, tax revenue and interregional transfers. The household also determines the allocation of income between household consumption, government consumption and savings.

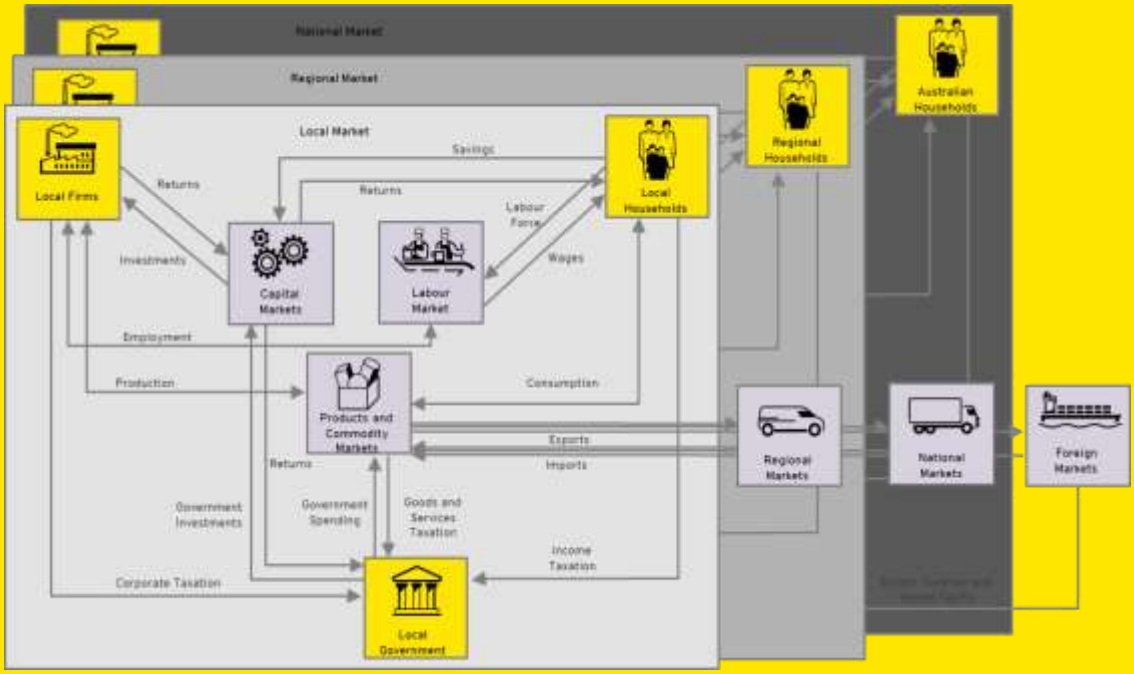
Capital in each region of the model accumulates by investment less depreciation in each period. Capital is mobile internationally in EYGEM where global investment equals global savings. Global savings are made available to invest across regions. Rates of return can differ to reflect region specific differences in risk premiums.

The model assumes labour markets operate in a model where employment and wages adjust in each year so that, for example, in the case of an increase in the demand for labour, the real wage rate increases in proportion to the increase in employment from its base case forecast level.

EYGEM determines regional supplies and demands of commodities through optimising behaviour of agents in perfectly competitive markets using constant returns to scale technologies. Under these assumptions, prices are set to cover costs and firms earn zero pure profits, with all returns paid to primary factors. This implies that changes in output prices are determined by changes in input prices of materials and primary factors.

In terms of specifying the elasticity of labour supply, this analysis follows the lead of the Australian Treasury and use a labour supply elasticity assumption of 0.15, which indicates a relatively 'inelastic' response from workers.

The below diagram is a visual representation of the EYGEM model.



That noted, real GSI does not capture some non-market effects that can impact on the living standards of NSW residents. These could include impacts such as the noise impacts for residents or pollution as considered in the detailed CBA above.

EYGEM is a recursive dynamic model that solves year-on-year over a specified timeframe. The model is used to project the relationship between variables under different scenarios over a predefined period. A typical scenario is comprised of a reference case projection (or the Base case scenario) that forms the basis of the analysis. In this instance, the reference case assumes no proposed development investment or coal output from the Project. Set against this scenario is the policy scenario (or the Project case) under consideration.

4.2 Overview of scenarios

All scenarios outlined in the modelling below use the central case assumptions:

- Capital expenditure of $551.5 million in NPV terms.
- Coal revenue of $2,447.4 million in NPV terms.

EY have also factored into our scenarios the benefits that flow from the proposed development outside of the Dapto – Port Kembla region and the NSW economy. This includes the repatriation of profits out of the region to foreign shareholders, along with wages and the payments out of the region for royalties to the NSW Government and corporation tax to the Australian Government. EY have conservatively assumed these royalty payments accrue to the rest of NSW.

In addition, EY have factored into our scenarios the level of migration of workers from the rest of NSW into the Dapto-Port Kembla SA3. As outlined above, 21.7 per cent of the workers at the Dendrobium Mine reside in Dapto-Port Kembla, where the remainder are sourced from the rest of NSW. This represents a migration into the region, increasing the labour supply in Dapto-Port Kembla and reducing the labour supply in the Rest of NSW.

4.3 Economy-wide modelling of the proposed development

The key macroeconomic variables projected under the core scenario is shown in Table 16. In the Dapto-Port Kembla region, the Project is projected to increase GRP by $1,546.1 million in NPV terms. GRI or regional welfare, is projected to increase by $578.4 million in NPV terms. The projected increase in GRI is significant to the relatively small region of Dapto-Port Kembla, representing a total uplift in absolute GRI to the region of around 3.9 per cent, as a result of the Project. In total, the Project is projected to increase welfare for each person in Dapto-Port Kembla by $6,777 in NPV terms.

For NSW, the projected increase in GSP is $1,458 million in NPV terms. GSI is projected to increase by $1,293.8 million.

Table 16: Economy-wide impacts of the Project, 2022 - 2034

Variable	Description	Dapto-Port Kembla	NSW Total
Real GRP/GSP^	NPV* - $m	1,546.1	1,458.0
Real GRI/GSI^	NPV* - $m	578.4	1,293.8
Employment	Average FTE^^	360	399
Real Wages	Average – Per cent^^	1.11	0.02
Real GRI per person^	NPV* - Dollars	$6,777	$141

*Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Average over the period 2022 to 2034.*

Total employment in the region is projected to increase by 360 FTE workers on average. As outlined above the Project would employ 333 FTE workers on average, with a peak of 557 in 2028, as a result 27 additional workers will be employed in other sectors of the economy in the Dapto-Port Kembla region, taking into account employment in supplier industries and any crowding out effects. Across NSW, employment is projected to increase by 399 FTE comprising of 333 direct FTE and 66 flow-on FTE.

The analysis above outlines the impacts of the Project over the entire timeline of the proposed development. The Project includes several phases, these are:

- Capital intensive phase with development of Area 5.
- Longwall operations in Area 5.
- Peak extraction phase of up to 5.2 Mt of ROM coal in Area 5.
- Longwall completion in Area 5.

Table 17 provides an account of the economy-wide impacts during each of these phases, for an indicative year, for the Dapto-Port Kembla region. The relative impacts do shift during each phase of the Project. During the capital-intensive phase, welfare in the region, as measured by real GRI, is similar in relative size with the gross regional product. As we move into the operational phases of the Project, the welfare measure falls in relative size to GRP, showing the impacts of the repatriation of income to other regions.

Table 17: Economy-wide impacts of the Project to Dapto Port-Kembla, 2022 – 2034

Variable	Description	Capital Intensive	Longwall Operations	Peak Extraction	Longwall Completion
		2024	2027	2030	2034
Real GRP	$million^ [% change]	48.09 [0.83]	172.94 [2.77]	448.7 [6.66]	334.09 [4.49]
Real GRI	$million^ [% change]	64.02 [0.96]	123.43 [1.69]	87.81 [1.09]	84.86 [0.93]
Employment	FTE [% change]	85.08 [0.26]	507.09 [1.52]	644.17 [1.87]	411.05 [1.14]
Real wages	% change	1.18	0.57	2.30	0.93
Real GRI per Capita	Dollars^	$773	$1,459	$1,017	$959

Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars, undiscounted.

Table 18 outlines the economy-wide impacts to NSW during each phase of the Project.

Table 18: Project economy-wide impacts of the Project to NSW, 2022 – 2034

Variable	Description	Capital Intensive	Longwall Operations	Peak Extraction	Longwall Completion
		2024	2027	2030	2034
Real GRP	$million^ [% change]	44.54 [0.01]	143.51 [0.02]	436.07 [0.06]	328.1 [0.04]
Real GRI	$million^ [% change]	65.06 [0.01]	200.83 [0.03]	326.76 [0.04]	233.09 [0.03]
Employment	FTE [% change]	65.85 [0]	177.49 [0]	303.05 [0.01]	181.55 [0]
Real wages	% change	0.01	0.01	0.03	0.02
Real GSI per Capita	Dollars^	$8	$22	$35	$24

Source: EY estimates based on information provided by IMC. ^ Real 2021 Australian dollars, undiscounted.

Appendix A Information Received

The data inputs for the analysis presented in this report are derived primarily from:

- The Environmental Impact Statement.
- Various social and environmental consultant reports.
- *Coal Price and FX Markets Forecasts – September/October 2021.*
- Various data from the Australian Bureau of Statistics (ABS) including the most recent Census data.

In addition, EY was provided the financial model prepared by IMC, which includes Project capital expenditure, operational costs, output and employment for an optimised mine plan scenario for each year of the Project. All values in the financial model were in real 2021 Australian dollars.

The optimised mine plan scenario includes mining in Area 5 (Project) and Area 3C (currently approved). EY was provided both the capital costs and the operational costs for each of these mining areas based on the optimised mine plan. The new mine development capital and the replacement and sustaining capital costs and operational costs for Area 5 are included in the net benefit calculations for the Project. In addition, employment estimates for each of the areas was provided by IMC and the operational employment associated with Areas 5 (i.e. excluding Area 3C) is included in the net benefits calculation.

In addition to the operational costs, IMC has provided EY with several costings to meet required environmental mitigation and management costs of the Project. Some of these costs are subject to commercial negotiation and are not therefore available to publish on an individual basis. The economic analysis therefore combines all the environmental costs into one item called "mitigation and management" to ensure commercial confidentiality, and are included in the cost of the Project. The costs included in mitigation and management are:

- Subsidence monitoring, prevention, remediation and repair.
- Heritage monitoring and remediation.
- Road and rail noise controls, investigation and reduction measures.
- Biodiversity offsets.
- Other environmental, management and mitigation costs.
- Water offsets and licences.

Consistent with the Guidelines, the Project's indirect costs cover a range of net environmental, social and transport-related costs as well as the net public infrastructure costs as well as the estimated loss of surplus to other industries (listed in Table 13).

Consideration of these costs are based on a range of assessments undertaken by specialised consultants for the Project. The list of social and environmental consultant reports includes:

- Air Quality and Greenhouse Gas Assessment undertaken by Ramboll Australia presented in the report, *Dendrobium Mine Extension Project Air Quality and Greenhouse Gas Assessment.*
- Subsidence Predictions and Impact Assessment (Subsidence Assessment) undertaken by Mine Subsidence Engineering Consultants presented in the report Dendrobium Mine Extension Project Subsidence Predictions and Impact Assessment for the Natural and Built Features in Support of the Environmental Impact Statement Application.
- Biodiversity Development Assessment Report undertaken by Niche Environment and Heritage presented in the report, Dendrobium Mine Extension Project Biodiversity Assessment Report.
- Noise and Blasting Assessment undertaken by Renzo Tonin & Associates presented in the report Dendrobium Mine Extension Project, Noise and Blasting Assessment.

- Road Transport Assessment undertaken by TTPP presented in the report Dendrobium Mine Extension Project Road Transport Assessment.
- ACHA undertaken by Niche Environment and Heritage presented in the report Aboriginal Cultural Heritage Assessment, Dendrobium Mine Extension Project.
- Historical Heritage Assessment undertaken by Niche Environment and Heritage presented in the report Dendrobium Mine Extension Project Historical Heritage Assessment.
- Surface Water Assessment undertaken by Hydro Engineering and Consulting presented in the report Dendrobium Mine Extension Project Surface Water Assessment.
- Geographic review of mining effects on Upland Swamps at Dendrobium Mine prepared by Watershed HydroGeo.
- Groundwater Assessment undertaken by Watershed HydroGeo presented in the report Dendrobium Mine Extension Project Groundwater Assessment.

Appendix B Full Results and Sensitivity Analysis

Full-year inputs

Table 19 provides a detailed schedule of year-on-year coal production and coal prices (after quality adjustment) as key inputs into total coal sales revenue generated by the Project between 2022 and 2034. The Project focuses on metallurgical coal, accounting for 23.7 Mt (or 83.7 per cent) of total saleable coal.

Extraction rates increase substantially from 2027, peaking at 5.2 Mt of ROM coal in 2030, resulting in a similar revenue schedule. In total, the Project is estimated to general 31.4 Mt of ROM coal and revenue of $2,447.4 million in NPV terms.

Table 19: Central case assumptions – revenue projection (all years)

Year	ROM Output (Mt)	Met. Coal (Mt)	Thermal Coal (Mt)	PCI (Mt)	Met. Coal Price^	Thermal Coal Price^	PCI Price^	Total Revenue^
2022	-	-	-	-	179.69	104.71	128.37	-
2023	-	0.02	0.01	0.00	178.89	97.12	123.19	4.19
2024	0.06	0.04	-	-	175.83	91.25	117.22	6.18
2025	0.22	0.15	-	0.01	175.11	90.85	116.74	27.47
2026	0.41	0.32	-	0.01	177.33	85.33	124.39	59.05
2027	1.32	1.10	-	0.03	177.33	85.33	124.39	197.96
2028	3.21	2.72	-	0.07	177.33	85.33	124.39	490.32
2029	4.63	3.94	-	0.10	177.33	85.33	124.39	711.52
2030	5.17	4.40	-	0.12	177.33	85.33	124.39	794.78
2031	4.71	3.83	-	0.27	177.33	85.33	124.39	712.91
2032	4.73	3.26	-	0.83	177.33	85.33	124.39	681.11
2033	3.42	1.73	-	1.17	177.33	85.33	124.39	452.08
2034	3.50	2.20	-	0.84	177.33	85.33	124.39	494.53
Total	31.37	23.71	0.01	3.44				4,632.1
NPV*								2,447.4

*Source: EY estimates ^ Real 2021 Australian dollars. * NPV to 2021 based on a 7 per cent real discount rate.*

Sensitivity Analysis – CBA and LEA

The results of the systematic sensitivity analysis for the CBA are summarised in Table 20 (see Section 2.8 for descriptions of each assumption tested). This sensitivity analysis shows that the estimated net benefits are robust in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis. In isolation, the estimated net benefit of the proposed development is most sensitive to the coal price assumptions underpinning the analysis, but even assuming coal prices are 25 per cent lower than under the central case assumptions, the net benefits are estimated to be $469.6 million in NPV terms, a reduction of 27.7 per cent from the central case assumptions.

It is worth noting that the net producer surplus becomes negative under the lower price assumption, decreasing to negative $57.3 million in NPV terms, but the loss is more than offset by large direct benefits to the local government and substantial indirect benefits from the Project. Similarly, the worst-case estimate of net producer surplus is negative $93.1 million in NPV terms, but total direct benefits remain positive at $69.7 million due to substantial payments to the local government.

Table 20: CBA – sensitivity analysis of the net benefits of the Project (NPV*, $ million)

	Central Case	Higher Price	Lower Price	Higher Opex	Lower Opex	Higher Capex	Lower Capex	Higher Reservation Wage	Supplier Benefit	Higher Environ. Costs	Worst-case	Best-case	Central Case (4%)	Central Case (10%)
Direct Benefits	**$293.3**	**$473.2**	**$113.7**	**$260.5**	**$326.0**	**$281.2**	**$305.3**	**$293.3**	**$293.3**	**$292.9**	**$69.7**	**$518.5**	**$408.1**	**$210.0**
1. Net producer surplus	$35.1	$126.6	-$57.3	$13.0	$57.1	$24.3	$45.8	$35.1	$35.1	$34.7	-$93.1	$159.4	$70.9	$10.1
2. Royalties, payroll tax and Council rates	$176.6	$214.5	$138.7	$176.6	$176.6	$176.6	$176.6	$176.6	$176.6	$176.6	$138.7	$214.5	$229.3	$137.5
3. Company income tax apportioned	$81.6	$132.1	$32.4	$70.9	$92.3	$80.3	$83.0	$81.6	$81.6	$81.6	$24.2	$144.6	$108.0	$62.4
Indirect Benefits	**$364.1**	**$364.1**	**$364.1**	**$384.3**	**$343.9**	**$364.1**	**$364.1**	**$307.5**	**$350.8**	**$364.1**	**$312.4**	**$355.1**	**$470.1**	**$285.6**
1. Net economic benefit to existing landholders	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2. Net economic benefit to Local workers	$231.1	$231.1	$231.1	$231.1	$231.1	$231.1	$231.1	$174.5	$231.1	$231.1	$174.5	$231.1	$295.3	$183.0
3. Net economic benefit to Local suppliers	$132.9	$132.9	$132.9	$153.2	$112.7	$132.9	$132.9	$132.9	$119.6	$132.9	$137.8	$124.0	$174.8	$102.5
Indirect (Environmental costs)	$8.1	$8.1	$8.1	$8.1	$8.1	$8.1	$8.1	$8.1	$8.1	$8.9	$8.9	$7.3	$12.2	$5.7
Potential Net Benefits	**$649.2**	**$829.2**	**$469.6**	**$636.7**	**$661.7**	**$637.1**	**$661.3**	**$592.6**	**$635.9**	**$648.0**	**$373.2**	**$866.3**	**$866.0**	**$489.9**

*Source: EY estimates based on information from various sources. Estimated as the benefits of the Project case less the Baseline case. *NPV in real 2021 Australian dollars based on a 7 per cent real discount rate, except for "Central Case (4%)" which is based on a 4 per cent real discount rate and "Central Case (10%)" which is based on a 10 per cent real discount rate. See Section 2.8 for descriptions of each assumption tested.*

The results of the systematic sensitivity analysis for the LEA are summarised in Table 21 (see Section 2.8 for descriptions of each assumption tested). This sensitivity analysis shows that the estimated net benefits to the Dapto Port-Kembla SA3 region are robust in the sense that they remain positive after testing all key assumptions underpinning the analysis.

The estimated net regional benefit of the Project is strongly sensitive to reservation wage assumptions, given benefits to workers ($55.7 million in NPV terms under central case assumptions) make up the largest portion of total direct and indirect benefits to the region. Assuming the disutility of mining wage premium increases by 25 per cent on central case assumptions, the net benefits are estimated to be $71.3 million in NPV terms, a reduction of 13.2 per cent from the central case assumptions.

Table 21: LEA – sensitivity analysis of the net regional benefits of the Project (NPV*, $ million)

	Central Case	Higher Price	Lower Price	Higher Opex	Lower Opex	Higher Capex	Lower Capex	Higher Reservation Wage	Supplier Benefit	Higher Environ. Costs	Worst-case	Best-case	Central Case (4%)	Central Case (10%)
Direct Benefits	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.2**	**$2.6**	**$1.8**
1. Net producer surplus	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2. Royalties, payroll tax and Council rates	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.6	$1.8
3. Company income tax apportioned	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Indirect Benefits	**$82.3**	**$82.3**	**$82.3**	**$86.3**	**$78.2**	**$82.3**	**$82.3**	**$71.4**	**$79.6**	**$82.3**	**$72.3**	**$80.5**	**$106.1**	**$64.6**
1. Net economic benefit to existing landholders	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
2. Net economic benefit to Local workers	$55.7	$55.7	$55.7	$55.7	$55.7	$55.7	$55.7	$44.8	$55.7	$55.7	$44.8	$55.7	$71.1	$44.1
3. Net economic benefit to Local suppliers	$26.6	$26.6	$26.6	$30.6	$22.5	$26.6	$26.6	$26.6	$23.9	$26.6	$27.6	$24.8	$35.0	$20.5
Indirect (Environmental costs)	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.2	$2.4	$2.4	$2.0	$3.3	$1.5
Potential Net Benefits	**$82.2**	**$82.2**	**$82.2**	**$86.3**	**$78.2**	**$82.2**	**$82.2**	**$71.3**	**$79.6**	**$82.0**	**$72.1**	**$80.6**	**$105.3**	**$64.9**

*Source: EY estimated based on information from various sources. Estimated as the benefits of the Project case less the Baseline case. *NPV in real 2021Australian dollars based on a 7 per cent real discount rate, except for "Central Case (4%)" which is based on a 4 per cent real discount rate and "Central Case (10%)" which is based on a 10 per cent real discount rate. See Section 2.8 for descriptions of each assumption tested.*

Appendix C Alternative Scenarios

The analysis in this appendix outlines the net benefits of the proposed development to include Area 3C. The inclusion of Area 3C increases the Project output to 47.8 Mt of ROM coal. To estimate the net economic benefits, EY used the same information as outlined above, including detailed financial models from IMC. To estimate the indirect costs EY prorated the costs by the ROM coal extracted. The results are described in the sections below. As outlined in the Introduction, the economic assessment in this Appendix provides an account of including Area 3C within the Project case. That is, it assesses the potential impacts of development of the Project proposed Area 5 as well as the induced mining within the approved Area 3C. In total the inclusion of Area 3C provides an additional 16.4 Mt of ROM coal, for a total output of 47.8 Mt. This represents an additional output of 52.4 per cent over the core Project output of 31.4 Mt.

The results are summarised in Table 22. This net benefit is estimated to be $832 million in NPV[23] terms. This is comprised of $362.1 million and $479.1 million in direct and indirect benefits respectively. The incremental indirect costs of the Project are estimated to be $9.2 million in NPV terms.

Table 22: Project with 3C - estimated net benefits of the proposed development ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW	46.0		
Royalties, payroll tax and Council rates	222.7		
Company income tax apportioned to NSW	93.5		
Total direct benefits	362.1	Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	9.1
Net economic benefit to NSW workers	297.5	Greenhouse gas emissions^^	0.1
Net economic benefit to NSW suppliers	181.6	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	-
		Biodiversity impact^^	-
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	479.1	Indirect costs	26.3
Total economic benefit of Project	841.2	Total incremental cost of Project	9.2
NPV of Project - ($m)	832.0		

*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Incorporated into mitigation and management costs.*

The net benefit of the Project scenarios that includes Area 3C is $832 million in NPV.

[23] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated).

Appendix D Environmental and Other External Costs

The following sections provide more detail on how the indirect environmental costs have been assessed based on the relevant environmental assessments provided.

D.1 Greenhouse gas emissions

Consistent with Australia's international obligations under the United Nations Framework Convention on Climate Change the level of GHG emissions attributable to the Project is measured by the:

- Scope 1 emissions: representing the direct GHG emissions from the Project (e.g. from the use of diesel in plant and equipment).
- Scope 2 emissions: representing the indirect emissions from the Project's purchases of inputs, (generally associated with the purchase of electricity).

The estimation of GHG emissions over the life of the Project was undertaken by Ramboll Australia. The estimation of the GHG emissions in the Air Quality and Greenhouse Gas Assessment is outlined in the report, *Dendrobium Mine Extension Project Air Quality and Greenhouse Gas Assessment*.

The GHG emissions were estimated using information from the Australian Government Department of the Environment and Energy's National Greenhouse Accounts Factors and the requisite workbooks, methodologies and technical guidelines.

The Air Quality and Greenhouse Gas Assessment provides an account of the annual GHG emissions for all the Project sources (i.e., including the additional extraction from Area 5), as well as the GHG emissions from the transport and processing of coal for the approved Mine.

To price the GHG emissions, EY has applied the latest carbon price resulting from the most recent (October 2021) auction undertaken by the Clean Energy Regulator under the Emissions Reduction Fund (ERF).[24] The results of this auction yielded an average carbon price of $16.94 per tCO_2-e abated. While this is an average figure, it represents a useful proxy to the marginal cost of abatement under Australia's current emission abatement policy represented by the ERF.

The externalities arising from GHG emissions associated with the Project are derived by taking the year-on-year emissions and multiplying these figures by the $16.94 per tCO_2-e carbon price under the ERF over the life of the Project.

The impacts of GHG emissions are global in nature, and as a result, apportioning all the costs of climate change impacts associated with the Project to NSW overstates the cost of these impacts to NSW. To estimate the impacts on NSW, it is appropriate to apportion a component of the total global costs to NSW. The approach adopted is to apportion the global GHG costs estimated to NSW using the ratio of the NSW population to the global population.

On a global basis, the total estimated GHG cost is $137.4 million in NPV terms, see Table 23. Attributing the GHG costs based on the NSW population, consistent with the Guidelines, results in an attributed GHG cost of $0.148 million to NSW in NPV terms.

[24] The results of this auction are summarised at http://www.cleanenergyregulator.gov.au/ERF/auctions-results/october-2021 which was accessed in February 2022 for this analysis. (Australian Government, 2021).

Table 23: Greenhouse gas emissions attributable to the Project

	Total	2022	2026	2030	2034
ROM Coal Output Mt	31.4	-	0.41	5.17	3.50
Tonnes of GHG (Mt)					
Scope 1	14.1	0.13	0.40	1.38	1.65
Scope 2	1.1	0.07	0.05	0.09	0.07
Total	15.2	0.20	0.46	1.47	1.71
Price Path ($ per tonne CO_2-e abated^)		16.94	16.94	16.94	16.94
Global Impact (NPV*, $ million^)	137.4	3.43	7.72	24.97	29.03
NSW (NPV*, $ million^)	0.148	0.004	0.008	0.027	0.032

Source: EY estimates based on Ramboll Australia (2022).
^ Real 2021 Australian dollars.
* NPV in 2021 Australian dollars based on a 7 per cent real discount rate.

D.2 Biodiversity offsets required

The Biodiversity Development Assessment Report concludes that, either through subsidence or native vegetation clearing, the Project would have an adverse impact on biodiversity (both flora and fauna) within the Study Area. The impacts of flora and fauna would require offsets to be either purchased or generated to manage the impacts of the Project. The biodiversity credit requirements are summarised in table 24, which shows a breakdown of the number of credits required to offset the impacts of the Project.

Table 24: Biodiversity credit requirements

	Credits
Species credit requirements	
Gang-gang Cockatoo	399
Eastern Pygmy-possum	472
Large-eared Pied Bat	3
Southern Myotis	126
Koala	456
Giant Dragonfly	186
Giant Burrowing Frog	257
Broad-headed Snake	5
Littlejohn's Tree Frog	343
Southern Myotis	126
Red-crowned Toadlet	68
Ecosystem credit requirements	
Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion	346
Illawarra Escarpment Blue Gum wet forest	2
Coastal sandstone gully forest	17
Needlebush - banksia wet heath on sandstone plateaux of the Sydney Basin Bioregion	106
Coastal upland wet heath swamp	1

Source: Niche Environment and Heritage (2022c)

To generate these biodiversity credits, IMC would implement a biodiversity offset strategy. As outlined previously in this assessment, these costs are included in the mitigation and management costs of the Project.

D.3 Water offsets required

The Groundwater Assessment was undertaken by Watershed HydroGeo, with the findings of the assessment, including estimated peak annual surface water losses during and post-mining, outlined in the *Dendrobium Mine Extension Project Groundwater Assessment*. The peak annual surface water losses attributable to Area 5 have been considered in the assessment. The predicted water surface losses, throughout the Project operation and post-mining, are expected to peak at 428 ML/year in 2037.

To estimate the economic costs associated with this water loss, the economic assessment has costed the annual during mining and post-mining losses consistent with the methodology used by the NSW Government in developing the planning agreement for offsets of predicted surface water losses for the previous application. Accordingly, surface water losses during mining have been costed based on the weighted-average IPART base water price and drought water price, of $2,433 ($/ML) and have been included as part of the operating costs of the Project. Predicted post-mining surface water losses have been costed as an up-front payment based on the present value of modelled post-mining losses and the IPART price, consistent with the draft planning agreement for the previous application.

Appendix E Worker and Supplier Benefits

E.1 Introduction

In this Appendix, additional supporting evidence is presented to substantiate the addition of worker and supplier benefits as part of the economic CBA undertaken for the extension of the life of the Dendrobium Mine. In this case, we have considered the relevant NSW planning guidelines, including:

1. NSW Government (2015) Guideline (the "Guidelines") for the economic assessment of mining and coal seam gas proposals.

2. NSW Government (2018) Technical Notes supporting the Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals.

Mining approvals in NSW require a CBA to be undertaken based on the above Guidelines published by the NSW Government.[25] At the outset, we believe that it is important to recognize the relatively unique role that the economic CBA plays in the approvals process. Whilst it is common for governments to undertake CBA when considering public expenditures such as large infrastructure developments or programs, it is much less common for governments to undertake CBA for private sector investments.

The Guidelines explicitly recognise that there are a range of potential beneficiaries from a mining project, along with the direct and indirect costs. These beneficiaries are appropriate to consider when assessing private investment and include the NSW government through tax and royalty collection, workers at a mine and suppliers to the mine. Furthermore, the Guidelines explicitly recognise that the "benefits to workers can be one of the major economic benefits from a project".

What we have observed in the approvals process broadly, is that much of the commentary around the merits of CBA analysis calls for the exclusion of key benefits, such as those that accrue to workers and suppliers at a new mine. The exclusion of these benefits is often based on highly theoretical arguments, with little supporting evidence provided, and are only justifiable under the most restrictive of circumstances. Further, the commentary overlooks the fact that the assessment considers net benefits, that is, the benefits of the Project proceeding versus there being no project (and therefore no additional demand for suppliers nor additional employment).

In this appendix we set out to address some of the common (often unsubstantiated) claims that are used to justify the exclusion key benefits, such as those related to worker and supplier benefits.

In addition, a further set of sensitivity analysis is presented with the impact on the overall benefits and costs of the Project on a range of benefits to workers and suppliers. This Appendix is additional to the analysis undertaken in the main report.

E.2 Benefits to workers

The Guidelines are explicit in their allowance of positive worker benefits and recognise that such benefits can represent a major proportion of the overall benefits of a project, provided there is sufficient evidence to support it. The basis for estimating the benefits that accrue to workers in a mine is based on the following principles, as highlighted in the Guidelines:

- Wages earned in the mine.

- Minus the opportunity costs of labour for working in the mining sector, compared to working in non-mining sectors (or being unemployed).

- Minus the wage difference due to skills and the disutility of working in the mining industry.

To measure the opportunity cost compared to the non-mining sector, the wages earned by Dendrobium Mine workers are compared to an estimated reservation wage, which is constructed as a weighted average of the wages paid to occupations not in the mining sector. The weights are given by the occupational distribution of those found working in the coal mining sector. Furthermore, the reservation wage is adjusted upwards to account for the differential in hours worked between those in the coal mining sector and those employed in the wider economy. This implies that should the Project not go ahead, those

[25] Department of Planning and Environment (2015).

who would have been employed by Dendrobium would find alternative work at the average wage paid for their occupation in NSW. The reservation wage across NSW is estimated at $94,425.2 per annum, based on 2016 Census data (updated to 2021 dollars using ABS cat. No. 6401.0 and ABS cat. No. 6345.0).

However, the inclusion of worker benefits is a key area of disagreement in the assessment process for many mine applications, as the Guidelines are not explicitly prescriptive in their treatment of these benefits. For example, in the Independent Planning Commission's (the "IPC") statements[26] regarding the Mangoola Coal Continued Operations Project, which was approved in April 2021[27], it is noted that worker benefits were overstated and were not prepared in accordance with the Guidelines. It was in part, because that "should mining cease at the site, workers would likely gain employment elsewhere in the mining industry".

Further general criticisms on the inclusion of worker benefits for mining projects in NSW tend to follow three common approaches, that:

- Projects will generally not employ people locally, and rather source employees through drive-in-drive out and fly-in-fly-out arrangements from broader areas and interstate.
- Any calculation of worker benefits should include an adjustment for the disutility of working in the mines and the extra skills needed to work in the mining industry.
- By measuring the mining wage against the average wage in NSW implies that workers will find alternative work at an average wage paid in NSW, which implies that there are no significant differences in skills between miners and the average worker.

Each of these arguments are addressed in commentary below.

E.2.1 Worker locations and jobs

Mining Jobs

Standing in contrast to the assertion that coal miners will simply find employment in alternative mines, Figure 18 details the forecasted coal mining employment in NSW.[28] These projections of employment also operate as a proxy for coal production. Under all scenarios, there is predicted to be a potential decline in projected employment within the coal sector in NSW over the expected life of the Project with only the high demand scenario showing a potential increase in employment over the short term. In contrast to the 2016 NSW Intergenerational Report (IGR), the 2021 IGR highlights a quick and significant shift in the outlook for the coal mining industry, with Australia's three of the top four metallurgical coal export countries (Japan, South Korea and China[29]) committing to achieving net zero emissions by the middle of the century.

In 2021 IGR, *The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report,* the NSW treasury writes that a "declining global demand for NSW coal will impact employment in coal mining. Under the reference case, employment in coal mining is projected to decline by an average of 600 per year for the next two decades".

As global demand for coal is forecast to plateau, NSW plans to slowly unwind investing in coal mining projects, as countries transition to a clean energy framework.[30] Those currently employed in the sector are going to face increasing challenges in finding alternative employment within the mining sector. Those that do will displace a person already in the workforce, who may either retire from the workforce or seek employment in some other profession. Therefore, the continued operations related to the Project would give the employees at the Dendrobium Mine an opportunity to have access to stable employment in an environment where global factors mean that alternative opportunities in coal mining in NSW are becoming increasingly scarce.

[26] New South Wales Government Independent Planning Commission, Mangoola Coal Continued Operations Project – Statement of Reasons for Decision

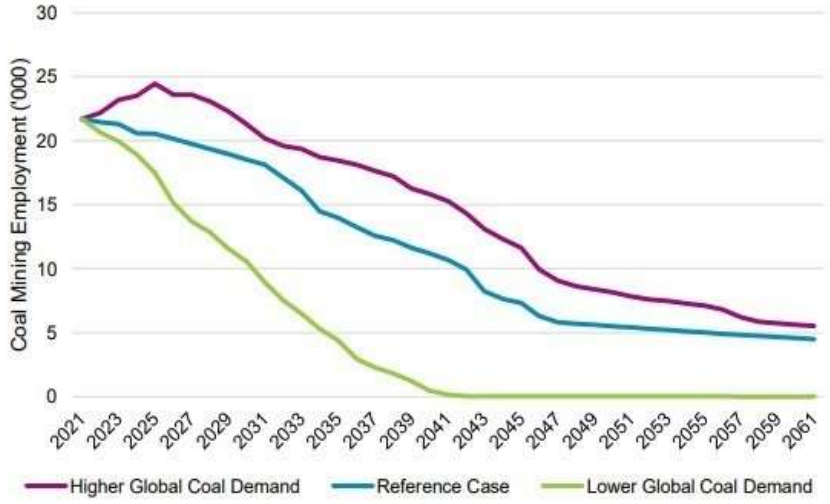
[27] Notice of State Significant Development Determination – Mangoola Coal Continued Operations Project – SSD 8642

[28] NSW Treasury (2021) TTRP21-07 The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report

[29] https://publications.industry.gov.au/publications/resourcesandenergyquarterlymarch2021/documents/Resources-and-Energy-Quarterly-March-2021-Met-Coal.pdf, Accessed 10/03/2022

[30] https://resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0004/1236973/Strategic-Statement-on-Coal-Exploration-and-Mining-in-NSW.pdf

Figure 18: Forecasted Coal Mining Employment



Source: NSW Treasury and VURM

In the establishment of a base case to compare the Project against, one of the key assumptions in the Guidelines is that alternative project and land uses should continue on in a business-as-usual fashion, unless there is a significant and material impact that a new project would have.

In this respect, we also assume that alternative mines would be operating in a business-as-usual manner, irrespective of whether a project is approved. That is, they would be also be attempting to maximise their production though the minimisation of vacancies, which would result in minimal lateral transitions between operations. Taking this assumption in conjunction with the estimates shown in Figure 18, it becomes increasingly difficult to argue that, should the Project not proceed, that the existing workforce would find alternative employment in the coal mining industry in NSW. While these employees may find employment in other jurisdictions, this would result in a net loss of benefits to NSW relative to the Project Case (and assumed base case).

Worker locations

Relatedly, it is also commonly argued that many workers would not be sourced locally, and that workers would alternatively be resourced through Fly-In-Fly-Out programs. As such, many of the employment benefits would accrue to workers that may not be from the state. However, since this is an extension of a currently operating mine, it is expected that many of the workers currently employed will remain working at Dendrobium. To the extent that increased workforce numbers associated with this project would dislodge workers from alternative mines, the subsequent filling of that vacancy would eventually result in workers being sourced either from other sectors or the unemployment queue. According to residential information provided by IMC, nearly all the workforce resides within NSW, therefore it is reasonable to expect that the vast majority of wage benefits that accrue to employees in the project case would be attributable to NSW.

E.2.2 The skills argument

The second major criticism usually put against worker benefit estimations is the fact that miners will possess specialised and unique skillsets, which would mean that, should approvals for a project not be granted, workers would simply end up employed elsewhere in the mining industry. Alternatively, that a project will generally source most of its employees from within the mining sector. Therefore, the reservation wage that should be utilised in the estimation of worker benefits is the average mining wage. However, as noted in the previous subsection, it is unlikely that any workers at Dendrobium that are to lose a prospective employment opportunity by this project not proceeding can assume they would gain employment in the NSW mining industry. Accordingly, the assumption that the use of the average mining wage as a reservation wage cannot be justified unless there is evidence of additional demand for mining employment in NSW that would enable the displaced workers to be employed in the mining sector. In the following section we aim to show that using the average mining wage as a reservation wage is not appropriate, based on an examination of inter-industry movements and the average age and education level of occupations that are found in the mining industry, and of comparable industries.

4.3.1.1 Inter-industry movement

One of the major arguments levied on the estimation of worker benefits are that jobs in the mining sector require a very specialised and niche set of skills. Such an implication would mean that there would be a significantly lower level of transitions from other industries into the mining sector, whether individuals work in the same occupation (for example, technicians) or not.

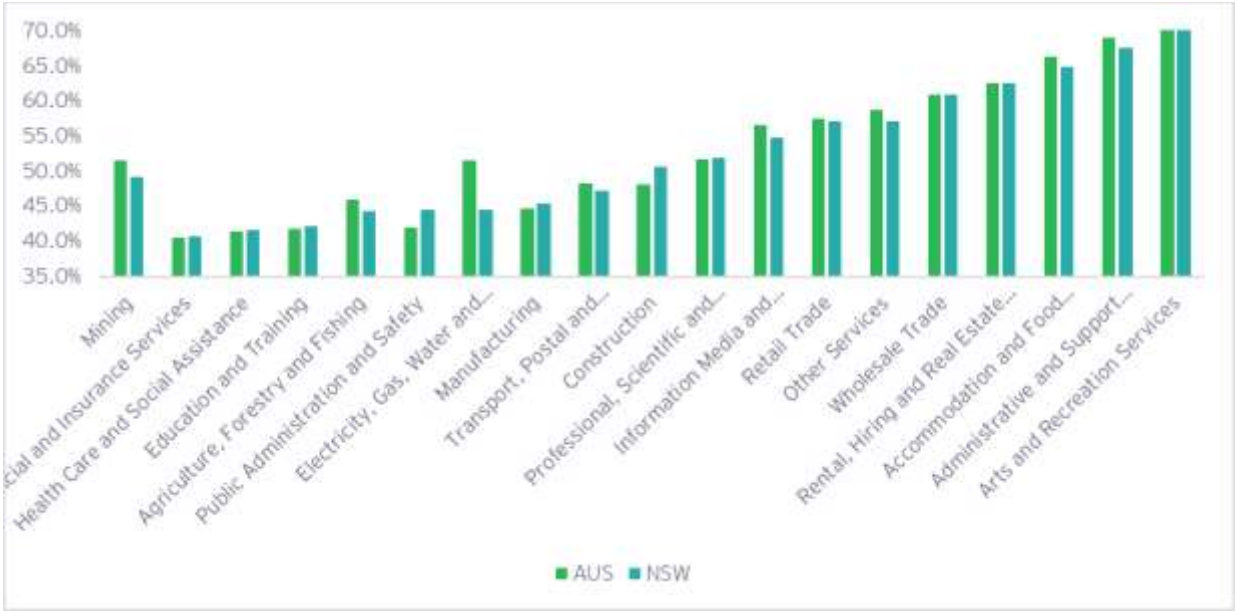
Figure 19 outlines the proportion of workers that reported changing industries between 2011 and 2016 from Census data. Longitudinal census analysis can represent a reasonable proxy on estimating the level of difficulty, or levels of qualifications required, to enter certain industries, as these can be compared on a like-for-like basis across a range of sectors in the Australian economy. For example, the industries which showed the lowest proportions of lateral transfers (i.e. staying in the same occupation but switching sectors) were the financial services, health care, and education and training. These industries generally require significant qualifications and educational levels to enter, which explains the lower level of lateral transfers into these industries.

Alternatively, the industries which saw the highest lateral transfers were the accommodation and food services, administration and support services and arts and recreation services. These industries are characterised as having lower barriers to entry for jobs (in terms of educational or required qualifications), as well as generally providing short term employment.

From 2011 to 2016 (at the time of the census), roughly half of the employees in the mining sector had transferred from alternative industries, placing it roughly between the construction and professional, scientific and technical services sectors in terms of ease of entry. In this respect, there doesn't appear to be any significant differences in the level of accessibility for employees of this industry relative to the rest of Australia. Figure 20 demonstrates that the construction, manufacturing and professional services sectors are the main sectors supplying skilled workers to mining between 2011 and 2016.

Moreover, this implies that there doesn't appear to be any significant differences in the level of qualification, or education needed to secure entry into the mining, with that of the general employment landscape in Australia, which we show in more detail below.

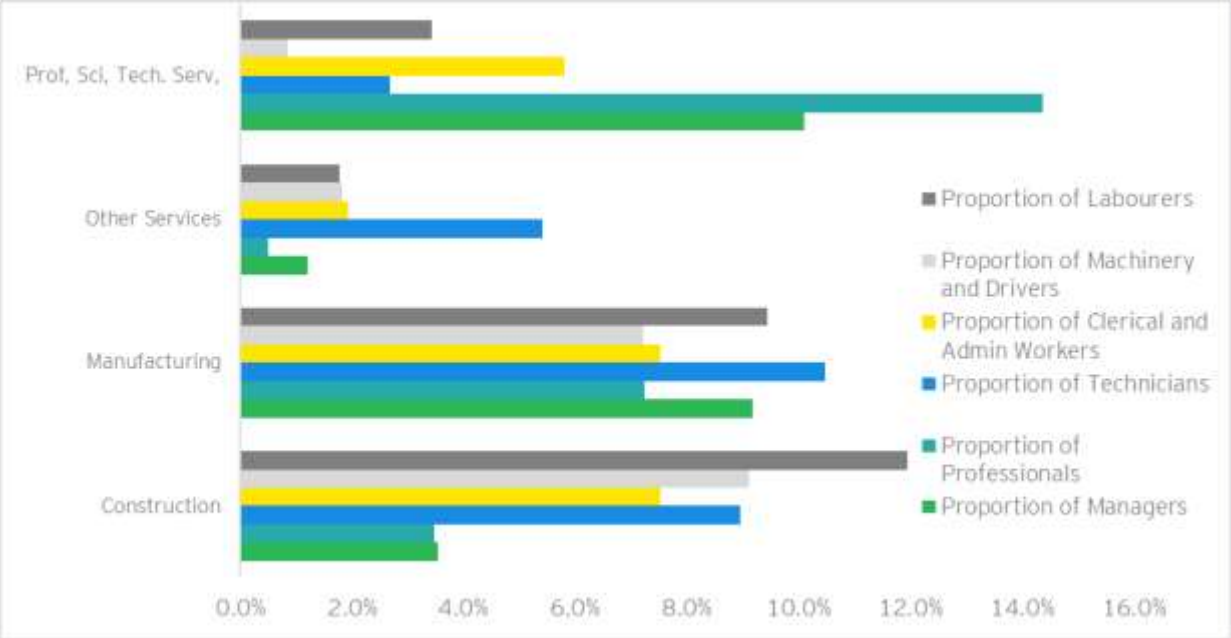
Figure 19: Proportion of workers that transferred laterally into select industries from 2011 - 2016[31]



Source: Australian Bureau of Statistics (2016)

[31] From 2011 and 2016 the ABS changed their method of collecting industry of employment data. The changes were aimed at reducing the amount of responses which provided an industry but failed to provide sufficient information to code the information at the Australia New Zealand Industry Classification (ANZIC) 2-Digit level or higher. As such, we've limited the longitudinal analysis to only consider ANZIC 1-Digit industry codes, as we believe this change would not have a material effect on these results

Figure 20: Longitudinal movements into the mining sector from 2011 - 2016 at the occupational level



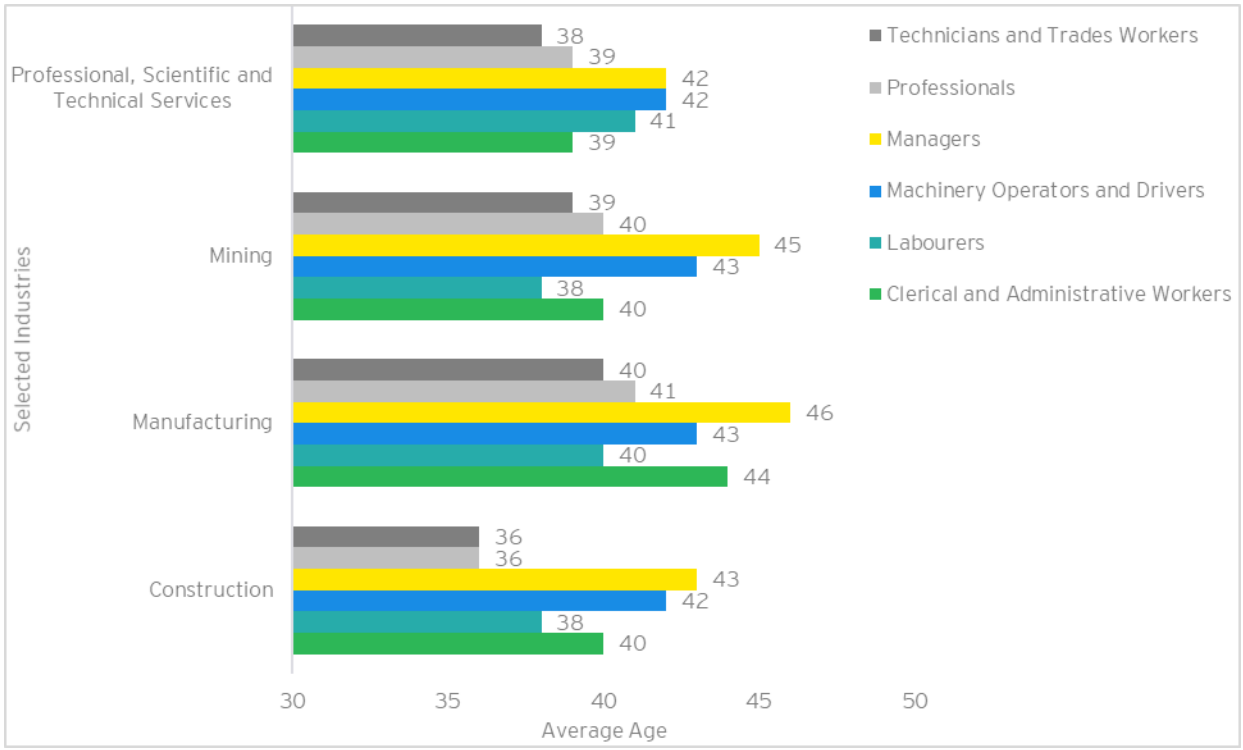
Source: Australian Bureau of Statistics (2016)

4.3.1.2 Average age of the workforce

Measuring the unique skillsets of a workforce also presents challenges, however some reasonable proxies can be utilised to examine whether occupations in the mining sector are different relative to these comparable industries. These can be, for example, examining demographics such as the average age of occupations as a proxy for experience, as well as the total years of reported schooling, to measure education and skill levels.

Figure 21 details the average age of workers by occupation across the mining sector in comparison to the sectors that supplied the most workers to mining between 2011 and 2016. Broadly speaking it appears that there are no significant differences in the age of workers at the occupational level between mining and the three comparable industries. For example, the occupation which sees the largest representation in the mining workforce, machinery operators and drivers, has an average age of its workforce at around 43 years old, which is consistent with machinery operators and drivers in other sectors. This shows that there may be no significant differences in the level of experience between those employed in the mining sector, and those that are employed in comparable industries.

Figure 21: Average age of employees at the occupation level



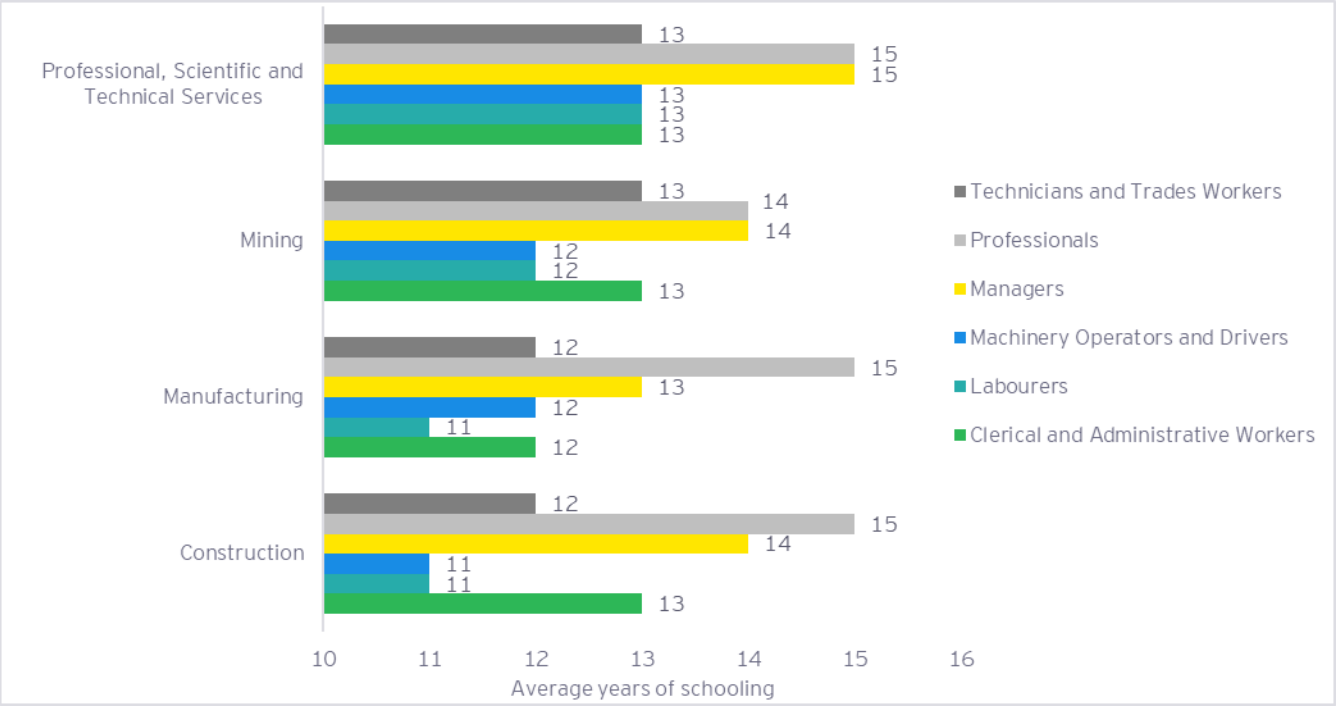
Source: Australian Bureau of Statistics (2016)

4.3.1.3 Skills and qualifications

A suitable proxy for examining the skill and qualification levels of employees in occupations is to look at the amount of time each employee has spent in schooling. Figure 22 details the average number of years of schooling that employees have by each occupation and industry.

In mining, professionals and managers have the highest levels of schooling, at 14 years on average. This in contrast to the Professional Scientific and Technical Services industry, where, on average, managers and professionals undertake and extra year of schooling. Overall, education levels in each occupation is similar across mining and other sectors. This implies that there are no significant differences in the amount of schooling that employees undertake in the mining sector relative to some of the comparable industries.

Figure 22: Estimated^ average number of years of schooling



Source: Australian Bureau of Statistics (2016) ^Based on reported highest levels of education achieved.

E.2.3 Disutility argument

General criticisms against worker benefits tend to argue that the high reservation wage is due to the disutility of working at the mine face, and therefore any wage premium should be adjusted due to the challenges of working in the mining sector. The application of any premium to account for these externalities will be specific to the mine site and type of commodity being mined.

Any metrics around the disutility of working in mining are very difficult to ascertain in both an absolute (mining specific) or relative (compared with other industries) way. As noted in the Report, regarding the mining specific measures of disutility, one source of information considered in this analysis was any documented 'hardship' allowances recognized in mining awards. However, these allowances appear to be relatively minor. For example, the Black Coal Mining Industry Award 2010 does provide for the payment of an Underground allowance (Electrical/ Mechanical) of 0.23 per cent per day or shift (above the standard rate/ reimbursement) to an adult employee who works underground on any shift. In addition, there is a Confined space allowance of 0.08 per cent and a Dirty work allowance of 0.23 per cent, that may apply to underground workers. These are not significant uplift rates relative to allowances for other functions in coal mining (for example, the First Aid Officer Allowance is 0.76 per cent per day or shift above the standard rate).

On the other hand, one possible way to measure the relative disutility of working in mining, would be through published work health and safety statistics, which examine various fatality and injury statistics, nation-wide, for all industries.

The mining sector has focused on providing a safe working environment for all its workers.

Table 25 outlines the incidence rates by sector per million hours worked from 2000 to 2019. During the period of analysis, the Australian mining sector has reduced their average number of claims per million hours worked by 57 per cent, which represented the largest decline in incidence rates, from 2000 to 2019, of any sector, except for financial services.

Comparable industries, such as agriculture, forestry and fishing, construction and manufacturing reduced their rates (defined as claims per million hours worked) from between 35 and 42 per cent over the same period.

Based on a 5-year moving average, on a claims per million hours worked basis, the mining industry also ranks well below these comparable industries and delivered incidence rates below the national average.

Table 25: Work health and safety statistics for Australia

Industry	Average claims per million hours worked (2013 – 2019)	Change from 2000 to 2019	Ranking
Agriculture, forestry, and fishing	9.2	-35%	19
Manufacturing	8.5	-39%	18
Transport, postal and warehousing	8.4	-44%	17
Construction	8.1	-33%	16
Retail trade	5.1	-42%	9
Mining	4.6	-57%	7
Information media and telecommunications	1.5	-51%	3
Financial and insurance services	0.9	-58%	1

Source: Safe work Australia (2020)[32]

Given the relative safety of the mining industry, the minor allowances for working in a coal mine and the measurement difficulties associated with measuring these disutility's generally, we have assumed the disutility for workers under the Project cases is zero. This implies, effectively, that those workers employed by the Project experience no additional disutility from working in the mine compared with any alternative employment they would have secured in the absence of the Project.

E.2.4 Concluding remarks

The evidence presented here supports the argument for the inclusion of worker benefits in the CBA. For example, by utilising census data, we have shown that, not only does the industry not appear to be any more difficult to transfer into related industries such as construction manufacturing, but that a significant proportion of those working in the mining sector, as of 2016, had previously been drawn from said industries. Moreover, the level of educational attainment and estimated level of experience (proxied by age) support the argument that the characteristics of workers in the mining industry are not significantly different to those in comparable industries.

Secondly, on the concept of disutility, evidence suggests that there are minor additional negative externalities incurred by workers,[33] especially given that a sizeable portion of the workforce would not be working at the mine face. Relative to comparable industries, the mining sector appears not only have implemented significant safety measures over the last two decades, which has resulted in a consistently lower claims rate. Lastly, given the Projects proximity to the city of Wollongong, the mine can be considered hardly remote, with the majority of the current Dendrobium workforce residing in the local region, it is therefore unlikely that there would be any significant disutility arising due to the location of the mine.

In this respect, we believe that, not only would the majority of worker benefits accrue to NSW, but that employees in this Project would be paid a significant wage premium driven primarily by the highly capital-intensive nature of the mining sector which results in a higher average labour productivity for workers in the sector. The high capital requirements of the sector imply high operating leverage (i.e. a higher proportion of fixed to total costs). Such businesses have a strong incentive to maximise the utilisation of those assets, failing which, their margins fall disproportionately.

This means that such firms, included mining firms, would be willing to pay a large premium to ensure that vacancies are minimized, turnover is kept low, employees are trained sufficiently, and that the safety of employees are considered as top priority.

[32] Safe Work Australia National Data Set for Compensation-based Statistics (NDS)

[33] That is, would be subject to any negative externalities over and above those incurred from alternative employment

E.3 Benefits to suppliers

One of the key benefits of private sector investment is through the establishment of supply chain networks that act to disperse economic benefits to a myriad of businesses.

The Guidelines are clear in their allowance for the use of supplier benefits as part of the CBA. Consistent with the Guidelines, we have made an estimate of the producer surplus associated with the additional demand for inputs into production.

E.3.1 Supplier demographics

Based on selected interviews completed by Elliott Whiteing[34], businesses attributed anywhere from 5 per cent to 100 per cent of their business to the operation of the Dendrobium Mine. As a result, some suppliers are operating in an environment which is significantly dependent on both the mining industry, and on the operations at the Dendrobium Mine.

E.3.2 Methodology for the estimation of supplier benefits

The economic benefit to suppliers is estimated as a producer surplus generated from goods and services provided from NSW-based firms to the Project. As summarised in the Main Report, based on the input cost data provided by IMC, the proposed development is estimated to use $658.8 million in intermediate inputs supplied from NSW over its life-cycle in NPV terms. Currently, 75 per cent of the Dendrobium Mine inputs used are supplied from NSW-based businesses and it is assumed this would also be the case with the Project.

The producer surplus is not readily observable through this spend that is allocated to local suppliers by the Dendrobium Mine. However, aligning with the assumptions in setting up the CBA, this spend represents a net increase in demand for the production of goods and services in the NSW economy.

To proxy for producer surplus, we have used the gross operating surplus allocated to suppliers from the spend by Dendrobium in the region. Gross operating surplus is a measure of the profits earned by firms in the economy. According to the ABS, gross operating surplus is "the surplus accruing from processes of production before deducting any explicit or implicit interest charges, land rent or other property incomes payable on the financial assets, land or other tangible non-produced assets required to carry on the production".[35] In using an average gross operating surplus ratio for suppliers of around 20 per cent, derived from an in-house regional input-output model, the total benefits to suppliers are estimated at $132.9 million in NPV terms.

E.3.3 Current criticisms and responses

In its reasons for approving the Mangoola Coal Continued Operations project, the IPC noted: "[The IPC] is of the view that local suppliers will earn similar margins relative to what they receive under the base case, such that there are no additional benefits to suppliers in NSW".[36] However, the base case that would result in the Project's operations not being extended is a direct and significant reduction in demand for goods and services in the region, as outlined in the supplier demographics section above, which will not necessarily be replaced by other projects or alternative sectors. The supply curve for goods and services in this instance can be considered as "horizontal" meaning that there are strong levels of competition in the region for goods and services to be supplied to mines. An increase in demand from a mine is unlikely to result in a change in prices from suppliers, especially when we consider the long run nature of the operations of a mine.

In the long run, we can expect relatively low barriers to entry for firms to fill changes in demand, and equally, there is likely to be some form of spare capacity in the economy (as is evidenced with the low levels of inflation in the region and discussed below). Mining companies are likely to have access to a variety of firms to supply products, who are competing and reducing their overall margins.

However, this does mean that the change in demand that is directly a result of the Project case must result, at a minimum, in a linear increase in overall gross operating surplus (which again, is the profits that firms receive from supplying their goods into the mining sector). This can be considered as a relatively conservative estimate of the change in producer surplus, as we could see a more inelastic supply curve for some goods and services, and this would result in an increase in the gross operating surplus relative to the base case.

Put another way, the Project is unlikely to increase the margin that suppliers receive, however the extended life of the Projects and the associated required capital and operational expenditure of the mine is expected to increase the demand for

[34] Elliotwhiteing, Dendrobium Mine – Plan for the future: Coal for Steelmaking Project - Social Impact Assessment (April 2019)

[35] https://www.abs.gov.au/AUSSTATS/ABS@.NSF/2f762f95845417aeca25706c00834efa/ac6c11a0f11910fbca2569a40006164b!OpenDocument

[36] Mangoola Coal Continued Operations Project (SSD 8642) – Statement of Reasons for Decision

services and supplies relative to the base case of the Project not proceeding. The effect of this is that the same margin is applied to increased turnover which can be considered as a supplier benefit associated with the Project that should be considered as part of the benefits indirectly accruing to NSW.

Lastly, in contrast to the IPCs view, in their review of the Tahmoor South Coal Mine[37] BIS Oxford Economics (2020) writes that such an approach appears to be broadly consistent with the specifications in the Guidelines. Whilst the use of gross operating surplus is not quite equivalent to a strict definition of Producer Surplus, the approach is said to be reasonable, given data limitations.

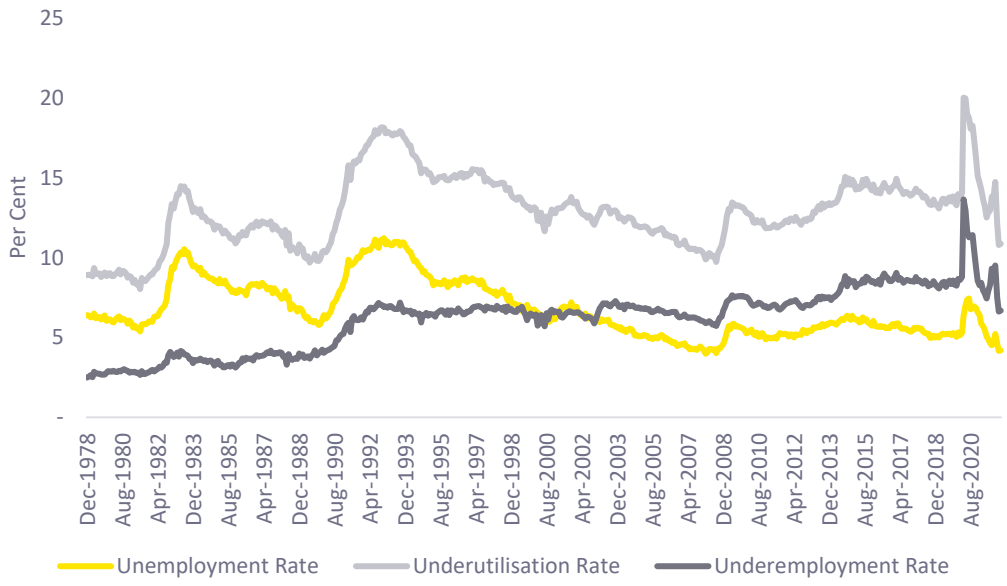
E.3.4 The relationship between spare capacity, inflation and, unemployment

An important consideration that the Reserve Bank of Australia (RBA) considers in their monetary policy actions is the level of spare capacity in the economy. Spare capacity relates to the balance of demand for goods and services, relative to the economy's potential to produce them.

At an aggregate level, inflationary pressure is likely to be greater in an economy operating at a higher level of capacity utilisation than if it is operating at a lower level[38]. For example, firms that have a greater degree of pricing power should be able to expand their mark-ups in an economy experiencing strong growth in demand relative to available supply.

A second indicator of spare capacity in the economy is the unemployment rate and underemployment rate. A high unemployment rate implies that there is a large pool of workers willing to work, but are not engaged in production, which suggests that the economy is operating below its potential. Whilst the unemployment rate has been relatively consistent, if trending slightly downwards, as shown in Figure 24 and Figure 24, over the past four decades the underemployment rate has trended upwards, and has been higher than the unemployment rate since the early 2000s.

Figure 23: Unemployment, Underemployment and Underutilisations rates



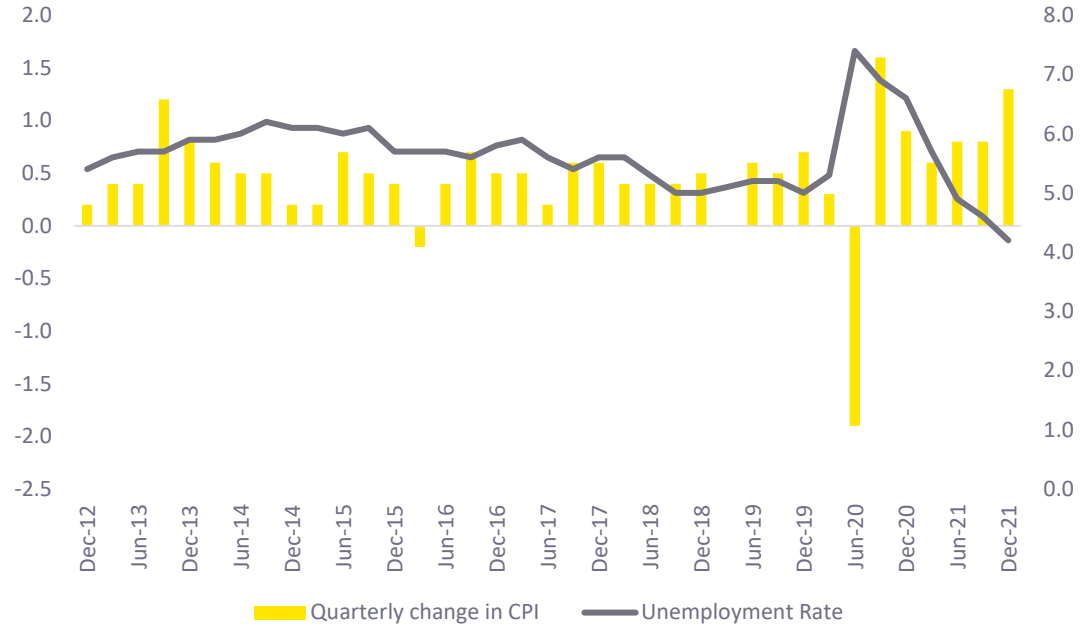
Source: ABS Cat. No. 6202.0.

What we've observed more broadly, in Figure 24, is that inflation has been benign and dropped into negative territory in July-2020, due to the large spike in unemployment related to the COVID-19 pandemic. The subsequent recovery, lack of employment immigration and supply shocks as a result of geopolitical tensions have contributed to a tighter labour market and has resulted in upwards pressure in inflation. It is arguable that these recent developments are potentially transient in nature, and will likely subside once the supply side pressures ease up, and the national labour market is able to import labour. It could be argued that the economy, over a longer time horizon, could return to operating with some level of slack in its capacity.

[37] Oxford Economics (2020) Peer Review of Economic Impact Assessment Tahmoor South Coal Project

[38] RBA (2015), Firm-level Capacity Utilisation and the Implications for Investment, Labour and Prices

Figure 24: Quarterly Change in CPI (LHS) and the Unemployment Rate (RHS)



Source: ABS Cat. No. 6462.0, ABS Cat. No. 6202.0

E.4 Concluding remarks

The Dendrobium Mine is located in a region that is characterised by a high dependence on the manufacturing industry, and in particular within the Iron and Steelmaking sector, being home to Australia's largest steelworks, BlueScope Steel. As a result, the mine supports a major position within the Iron and Steelmaking supply chain, and as part of IMC's operations, provides around 60% of BlueScope Steel's metallurgical coal requirements.[39] The continuation of the Project would therefore enable for the continuation of these such existing relationships, such as those alluded to in the supplier demographics above, as well as contribute indirectly to downstream job security, such as those in the BlueScope steelmaking complex.

In summary, the coal mining industry is important to both NSW, and the surrounding region, and represents a significant source of direct and indirect jobs in the region. The coal industry also forms the State's largest export commodity, which contrasts with the criticisms levied against measuring worker, and indeed supplier benefits associated with the Project. Further, over the coming decades, as shown in Figure 18 above, coal mining output is expected to decline. In their Strategic Statement on Coal Exploration and Mining in NSW[40], the NSW government sets out how the NSW Government will take a balanced approach to scaling back the State's dependence on coal exports, whilst continuing to meet a global demand that is forecast to plateau.

The ways in which the NSW Government could work to support coal-reliant communities in the future is through both encouraging diversification away from coal mining, whilst considering reasonable operating extensions to currently operating coal mines, to make such a transition as smooth as possible for the community. The Project is consistent with this approach.

Overall, this evidence indicates a high dependence on coal mining in the region, both from a supplier and worker standpoint. The negative outlook for coal demand, coupled with the expectation that the mine is planned to operate for an additional 12 years and will provide around 333 employees (on average over the life of the Project), and stable demand for goods and services in the region provide strong evidence to account for the benefits that accrue to both workers and suppliers in the CBA.

[39] Elliotwhiteing, Dendrobium Mine – Plan for the future: Coal for Steelmaking Project - Social Impact Assessment (April 2019)

[40] NSW Government (2021) Strategic Statement On Coal Exploration and Mining in NSW

E.5 Sensitivity Analysis

In addition to the arguments put forward in this Appendix, we extend the sensitivity analysis presented in the Report to include a full range in both worker and supplier benefits. These results are presented in Table 26, below.

Table 26: Worker and supplier benefits scenario analysis ($million**)

Planned Project	Worker Benefits			Supplier Benefits		
Scenario	25% Worker Benefits	50% Worker Benefits	75% Worker Benefits	25% Supplier Benefits	50% Supplier Benefits	75% Supplier Benefits
Direct Benefits	$293.3	$293.3	$293.3	$293.3	$293.3	$293.3
1. Net producer surplus	$35.1	$35.1	$35.1	$35.1	$35.1	$35.1
2. Royalties, payroll tax and Council rates	$176.6	$176.6	$176.6	$176.6	$176.6	$176.6
3. Company income tax apportioned	$81.6	$81.6	$81.6	$81.6	$81.6	$81.6
Indirect Benefits	$182.6	$240.4	$298.2	$256.2	$289.5	$322.7
1. Net economic benefit to existing landholders	$0	$0	$0	$0	$0	$0
2. Net economic benefit to Local workers	$57.8	$115.6	$173.4	$231.1	$231.1	$231.1
3. Net economic benefit to Local suppliers	$132.9	$132.9	$132.9	$33.2	$66.5	$99.7
Indirect (Environmental costs)	$8.1	$8.1	$8.1	$8.1	$8.1	$8.1
Potential Net Benefits	$475.9	$533.6	$591.4	$549.5	$582.7	$616.0

*Source: EY estimates based on information from various sources. * Estimated as the benefits of the Planned Project case less the Baseline case. ** NPV in 2021 dollars based on a 7 percent real discount rate.*

Appendix F Greenhouse Gas Externality Sensitivities

This appendix presents some further analysis surrounding the estimation of greenhouse gas externalities for the Project. The sensitivity analysis both increases the proportion of costs which are attributed to NSW and the Project, in addition to increasing the cost per tonne of carbon emissions. In this appendix, the total cost of greenhouse gas externalities are apportioned based on the ratio between the population of NSW and Australia, resulting in around 32 per cent of the total indirect costs attributed to the externality arising by greenhouse gas emissions being borne by NSW.

In addition to altering the method of apportionment, three additional price trajectories were assessed in the scenario analysis. The details on the price trajectory per tonne of carbon emissions are detailed below. The price assumptions derived from recent estimates on the social cost of carbon by the United States Government, based on the social cost of one tonne of carbon at 5 per cent, 3 per cent and 2.5 per cent discount rates[41]:

- **Low Price Trajectory.** The Low Price Trajectory adopts a starting price of $19.1/t CO_{2-e} was adopted in 2021, which grows at an average rate of 2.8 per cent pa to $33.2/t CO_{2-e} by 2041.
- **Mid Price Trajectory.** The Mid Price Trajectory scenario adopts a starting price of $69.7/t CO_{2-e} was adopted in 2022, which grows at an average rate of 1.7 per cent pa to $98/t CO_{2-e} by 2041.
- **High Price Trajectory.** The High Price Trajectory adopts a starting price of $103.9/t CO_{2-e} was adopted in 2021, which grows at an average rate of 1.4% to $137.7/t CO_{2-e} by 2041.

Table 27 details the total Net Benefits of the Project under the adjusted apportionment method and additional price sensitivities.

Table 27: Net Benefits of the Project with adjusted method of apportionment and various price trajectories^($ million NPV @ 7 per cent real interest rate)

Benefit Stream	Low Price Trajectory	Mid Price Trajectory	High Price Trajectory
Direct Benefits^	$293.3	$293.3	$293.3
Indirect Benefits^	$364.1	$364.1	$364.1
Total Greenhouse Gas Costs (Costs to Australia)^	$194.6	$649.9	$945.3
Apportionment to NSW (%)	32.7%	32.7%	32.7%
Indirect (Environmental Costs)			
Air Quality Effects^	$8.0	$8.0	$8.0
Greenhouse Gas Emissions^	$63.6	$212.4	$308.9
Net Benefit^	**$585.7**	**$437.0**	**$340.5**

Source: IMC

[41] United States Government, 2021, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide

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Our report may be relied upon by South32 for the purpose of the economic assessment of the Dendrobium mine only pursuant to the terms of our proposal dated 19 March 2021. We disclaim all responsibility to any other party for any loss or liability that the other party may suffer or incur arising from or relating to or in any way connected with the contents of our report, the provision of our report to the other party or the reliance upon our report by the other party.

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