Economic impact assessment of amended Tahmoor South Coal Project

Tahmoor Coal Pty Ltd

3 August 2020

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Ernst & Young was engaged on the instructions of Tahmoor Coal Pty Ltd ("Client") to perform an economic impact assessment in relation to the proposed Tahmoor South Coal Project ("Project" or "Proposed development"), in accordance with the engagement agreement dated 26 September 2019.

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 28 July 2020 ("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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Ernst & Young
121 Marcus Clarke Street
Canberra ACT 2600 Australia
GPO Box 281 Canberra ACT 2601

Tel: +61 2 6267 3888
Fax: +61 2 6246 1500
ey.com/au

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28 July 2020
Charlie Wheatley
Project Director Tahmoor South
Tahmoor Coal Pty Ltd
2975 Remembrance Drive
Tahmoor NSW 2573

Economic impact assessment of the Tahmoor South Coal Project

Dear Charlie

In accordance with our Engagement Agreement dated 26 September 2019 ("Agreement"), Ernst & Young ("we" or "EY") has been engaged by Tahmoor Coal Pty Ltd ("you", "Tahmoor" or the "Client") to provide economic impact assessment services (the "Services") in relation to a proposed Tahmoor South Coal Project (the "Project" or "Proposed Development").

The enclosed report (the "Report") sets out the outcomes of our work. You should read the Report in its entirety. A reference to the report includes any part of the Report. A draft report was issued on 4 December 2019, though this report accounts for certain changes to the project based on what we were asked to update based on the project amendment.

Purpose of our Report and restrictions on its use

Please refer to a copy of the Agreement for the restrictions relating to the use of our Report. We understand that the deliverable by EY will be used for the purpose of outlining the net economic impact of the Project to NSW (the "Purpose").

This Report was prepared on the specific instructions of Tahmoor solely for the Purpose and should not be used or relied upon for any other purpose.

This Report and its contents may not be quoted, referred to or shown to any other parties except as provided in the Agreement. We accept no responsibility or liability to any person other than to you or to such party to whom we have agreed in writing to accept a duty of care in respect of this Report, and accordingly if such other persons choose to rely upon any of the contents of this Report they do so at their own risk.

Nature and scope of our work

The scope of our work, including the basis and limitations, are detailed in our Agreement and in this Report.

Our work commenced on 26 September 2019, a draft report was issued on 4 December 2019 and the current version of the Report was completed on 28 July 2020. Therefore, our Report does not take account of events or circumstances arising after 28 July 2020 and we have no responsibility to update the Report for such events or circumstances.

In preparing this Report we have considered and relied upon information from a range of sources believed after due enquiry to be reliable and accurate. We have not been informed that any information supplied to us, or obtained from public sources, was false or that any material information has been withheld from us.

We do not imply and it should not be construed that we have verified any of the information provided to us, or that our enquiries could have identified any matter that a more extensive examination might disclose. However, as part of our scope of work we have evaluated the information provided to us by Tahmoor as well as other parties through enquiry and analysis.

The work performed as part of our scope considers information provided to us and a combination of input assumptions relating to future conditions, which may not necessarily represent actual or most likely future conditions. Additionally, modelling work performed as part of our scope inherently requires assumptions about future behaviours and market interactions, which may result in forecasts that deviate from future conditions. There will usually be differences between estimated and actual results,

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because events and circumstances frequently do not occur as expected, and those differences may be material. We take no responsibility that the Projected outcomes will be achieved.

We highlight that our analysis and Report do not constitute investment advice or a recommendation to you on a future course of action. We provide no assurance that the scenarios we have modelled will be accepted by any relevant authority or third party.

Our conclusions are based, in part, on the assumptions stated and on information provided by Tahmoor and other information sources used during the course of the engagement. The modelled outcomes are contingent on the collection of assumptions as agreed with you and no consideration of other market events, announcements or other changing circumstances are reflected in this Report. Neither Ernst & Young nor any member or employee thereof undertakes responsibility in any way whatsoever to any person in respect of errors in this Report arising from incorrect information provided by you or other information sources used.

This letter should be read in conjunction with our Report, which is attached.

Thank you for the opportunity to work on this Project for you. Should you wish to discuss any aspect of this Report, please do not hesitate to contact George Michalas on (02) 6279 4525.

Yours sincerely

Steve Brown
Partner

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Executive summary

Tahmoor Coal Pty Ltd (Tahmoor Coal) is seeking approval under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for an extension of underground coal mining and associated activities at the Tahmoor Mine (the Project).

Tahmoor Coal is a wholly owned entity within the SIMEC Mining divisions of the GFG Alliance group, an international company.

The Project will continue longwall mining of the Bulli seam into the Tahmoor Central Domain. The Project will result in an additional mining of 32.7 million tonnes (Mt) of run-of-mine (ROM) coal, at an average extraction rate of up to 3.6 million tonnes of ROM coal per annum. Pre-mining activities are proposed to commence in financial year[1] 2020, with longwall mining to start in 2023 and will continue to 2032.

In accordance with the requirements of the EP&A Act and EPBC Act, an Environmental Impact Statement (EIS) was prepared to assess the potential environmental, economic and social impacts of the Project. The EIS for the Project was placed on public exhibition by the Department of Planning, Industry and Environment (DPIE) (formerly the Department of Planning and Environment (DPE)) from 23 January 2019 to 5 March 2019.

Key issues raised in submissions included concerns relating to the proposed extent of longwall mining, the magnitude of subsidence impacts and the extent of vegetation clearing required for the expansion of the reject emplacement area (REA).

On 20 February 2020, a Submissions Report was lodged with DPIE which responded to all submissions made during exhibition of the EIS. At the same time a Project Amendment Report was lodged with DPIE to document amendments made to the Project in response to the submissions and to reduce potential environmental impacts.

The amendments documented in the project amendment report included, among other things, changes to the mine plan and the REA. The changes to the mine plan included the removal of a longwall in the northern part of the mine (LW109), reconfiguration of the longwall layouts to comprise two series of shorter longwall panels, the reduction of the width of the longwalls, and a reduction in the height of extraction within the longwalls. The changes to the REA included a reduction in the proposed extension area by increasing the height of the REA.

Tahmoor Coal has now made the decision to make further changes to the Project to further reduce potential environmental impacts, particularly potential subsidence and biodiversity impacts.

The key amendments to the Project relevant to the economic impact assessment are:

- The removal of two longwalls in the southern part of the mine (LW107B and LW108B);
- A reduction in the total amount of Run-of-Mine (ROM) coal to be extracted over the Project life, from approximately 43 million tonnes (Mt) to 32.7 Mt of ROM coal;
- A change to the layout of the ventilation shafts and associated transmission line easements; and
- A revised extended REA; including:
    - the containment of the REA within the bounds of the currently approved disturbance footprint; and
    - an increase in the final height of the REA (from RL 310 m to RL 320 m).

The analysis

This report provides an Economic Impact Assessment (EIA) for the amended Project. The assessment considers and outlines the differences in impacts compared to the original project as presented in the Project Amendment Report. In this way, it serves as an update to the EIA prepared for the EIS (Cadence Economics,[2] 2019) (Appendix R of the Tahmoor South Project EIS) and the updated Economic Impact Assessment undertaken and completed by EY in October 2019.

It 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. The analysis is also consistent with the Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam

[1] All references to years are financial year.

[2] Since authoring this report Cadence Economics was acquired by Ernst & Young.

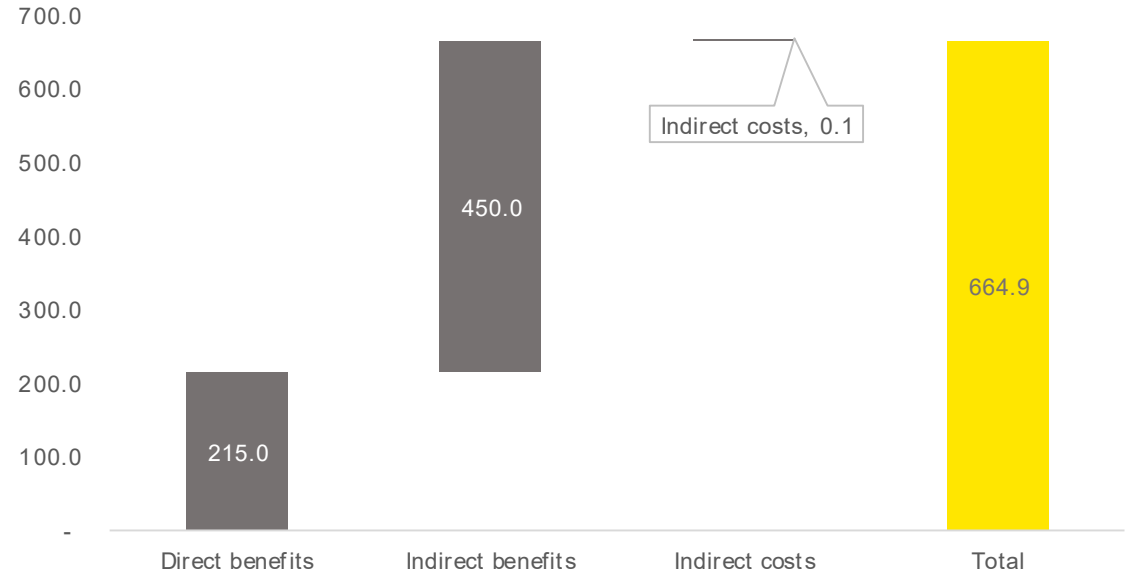
Gas Proposals (the Technical Notes) published in April 2018. References herein to the Project are referring to the amended Project, unless otherwise stated.

Consistent with the 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 Project to NSW. The LEA is based on analysis for the Wollondilly local region (as defined by the Australian Bureau of Statistics SA3 (12303) region).

Results of the CBA

Based on the CBA methodology outlined in the Guidelines, and information provided by Tahmoor Coal, the Project is estimated to provide a net benefit to NSW. This net benefit is estimated to be $664.9 million in net present value (NPV)[3] terms, as shown in Figure 1.This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively and incremental cost of the Project is $0.1 million.

Figure 1: CBA summary of potential net benefits under central case assumptions, ($ million NPV*)



*Source: EY analysis based on the EIS and information provided by Tahmoor Coal. * Net Present Value in real 2020 Australian dollars calculated over the period 2020 to 2032 using a 7 per cent real discount rate*

The Project generates ***direct benefits*** of:

- An overall net producer surplus of $119.4 million in NPV terms, of which ***zero*** is attributed to NSW as Tahmoor Coal is assumed to be 100 per cent foreign owned;
- Total corporate taxes of $178.7 million in NPV terms for Australia, of which $57.2 million is attributed to NSW; and
- $157.8 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $131.5 million with council rates and payroll taxes contributing $4.7 million and $21.5 million respectively.

The ***indirect benefits*** of the Project are related to the linkages that the Project has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $450.0 million in estimated indirect benefits:

- Worker benefits are $216.9 million in NPV terms; and
- Supplier benefits are $233.2 in NPV terms based on NSW-based operational expenditure over the life of the development of $1,155.5 million in NPV terms.

[3] All NPV figures reported are in real 2020 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated). All net present values are calculated using a 7% real discount rate, consistent with the Guidelines

The incremental indirect costs of the Project are $0.1 million, attributed entirely to greenhouse gas emissions. Other indirect costs, like subsidence, noise air quality and biodiversity impacts are being borne by the proponent and are included in the financial costs of the Project.

Consistent with the Guidelines, systematic sensitivity analysis of the estimated net benefits is undertaken in this report. 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 Project 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 $570.8 million in NPV terms (a 14.2 per cent reduction in net benefit).

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 $526.3 million in NPV terms. The upper bound estimate, based on the most optimistic assumptions, is $811.5 million in NPV terms.

The results are relatively sensitive to the choice of discount rate chosen due to the long timeframe of the Project. The NPV of the estimated net benefits to NSW range from between $555.4 million and $805.4 million under real discount rates of 10 and 4 per cent respectively.

Results of the LEA

The LEA considers the costs and benefits of the Project on residents of the Wollondilly region of NSW. The analysis shows an estimated net benefit of $137.5 million to the Wollondilly region in NPV terms. This is driven largely by:

- Benefits to local workers of $100.3 million in NPV terms based on the assumption that 45 per cent of the mine's direct employees continue to be drawn from Wollondilly;
- Benefits to local suppliers of $32.5 million in NPV terms which is based on the assumption that 12.9 per cent of the inputs to production are from the region; and
- The payment of local council rates totalling $4.7 million in NPV terms.

The report shows that the estimated local effects are ***robust*** under the sensitivity analysis conducted with a lower bound estimate of net benefits to the Wollondilly region of $129.8 million and upper bound estimate of $146.2 million in NPV terms.

Economy-wide modelling

In total, the Project is expected to net provide positive economy-wide impacts to both Wollondilly SA3 region and to NSW. The net economic impacts of the Project are shown in Table 1. In the Wollondilly region, the Project is expected to increase real gross regional product (GRP) by $1,624.5 million in NPV terms. Real gross regional income (GRI), a proxy for regional welfare, is projected to increase by $1,189.0 million in NPV terms. The projected increase in real GRI is significant to the relatively small Wollondilly region. In total, the Project is expected to increase welfare for each person in the region by $19,681.7 in NPV terms.

For NSW, the projected increase in real gross state product (GSP) is $1,844.6 million in NPV terms. Real gross state income (GSI) is projected to increase by $2,347.4 million.

Table 1: Economy-wide impacts of the Project, 2021 – 2032

Variable	Description	Wollondilly	NSW
Real GRP	NPV - $m	1,624.5	1,844.6
Real GRI	NPV - $m	1,189.0	2,347.4
Employment	Average (FTE)[4]	245.4	138.0
Real Wages	Average	4.11	0.02
Real GRI per person	NPV - Dollars	19,681.7	193.9

[4] Employment and real wage figures are averages over the period 2021 to 2032.

Source: EY analysis based on information provided by Tahmoor.

Total employment in the Wollondilly region is projected to increase by 245.4 full time equivalent (FTE) workers on average, and across NSW employment is projected to increase by 138.0 FTE.

As outlined in Chapter 4 below, the Computable General Equilibrium (CGE) modelling takes into account the coal output, the payment of royalties from Wollondilly into the Rest of NSW, and the repatriation of profits overseas. The CGE modelling also reflects that the Project will draw workers from the Rest of NSW into Wollondilly.

1. Introduction

EY was commissioned by Tahmoor Coal Pty Ltd (Tahmoor Coal) to undertake an Economic Impact Assessment (EIA) of the Tahmoor South Project (the Project).

This Economic Impact Assessment (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.[5] In consideration of indirect costs, these have been assessed consistently with the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (the Technical Notes).[6]

The CBA is presented in Chapter 2 and measures the net benefits of the Project to the NSW community. The LEA, which focusses on the benefits accruing to the Wollondilly region is presented in Chapter 3.

In addition to the CBA and LEA, the report also contains an assessment of the economic impacts of the Project on the Wollondilly region of NSW based on computable general equilibrium (CGE) modelling. This modelling is presented in Chapter 4.

The Project

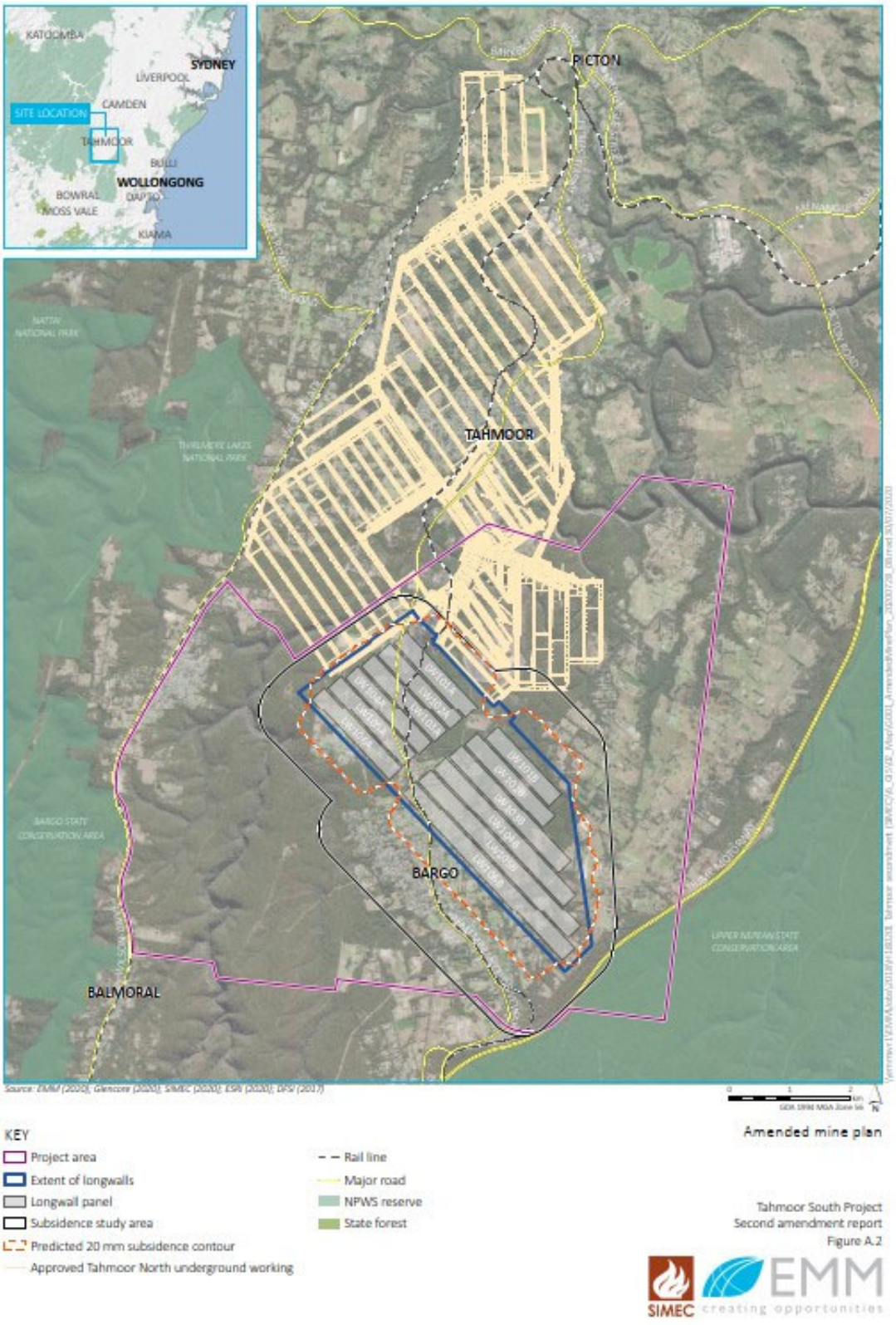
Tahmoor Coal is seeking approval for the Tahmoor South Project, being an extension of underground coal mining at Tahmoor Mine, to the south of Tahmoor Coal's existing mining area (the Project). The Project seeks to extend the life of underground mining at Tahmoor Mine for an additional 10 years until approximately 2032.

A comprehensive environmental impact statement (EIS) of the Project was placed on public exhibition with the Department of Planning, Industry and Environment from 23 January 2019 to 5 March 2019. A submissions report and Project Amendment Report (PAR) was lodged with DPIE in February 2020 in response to submissions and to reduce potential environmental impacts of the Project. Further changes to those proposed in the PAR are proposed to the Project, so as to also further reduce the predicted environmental impacts of the Tahmoor South Project. The key amendments relevant to the EIA include the removal of two longwalls in the southern part of the mine (LW107B and LW108B), reducing the Run-of-Mine (ROM) coal from 43 Mt to 32.7 Mt (noting 48 Mt ROM coal was proposed to be extracted in the EIS), the containment of the reject emplacement area (REA) within the bounds of the currently approved disturbance footprint, and changes to the layout of the ventilation shafts and associated transmission lines. The amended development also incorporates the planning for rehabilitation and mine closure once mining ceases.

[5] New South Wales Government (2015).

[6] New South Wales Government (2018).

Figure 2: Project Area – Tahmoor South Project



Source: Tahmoor Coal

2. Cost-benefit analysis

The Guidelines released by the NSW Government in December 2015 set out the CBA framework to measure the net benefits to the NSW community and outline the distribution of benefits and costs. 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 mine	The net benefits that are generated for parties that economically interact with the proposed mine	Social costs generated by the proposed mine, 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. 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.

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

- The Project EIS as well as other data provided by Tahmoor Coal including key financial parameters of the Proposed development not deemed to be commercial-in-confidence;
- Various social and environmental consultant reports including:
  - *Tahmoor South Proposed development – Greenhouse Gas Assessment of the Amended Development* undertaken by ERM
  - *Social Impact Assessment Tahmoor South Proposed development* undertaken by AECOM
  - *Tahmoor Mine – Tahmoor South Project - Amendment Report for Longwalls 101A to 108A Subsidence Impact Assessment* undertaken by Mine Subsidence Engineering Consultants
  - *Tahmoor South Amended Project Report: Groundwater Assessment* undertaken by Hydro Simulations
  - *Tahmoor South EIS Flood Study* by Hydro Engineering & Consulting
  - *Tahmoor South Project Surface Water Impact Assessment* by Hydro Engineering & Consulting
  - *Agriculture Impact Statement Tahmoor Mine, Tahmoor South Project* undertaken by SLR Consulting
  - *Tahmoor South Proposed development Biodiversity Assessment of the Amended Project Report* undertaken by Niche Environment and Heritage
  - *Tahmoor South Proposed development – Air Quality Impact Assessment of the Amended Project* undertaken by ERM
  - *Tahmoor South Proposed development Noise and Vibration Assessment of the Amended Project* undertaken by EMM Consulting
  - *Traffic Impact Assessment for Tahmoor South Proposed development* undertaken by Transport & Urban Planning

- *Aboriginal Cultural Heritage Assessment Tahmoor South Project – Regulator Document* undertaken by Niche Environmental and Heritage
- *Amended Tahmoor South Project – update to the Historical Heritage Assessment* undertaken by Niche Environmental and Heritage
- *Tahmoor South Proposed development, Visual Impact Assessment* undertaken by Green Bean Design

- *Coal Price and FX market forecasts*, March/April 2020, KPMG
- *Resources and Energy Quarterly June 2020,* Office of Chief Economics, Department of Industry, innovation and Science
- Various data from the Australian Bureau of Statistics (ABS) including most recent Census data

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.

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.

2.1 Project economics

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 also form the basis of the LEA presented later in the report.

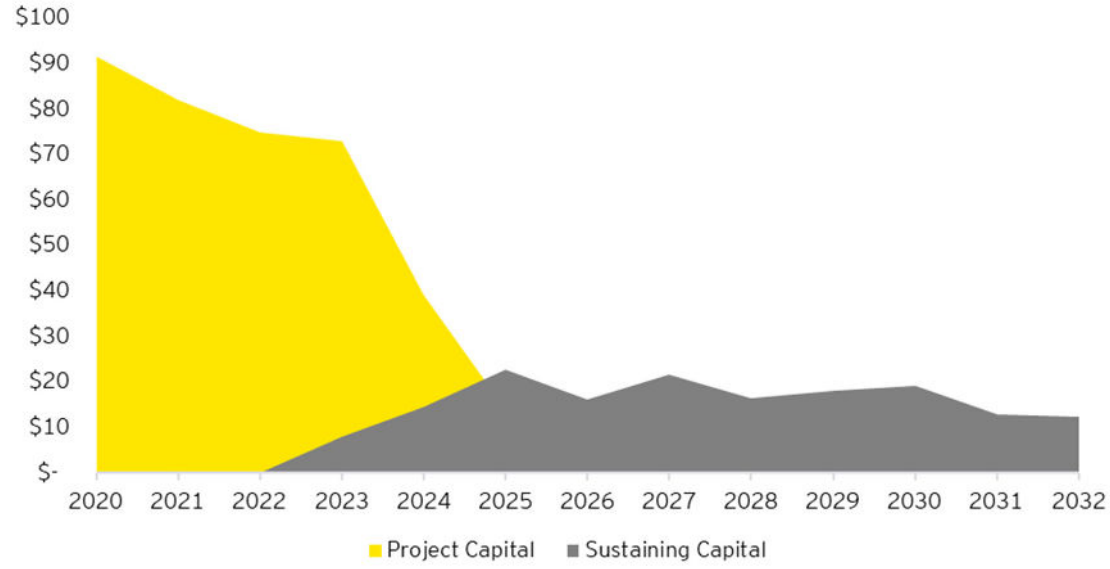
Capital costs

Tahmoor Coal provided EY with the capital expenditure profile of the Project which is summarised in Figure 3, the bulk of the planned investment is to take place between 2020 and 2024 which corresponds with the large capital outlays for surface and underground mining infrastructure.

Over the period 2020 to 2032, the total capital expenditure is $540.3 million in real 2020 dollars in undiscounted terms. In net present value (NPV) terms, the total real capital expenditure is $434.1 million in NPV terms in real 2020 Australian dollars (based on a 7 per cent real discount rate).[7]

[7] All NPV figures reported are in real 2020 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated).

Figure 3: Capital expenditure, 2020-2032 (2020 dollars)



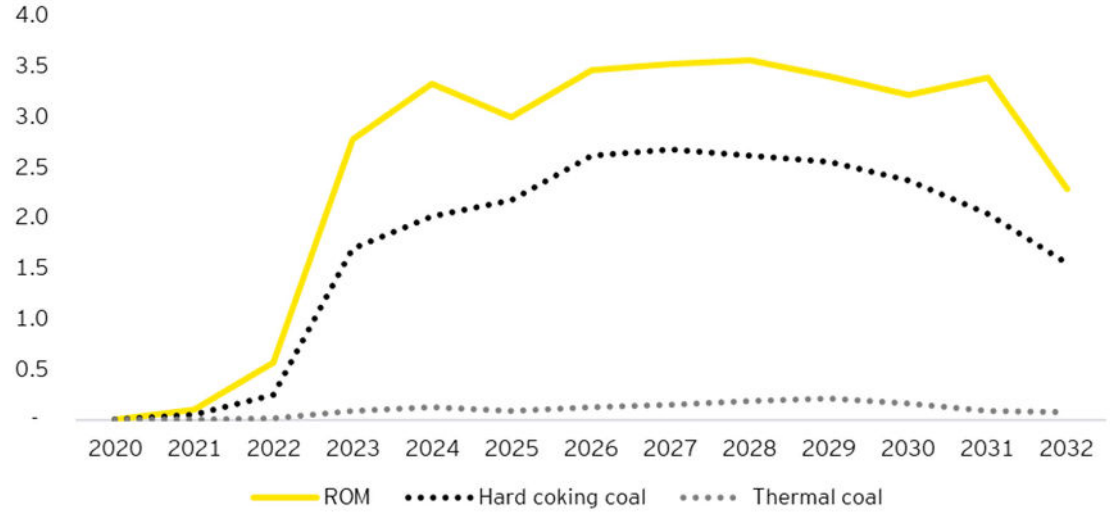
Source: Tahmoor Coal.

Production assumptions

Tahmoor Coal provided EY with the estimated production figures for the Project which are summarised in Figure 4. Production is expected to be 32.7 Mt of ROM during the period 2020 to 2032, under the current mine schedule. Initial longwall development is expected to take place over the period 2020 to 2022. Once the longwall panels are established, starting in around 2023, extraction rates increase substantially to average 3.6 Mt of ROM coal over the period 2023 to 2032.

Under the current mine plan production is anticipated to peak in 2028 at 3.6 Mt of ROM, pending factors such as geological conditions and market factors at the time. Hard coking coal (HCC) is expected to account for 22.6 Mt of the saleable coal output, with thermal coal accounting for 1.4 Mt.

Figure 4: Project key production figures (Mt)

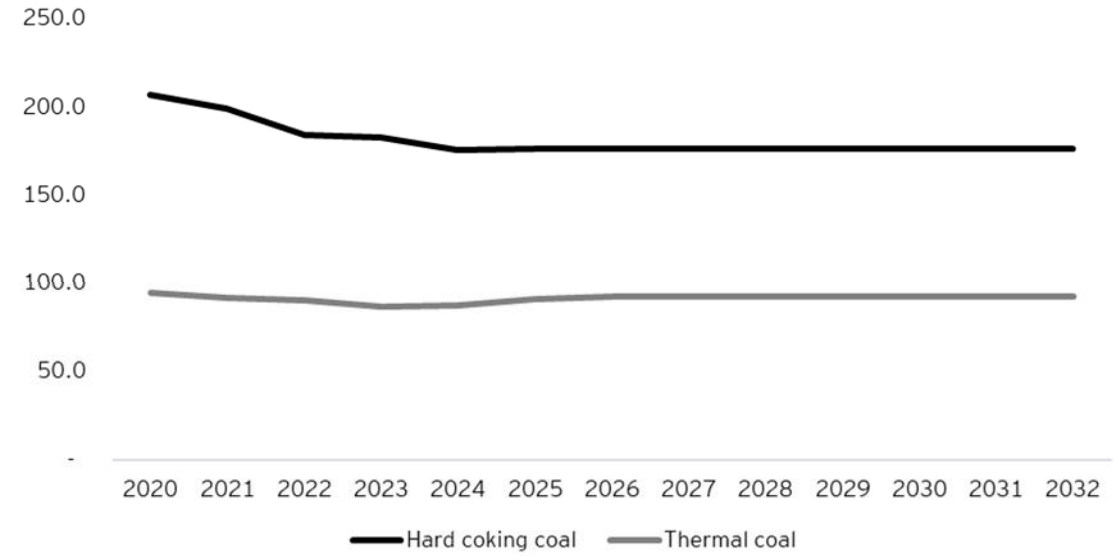


Source: Tahmoor Coal.

Price assumptions

The coal prices adopted for the analysis are outlined in Figure 5, on average, over the life of the Project (2020 to 2032) the thermal coal price is assumed to average $91.3 dollars per tonne. Over the life of the Project the hard coking coal price averages $181.5 dollars per tonne. The price peaks in 2020 at $207.3 declining to about $175.4 per tonne from 2024.

Figure 5: HCC and thermal coal price assumptions (real 2019 Australian dollars)



Source: EY analysis based on KPMG (2020), Office of the Chief Economist (2020) and Tahmoor Coal.

These prices are based on information provided by Tahmoor Coal, Consensus Economics and the Office of the Chief Economist. The basis of these price assumptions is:

- KPMG (March/April 2020)[8] publish a thermal price forecast in nominal US dollars out to 2024.
- The nominal US dollar thermal coal price forecast is converted to real 2020 Australian dollars using the exchange rate and inflation rate forecasts from Resources and Energy Quarterly (June 2020) produced by the Office of the Chief Economist to 2022.
- Beyond 2022, we assume both exchange rates and inflation remain constant, based on the last value produced by the Office of the Chief Economist.

Over the life of the Project, Tahmoor Coal advises that both the hard coking coal and thermal coal will sell for 90% of the reference price.

Projected revenue and Project financials

Based on the Project economics outlined above the Project is expected to generate real revenue of just over $4,130.1 million undiscounted real 2020 Australian dollars. This equates to $2,545.3 million real revenue in NPV terms as shown in Table 3 (this table shows selected years; full results are presented in Appendix A). In the context of this analysis, these are deemed to be ***central case assumptions***, and subject to sensitivity analysis later in this report.

[8] Link to source: https://home.kpmg/content/dam/kpmg/au/pdf/2020/coal-price-fx-market-forecast-march-april-2020.pdf.

Table 3: Coal production, real prices^ and total revenue

	Total	2021	2024	2027	2030	2032
Production (Mt)	24.0	0.06	2.1	2.8	2.5	1.6
Hard Coking Coal	22.6	0.05	2.0	2.7	2.4	1.5
Thermal Coal	1.4	0.00	0.1	0.2	0.2	0.1
Real price^						
Hard Coking Coal		199.0	175.4	176.3	176.3	176.3
Thermal Coal		91.7	87.7	92.2	92.2	92.2
Total Revenue^^	4,130.1	10.6	364.5	487.3	433.2	279.7
Total Revenue (NPV*)	2,545.3					

*Source: EY analysis ^ Real 2020 Australian dollars. ^^ Undiscounted. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

Based on information provided by Tahmoor Coal, the operating costs for the Project are summarised in

Table 4. In addition to operating revenue of $2,545.3 million in NPV terms, asset sales at the end of the development's life are expected to yield $61.2 million in NPV terms. This results in total revenue of $2,606.5 million in NPV terms.

Operating costs are estimated to be $1,705.7 million in NPV terms. Additional costs include, biodiversity offset of $10.5 million, subsidence mitigation of $13.8 million and rehabilitation costs at $8.1 million in NPV terms.[9] In terms of other costs:

- Depreciation is calculated using the straight-line method, assuming zero residual cost of capital (which is consistent with the standard Tahmoor Coal treatment);
- Royalties are based on standard NSW Government royalty rates of 7.2 per cent *ad valorem* for underground mines up to 400 metres in depth. A discount of $3.50 per ROM tonne is applied for washing as is allowed by the NSW Government;
- The estimated council rates data was provided by Tahmoor Coal; and
- Company tax payments are estimated by EY.

Based on this data, the Project is estimated to generate a pre-tax profit of $490.0 million in NPV terms. These are deemed to be ***central case assumptions***, and subject to sensitivity analysis later in this report.

[9] In 2033, following the mine closure, a program of rehabilitation will begin. This program will take a number of years to complete. For the purposes of this assessment it is conservatively assumed that all rehabilitation costs, $19.5 million in real 2020 Australian dollars (undiscounted) will be incurred in 2033.

Table 4: Project financials ($ million^)

	Total (NPV*)
Operational revenue	2,545.3
Asset Sales Revenue	61.2
Total Revenue	2,606.5
Operating costs	1,705.7
Council Rates	4.7
Rehabilitation	8.1
Subsidence Mitigation	13.8
Biodiversity Offsets	10.5
Other Mitigation Costs	-
Depreciation	242.2
Royalties	131.5
Total operating costs	2,116.5
Total Profit	490.0

*Source: EY analysis based on information provided by Tahmoor Coal. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 percent real discount rate.*

2.2 Direct benefits

Net producer surplus attributable to NSW

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

The Project is estimated to generate an operating surplus of $298.1 million in NPV terms (see Table 5). The operating surplus is estimated using cash earnings and cash cost, with cash costs made up of both capital expenditure and operating costs (excluding depreciation). As outlined in the section below, $178.7 million in NPV terms is payable in the form of corporate taxes, leaving a net producer surplus of $119.4 million in NPV terms.

In this case, the net producer surplus that is attributable to NSW is assumed to be zero. This is because Tahmoor Coal is a wholly owned entity within the SIMEC Mining division of the GFG Alliance group.

Table 5: Central case - estimate of potential net producer surplus attributable to NSW ($ million^)

Key data	NPV, real 2020 AUD
Total revenue	2,606.5
Total Cash costs	2,308.4
Operating surplus	298.1
Company tax[10]	178.7
Net Producer Surplus	119.4
NSW share of Project ownership	0%
Value of net producer surplus attributable to NSW	0

*Source: EY estimates based on information provided by Tahmoor Coal. ^ Real 2020 Australian dollars. ^^ Based on a 30 per cent company tax rate. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

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 Project. A company tax rate of 30 per cent[11] is used to estimate the tax payments made to the Australian

[10] A 30 per cent company tax rate is used for all company tax figures referenced in this report.

[11] This information does not constitute tax advice. The 30 per cent company tax rate has been assumed to remain unchanged throughout the forecast period.

Government under the assumption that all the profit generated by the mine is subject to company tax in Australia (the analysis does not include any financing costs or any carry forward of losses).

Consistent with the Guidelines, company tax attributable to NSW is based on the State's share of the national population (32 per cent) as specified under the Guidelines.[12]

As summarised in Table 6 it is estimated the Project will generate $490.0 million in taxable profit in NPV terms over the period 2020 to 2032 (this is an estimate of the accounting profit from which company taxes are calculated). At a company tax rate of 30 percent, the company tax estimate is $178.7 million in NPV terms, of which $57.2 million is attributable to NSW.

Table 6: Central case - company income tax attributable to NSW ($ million^)

Company tax attributable to NSW	NPV*
Total profit	490.0
Company tax^^	178.7
NSW Share[13]	57.2

*Source: EY analysis based on information provided by Tahmoor Coal. ^ Real 2020 Australian dollars. ^^ Based on a 30 per cent company tax rate. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

Payments to the State and the local Council

Under the Project, various payments are expected to be made to NSW Government and the Wollondilly Shire Council to extract and process coal in the State.

These are made up of three types of payments: coal mining royalties and payroll tax expected to be paid to the NSW Government and council rates expected to be paid to the Wollondilly Shire Council. Over the life of the Project, a total of $157.8 million in payments are expected to be made, in NPV terms (Table 7). This is made up of $131.5 million of royalty payments and $21.5 million in payroll tax. A further $4.7 million is paid in the form of council rates.

Table 7: Central case - total expected payments to State government ($ million^)

Corporations tax expected to be paid to NSW	NPV*
Total Royalties paid	131.5
Payroll tax	21.5
Council rates and land tax	4.7
Total Payments	157.8

*Source: EY analysis based on information provided by Tahmoor Coal. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

2.3 Indirect benefits to NSW

Benefit to workers

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

- Wages earnt in the 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

[12] New South Wales Government (2015).

[13] Based on a 32 per cent population share.

Tahmoor Coal provided EY with both the total level of expected employment and the estimated wages to be paid to employees, these are summarised in Table 8. Over the period of the Project, an average of 256.3 Full Time Equivalent (FTE) workers expected to be employed, which is expected to peak at 400 FTE between 2023 and 2032.

As a result of the analysis, the estimated average wage for a full-time coal mining employee is currently $150,000 per annum, and expected to remain constant throughout the life of the project. This yields a ***total of estimated wages to be paid*** to employees of $395.2 million in NPV terms.

Table 8: Project, estimated wages to be paid

	NPV*	2021	2024	2027	2030	2032
Employment (FTEs)		100	400	400	400	250
Average wage ($ per annum^)		150,000	150,000	150,000	150,000	150,000
Total wages paid ($ million^^)	395.2	15	60	60	60	37.5

*Source: Tahmoor Coal. ^ Real 2020 Australian dollars. ^^ Figures reported at selected years are in undiscounted 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

To measure the ***opportunity cost*** compared to the non-mining sector, we have compared the average wage for mining employment to the average wage paid in NSW. This implies that should the Project not go ahead, those who would have been employed at Tahmoor find alternative work at the average wage paid in NSW. The average wage across NSW is $67,688 per annum based on the 2016 Census data (updated to 2020 dollars).

Assuming no disutility of working in mining, this results in an estimated worker benefit of $216.9 million, in NPV terms, over the life of the proposed development. As shown in Table 9, this calculation is the difference between the total wages paid at mining average wages less the total wages that would be paid under the average wage prevailing in NSW.

Table 9: Central case – estimated NSW worker benefit

Employees	NPV*	2021	2024	2027	2030	2032
Average NSW wage ($ per annum^)		67,688	67,688	67,688	67,688	67,688
Mining wage ($ per annum^)		150,000	150,000	150,000	150,000	150,000
Total Wages Paid ($ million^^)						
► All sectors (NSW)	178.3	6.8	27.1	27.1	27.1	16.9
► Mining (Tahmoor)	395.2	15.0	60.0	60.0	60.0	37.5
Estimated worker benefit ($ million^^)	216.9	8.2	32.9	32.9	32.9	20.6

*Source: Tahmoor Coal, ABS (Table W17) Census (2016) Occupational Total Personal Income (Weekly) by Hours Worked, NSW. ^ Real 2020 Australian dollars. ^^ Figures reported at selected years are in undiscounted 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

In terms of the estimated worker benefits calculated above, it is important to note that there is no disutility assumed for working in mining.

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).

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. One source of information considered in this analysis was any documented 'hardship' allowances recognised in mining awards. However, these allowances appear to be relatively minor. For example, the Black Coal Mining Industry Award 2010 provides 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. To put this into context, First Aid Officer Allowance is 0.76 per cent per day or shift above the standard rate. In addition, the allowances set out in the Black Coal Mining Industry Award 2010 are not in the Tahmoor enterprise agreement.

Given the minor allowances for working in an underground mine, the measurement difficulties associated with measuring these disutilities and the current Tahmoor enterprise agreement we have assumed the disutility for workers under the Project case is zero for the purposes of this analysis but considered in the sensitivity analysis below.

Benefit to suppliers

Consistent with the Guidelines, the economic benefit to suppliers is estimated as a producer surplus generated from goods and services from NSW firms being provided under the Project. As summarised in Table 10, based on the input cost data provided by Tahmoor Coal, the Project is estimated to use $1,155.5 million in intermediate inputs supplied from NSW over its life-cycle in NPV terms. Currently, 92.8 per cent of the inputs used at the Tahmoor Mine are supplied from NSW-based businesses. For the purposes of this analysis, we have assumed the percentage of NSW-based supply continues under the Project.

The estimated economic benefit to suppliers (producer surplus) is based on the EY Regional Input-Output Model (EYRIOM). This model was customised to generate an NSW-specific Input-Output table so as 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 $233.2 million in NPV terms.

Table 10: Central case – estimated supplier benefits

	NPV*
Total intermediate inputs ($ million^)	1,155.5
Gross operating surplus ratio	0.202
Total benefits to suppliers (NPV*)	233.2

*Source: EY estimates. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate. * NPV in 2020 dollars based on a 7 percent real discount rate*

2.4 Indirect costs to NSW

Consistent with the Guidelines, a Project's estimated indirect costs are classified as the net public infrastructure costs, the estimated loss of surplus to other industries and the net environmental, social and transport-related costs. Table 11 provides a summary of the Project's estimated indirect costs. These include some costs that have been internalised by Tahmoor Coal including the biodiversity and subsidence impacts and costs that have been assessed qualitatively, like visual amenity. In total indirect costs are estimated to be $36.7 million in NPV terms over the life of the Project, which includes $0.1 million of incremental costs relating the greenhouse gas emissions, that are not internalised by Tahmoor Coal.

A detailed description of each cost is provided in Appendix A.

Table 11: Summary of estimated indirect costs ($ million^)

Scope of environmental costs	Discussion	NPV*
Greenhouse gas emissions	Based on scope 1 and 2 greenhouse gas emissions generated by the Project, as outlined in Appendix A.	0.1
Management, monitoring and mitigation costs		
Biodiversity impact	Tahmoor Coal has advised the costs of mitigation against the potential biodiversity impacts.	10.5
Ambient noise impact	Noise emission from Modification 4 will be similar to that predicted for Modification 3 for the equivalent stage, provided feasible and reasonable noise controls and management strategies are applied. Tahmoor Coal has advised the Project will contribute to management, monitoring and mitigation costs.	12.3
Subsidence	The Project will generate subsidence impacts, Tahmoor Coal has advised the costs of mitigating the subsidence impacts.	13.8
Sub total		36.7
Other environmental costs		
Air quality	A summary of the Air Quality Assessment (AQA) findings are outlined in Appendix A. The AQA findings are based on a number of management and mitigation steps incorporated into the operations. The costs of these costs are included in the operating and capital costs of the Project, but not individually identified.	Nil

Scope of environmental costs	Discussion	NPV*
Groundwater	Costs of mitigating against the potential groundwater impacts to bores are included in the operating costs, but not individually identified.	Nil
Loss of surplus to other industries	As outlined in Appendix A, there is no land which has been, or is currently used for agriculture, that will be impacted by surface disturbance associated with the Project.	Nil
Net public infrastructure cost	Project is not expected to generate public infrastructure costs. Tahmoor Coal is taking steps to internalise the costs of subsidence.	Nil
Residual value of land	As a result of the mining activities currently located on the site of the Project, it is unlikely that further approvals will impact the residual value of land.	Nil
Visual amenity	The Project will have a negligible visual impact. The Project includes a number of mitigation steps to reduce visual impacts, these costs are included in the operating costs of the Project.	Nil
Transport/ traffic impacts	The TIA analysis indicates relatively minor increases in wait times. As a result, the traffic impacts are qualitatively assessed and are likely to be negligible.	Qualitative assessment
Aboriginal cultural heritage	The Project will impact six sites will moderate or high cultural significance, the costs of managing the impacts are included in the operating costs. Any residual impacts are qualitatively acknowledged.	Qualitative assessment
Historical heritage	The Project will generate impact on historical heritage as a result of subsidence. The costs of mitigating against these impacts is included in the subsidence costs, any residual impact is qualitatively acknowledged.	Qualitative assessment
Surface water	The findings of the SWA are outlined in Appendix A. the SWA concludes that the Project will generate minor impacts to Thirlmere Lakes. While there is unlikely to be any impacts on Dog Trap Creek or the water catchment area the Metropolitan Special Area.	Qualitative assessment
Total		36.7

*Source: EY analysis based on information provided from Tahmoor Coal and various environmental assessments. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

2.5 Net benefit analysis results

Consistent with the Guidelines, the CBA is based on comparing the expected net direct and indirect benefits and subtracting the estimated indirect costs of the Project compared against the baseline scenario where the Project does not occur, the results are summarised in Table 12.

Based on the CBA methodology outlined in the Guidelines, and information provided by Tahmoor Coal, the Project is estimated to provide a net benefit to NSW. This net benefit is estimated to be $664.9 million in net present value (NPV) terms. This is comprised of $215.0 million and $450.0 million in direct and indirect benefits respectively. The incremental indirect costs of the Project are $0.11 million. Other costs, like subsidence and biodiversity impacts are being borne by the proponent and are included in the financial costs of the Project.

Table 12: Central case – estimated potential net benefits of the Project ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		**Direct costs**	
Net producer surplus attributed to NSW	$0.0		
Royalties, payroll tax and Council rates	$157.8		
Company income tax apportioned to NSW	$57.2		
Total direct benefits	**$215.0**	**Total direct costs**	**-**
Indirect benefits		**Indirect costs**	
Net economic benefit to landholders	-	Air quality	-
Net economic benefit to NSW workers	$216.9	Greenhouse gas emissions	0.11
Net economic benefit to NSW suppliers	$233.2	Visual amenity	
		Transport impact	
		Net public infrastructure cost	
		Surface water impact	
		Residual value of land	-
		Biodiversity impact	10.5

		Noise impact	12.3
		Loss of surplus to other industries	-
		Water	
		Aboriginal cultural and Historical heritage	
		Subsidence	13.8
Total Indirect benefits	**$450.0**	**Indirect Costs**	**36.7**
Total Project economic benefit	**$665.0**	**Total incremental cost of Project**	**0.11**
NPV of Project - ($m)	**$664.9**		**-**

*Source: EY analysis based on information from various sources. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate. ^^ Management and mitigation costs are included in the operating cost.*

The expected net benefits of the amended Project are similar to the Project as outlined in the EIS.

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

- An overall estimated net producer surplus of $119.4 million in NPV, of which ***zero*** is attributed to NSW as Tahmoor Coal is assumed to be 100 per cent foreign owned;
- Total estimated corporate taxes of $178.7 million in NPV terms for Australia, of which $57.2 million is expected to be attributed to NSW; and
- An estimated $157.8 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $131.5 million with council rates and payroll taxes contributing $4.7 million and $21.5 million respectively.

The ***indirect benefits*** of the Project are related to the linkages that the Project has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $450.0 million in estimated indirect benefits:

- The estimated worker benefits are $216.9 million in NPV terms attributable to an average employment of 256.3 Full Time Equivalent (FTE) workers over the period of the Project, which peaks between 2023 and 2032 at 400 FTE; and
- The estimated supplier benefits are $233.2 in NPV terms, based on NSW-based procurement of $1,155.5 million in NPV terms.

The Project is expected to generate modest incremental indirect costs on the NSW community of $0.11 million, through greenhouse gas emissions.

Expected net benefits – Sensitivity analysis

Consistent with the Guidelines, this section outlines a summary of the systematic sensitivity analysis undertaken for the Project. 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 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 price assumptions, where coal prices are increased by 25 per cent over the central case assumptions for the life of the Project
  - Lower price assumptions, where coal prices are decreased under the central case assumptions by 25 per cent
- Cost-base sensitivity
  - Higher operational expenditure (increased by 10 per cent over the central case)

    - Lower operational expenditure (decreased by 10 per cent under the central case)
    - Higher capital expenditure (increased by 10 per cent over the central case)
    - Lower capital expenditure (decreased by 10 per cent under 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
- Environmental impact costs, increased by 10 per cent over the central case
- Discount rate sensitivity, using a 4% and a 10% real discount rate (see Appendix B).

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

- 'Worst-case' scenario, the coal price is reduced by 25 per cent, operational expenditure is decreased by 10 per cent (as they lead to lower benefits to NSW), 10 per cent higher capital costs, 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. Environmental costs are increased by 10 per cent over the central case.
- 'Best case' scenario, the coal price is increased by 25 per cent, operational expenditure is increased by 10 per cent (as they lead to higher benefits to NSW), 10 per cent lower capital costs, 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. Environmental costs are decreased by 10 per cent over the central case.

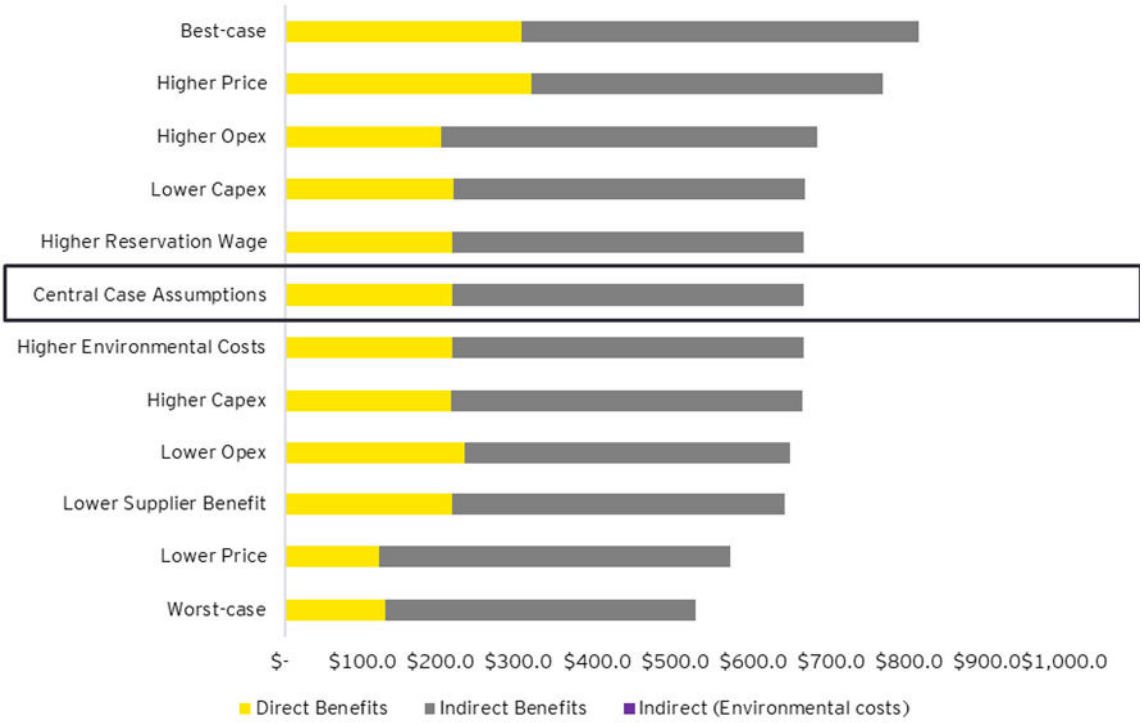
Consistent with the Guidelines, the revenue sensitivity undertaken considers the impact of higher or lower prices on the results of the CBA denominated in Australian dollars. There are two main factors effecting the price assumptions. First is the US dollar price of coal prevailing in international markets. Second is the exchange rate between the Australian and US dollar. A decrease in the price of coal can either reflect a reduction in world prices or an appreciation of the Australian dollar relative to the US dollar. As such, a 25 per cent reduction in coal prices can either be interpreted as:

- A 25 per cent reduction in the prevailing international coal price (denominated in US dollars with no change to the exchange rate)
- A 25 per cent appreciation in the Australian dollar relative to the US dollar (with the prevailing international price of coal unchanged)
- Some combination of both.

In isolation, the estimated net benefit of the Project 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 $570.8 million in NPV terms.

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, environmental impacts and supplier benefits, yields an estimated net benefit of $526.3 million in NPV terms. The upper bound, or best-case, estimate, based on the most optimistic assumptions, is $811.5 million in NPV terms.

Figure 6: Systematic sensitivity analysis of the CBA to key assumptions (NPV*, $ million^)



*Source: EY analysis based on information from various sources. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated).*

It can also be inferred from the sensitivity analysis how large the non-quantified negative externalities would need to be before the Project is no longer a net benefit to the NSW community. Using the most conservative estimate, the worst-case assumptions, these externalities would need to be $526.3 million in NPV terms before the Project would return a net negative return to NSW.

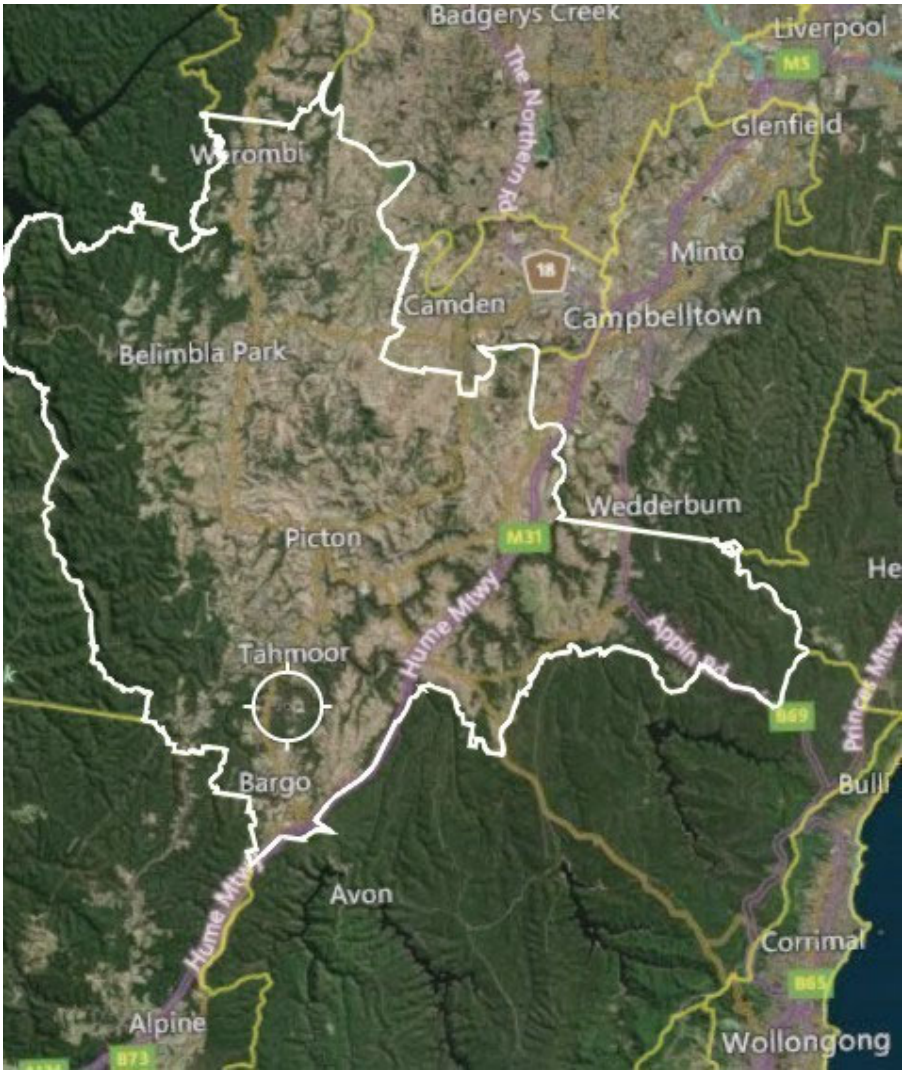
Given the relatively long timeframe of the Project (2020 to 2032) the net benefits are particularly sensitive to the discount rate used for the analysis. Under central case assumptions the Project is expected to generate $664.9 million of net benefit using a 7 per cent discount rate. Using a 4 per cent discount rate increases the net benefit to $805.4 million; conversely a 10 per cent discount decreases the net benefit to $555.4 million.

3. Local effects analysis

Consistent with the Guidelines, the local effects analysis (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 Statistical Area (SA3) as defined by the Australia Bureau of Statistics. In the case of this Project the Wollondilly SA3 area is used for the LEA.

As shown in Figure 7, the Wollondilly region is located to the south west of Campbelltown and Sydney and to the west of Wollongong.

Figure 7: Wollondilly SA3



Source: http://nationalmap.gov.au/

Local effects analysis

The LEA accounts for the economic benefits to the Wollondilly region only. It does not include any economic benefits that may accrue to the major regional centres that are located adjacent, including the 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 the Social Impact Assessment indicates over the life of the Project a small proportion of the inputs will be supplied from the Wollondilly region and just below half of the employees are sourced from the region. As a result, this Project may generate economic benefits to these regions; for example, those workers who reside in Wollongong (currently 30 per cent of the Tahmoor workforce), other parts of Sydney and regional communities to the south and the west of the Project. Underpinning the LEA are the assumptions that:

- No net producer surplus accrues to the region.
- No company income tax accrues to the Wollondilly SA3 region.
- 45 per cent of the workforce requirement of the Project and 12.9 per cent of intermediate inputs will be supplied from the SA3 region.

As a result of these assumptions, it is expected the Project will generate indirect benefits to local suppliers and employees of $32.5 million and $100.3 million respectively in NPV terms over the baseline case, as outlined in

Table 13. These benefits to workers and suppliers are similar to those outlined in the EIS.

The incremental indirect costs associated with the Project is $725, which is the global greenhouse gas costs apportioned to the local area.

Based on these assumptions, the Project is estimated to confer a net benefit on the Wollondilly SA3 region of $137.5 million in NPV terms.

Table 13: Estimated Local Effects Analysis of the Project ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		**Direct costs**	
Net producer surplus attributed to NSW			
Royalties, payroll tax and Council rates	$4.7		
Company income tax apportioned to NSW			
Total direct benefits	**$4.7**	**Total direct costs**	**-**
Indirect benefits		**Indirect costs**	
Net economic benefit to landholders		Air quality	-
Net economic benefit to NSW workers	$100.3	Greenhouse gas emissions	0.0
Net economic benefit to NSW suppliers	$32.5	Visual amenity	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact	-
		Residual value of land	-
		Biodiversity impact	10.5
		Noise impact	12.3
		Loss of surplus to other industries	-
		Water	-
		Aboriginal cultural and Historical heritage	-
		Subsidence	13.8
Total indirect benefits	**$132.8**	**Indirect Costs**	**$36.6**
Total Project economic benefit	**$137.5**	**Total incremental cost of Project**	**$0.0**
NPV of project - Wollondilly Community ($M)	**$137.5**		

*Source: EY analysis based on information from various sources. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate. ^^ Management and mitigation costs are included in the operating cost.*

Sensitivity analysis

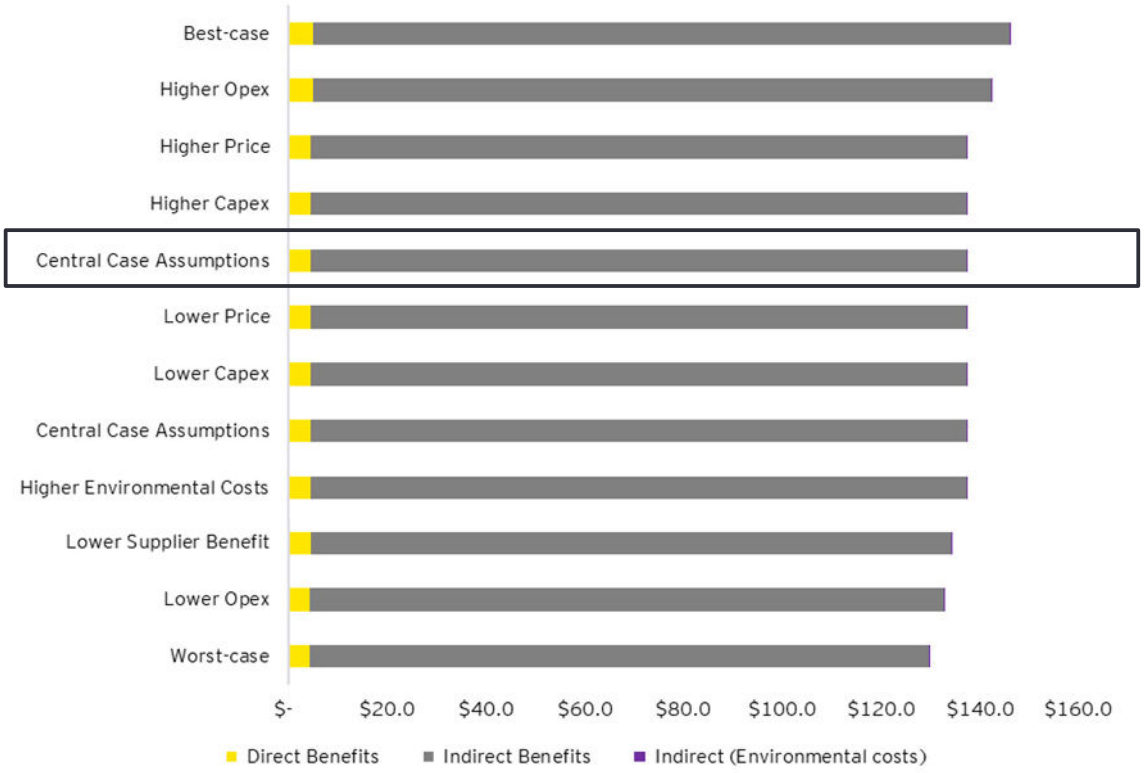
As outlined above the LEA relies on a number of modelling assumptions. Consistent with the Guidelines, this section includes a systematic sensitivity analysis undertaken for the Project. The sensitivity analysis tests the same assumptions outlined in the CBA.

The regional benefits of the Project are driven by 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 8. 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 detail of the sensitivity analysis is 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 $129.8 million in NPV terms. The upper bound, or best-case, estimate, based on the most optimistic assumptions, is $146.2 million in NPV terms.

Figure 8: Systematic sensitivity analysis of the LEA to key assumptions (NPV*, $ million^)



*Source: EY analysis based on information from various sources. ^ Real 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated).*

Given the relatively long timeframe of the Project (2020 to 2032) the net benefits are sensitive to the discount rate used for the analysis. Under the Central case, the Project is expected to generate $137.5 million of net benefit using a 7 per cent real discount rate. Using a 4 per cent real discount rate increases the net benefit to $165.3 million; conversely a 10 per cent real discount decreases the net benefit to $115.8 million.

4. CGE modelling

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

The aim of an economic impact study based on applied CGE modelling is to estimate the potential net benefit of the Project on economic activity and the living standards of those residing within the Wollondilly 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.[14] As a CGE model is able to analyse the impacts of the Project in a comprehensive, economy-wide framework meaning the modelling captures:

- Direct increases in demand associated with the Project (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 mine to overseas interests (in this case, Tahmoor Coal which is owned by SIMEC Mining) as well as through the redistribution of taxation and royalties.

About the EY CGE model

The estimates are based on the Ernst & Young 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 Wollondilly 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.

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

Box 1: An overview of EYGEM

EYGEM is a multi-commodity, multi-region, dynamic model of the world economy. Like all economic models, EYGEM is a 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.

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 follow the lead of the Australian Treasury and use a labour supply elasticity assumption of 0.15, which indicates a relatively 'inelastic' response from workers.

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 Project 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.

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 for each year over a specified timeframe, in this case each year from 2020 to 2032. 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 Project investment or coal output from the Project. Set against this scenario is the policy scenario (or the Project case) under consideration.

Overview of scenarios

The economy-wide impacts outlined below use the central case assumptions used in the CBA analysis above including, capital expenditure of $434.1 million in NPV terms and coal output of $2,545.3 million in NPV terms.

Our scenarios factor in the potential benefits that flow from the Project outside of the Wollondilly region and the NSW economy. This includes the repatriation of profits out of the region to foreign shareholders, other payments such as wages out

of the region, 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.

Economy-wide economic impacts of the Project

In total, the Project is expected to provide positive economy-wide impacts to both Wollondilly SA3 region and to NSW. The net economic impacts of the Project are shown in Table 14. In the Wollondilly region, the Project is expected to increase GRP by $1,624.5 million in NPV terms. GRI or regional welfare, is projected to increase by $1,189.0 million in NPV terms. The projected increase in GRI is significant to the relatively small Wollondilly region. In total, the Project is expected to increase welfare for each person in the region by $19,681.7 in NPV terms.

For NSW, the projected increase in GSP is $1,844.6 million in NPV terms. GSI is projected to increase by $2,347.4 million.

Table 14: Economy-wide impacts of the Project, 2020 – 2032

Variable	Description	Wollondilly	NSW
Real GRP	NPV - $m	1,624.5	1,844.6
Real GRI	NPV - $m	1,189.0	2,347.4
Employment	Average (FTE)[15]	245.4	138.0
Real Wages	Average	4.11	0.02
Real GRI per person	NPV - Dollars	19,681.7	193.9

Source: EY analysis based on information provided by Tahmoor.

Total employment in the Wollondilly region is projected to increase by 245.4 FTE workers on average, and across NSW employment is projected to increase by 138.0 FTE.

As outlined in Chapter 4 below, the CGE modelling takes into account the coal output, the payment of royalties from Wollondilly into the Rest of NSW, and the repatriation of profits overseas. The CGE modelling also reflects that the Project will draw workers from the Rest of NSW into Wollondilly.

[15] Employment and real wage figures are averages over the period 2020 to 2032.

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Appendix A Indirect costs

This Appendix provides a detailed description of the indirect costs associated with the Project. The quantitative and qualitative analysis draws on information provided in the technical assessments undertaken for the Project, as listed in Chapter 2.

Greenhouse gas emissions

The greenhouse gas assessment is outlined in the Tahmoor South Project – Greenhouse Gas Assessment by ERM and is used to estimate the indirect costs (for selected years), as shown in Table 15.

The greenhouse gas assessment states that the Project will generate almost 10.4 million tonnes $CO_{2\text{-}e}$ of Scope 1 and of Scope 2 greenhouse gas (GHG) emissions during the operations phase of the Project.

To price the GHG emission we have applied the latest carbon price resulting from the most recent (March 2020) auction undertaken by the Clean Energy Regulator (CER) under the Emissions Reduction Fund (ERF). The results of this auction yielded an average carbon price of $16.14 tCO2-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.

On a global basis, the total estimated GHG cost is $102.6 million in NPV terms. To maintain consistency with the CBA methodology, this figure needs to be attributed to NSW, specifically noting that the economic impacts of climate change are a global phenomenon. It is widely acknowledged that climate change is a global issue and a global externality. Different parts of Australia and the world are predicted to experience different levels of impacts. As a result, apportioning all the costs of climate change impacts associated with the Project's greenhouse gas emissions overstates the cost of these impacts to NSW.

One method for doing this, which is consistent with the Guidelines, is to attribute GHG costs based on the NSW population. This results in an attributed GHG cost of $0.1 million to NSW in NPV terms. This is similar the estimated GHG associated with the original project as presented in the EIS.

Table 15: Greenhouse estimated gas emissions attributable to the Project

	NPV*	Total	2021	2024	2027	2030	2032
Tonnes of GHG (Mt)							
Scope 1		9.4	0.1	0.7	0.9	1.4	0.3
Scope 2		1.0	0.0	0.1	0.1	0.1	0.0
Total		10.4	0.1	0.8	1.0	1.5	0.3
Price Path ($ per tonne^)			16.14	16.14	16.14	16.14	16.14
Global Impact (NPV*, $ million^^)	102.6		1.8	12.9	16.3	23.6	4.9
NSW (NPV*, $ million^^)	0.1		0.0	0.0	0.0	0.0	0.0

*Source: EY analysis based on ERM, Greenhouse Gas and Energy Assessment. ^ Real 2020 Australian dollars. ^^ Figures reported at selected years are in undiscounted 2020 Australian dollars. * NPV in 2020 Australian dollars based on a 7 per cent real discount rate.*

Air quality

The Air Quality Assessment (AQA) has been undertaken by ERM, and the findings are outlined in the *Tahmoor South Project – Air Quality Impact Assessment* report. The AQA includes a discussion of the Project's particulate matter output of less than 10 micrometres in diameter (PM_{10}) and less than 2.5 micrometres in diameter ($PM_{2.5}$).

The assessment also outlines the emissions of Total Suspended Particulates (TSP), odour and other gas pollutants like Nitrogen Dioxide (NO2), Carbon Monoxide (CO) and Hydrocarbons (HC). The assessment sets out the local conditions including meteorology, climatic conditions and existing air quality.

The assessment is informed by a number of monitoring stations located in the region and uses The Air Pollution Model (TAPM) and dispersion modelling to predict the Project's air quality impacts. In addition, the report measures these findings against the relevant EPA assessment criteria. In addition, ERM has incorporated into the air quality modelling the mitigation steps taken by Tahmoor Coal to reduce the Project's air quality impacts.

These mitigation steps include

- Unsealed Roads: watering with a water truck daily and applying a chemical dust suppressant once a month (or more if required).
- Sealed Roads: operators to avoid overloading to minimise spillage, minimise haulage distances, cover loads (where required).
- Exposed areas: Watering with a water truck daily, if dusty conditions are detected which require watering, personnel to contact CHPP Control Room to notify water truck. Areas not needed are sealed and / or re-vegetated.
- Stockpiles (ROM, product and topsoil) to be watered using automated water sprays triggered by wind speed monitoring. Regular visual inspection, revegetation of topsoil (on a risk-based approach) and reduced vehicle traffic and speed around stockpiles until dust controls are implemented.

A Full list of the mitigation steps are outlined in the AQA. Consistent with the Technical Notes, the cost of these mitigation steps is included in the operating and capital costs (although an exact figure is not separately identified).

The AQA concludes that the Project alone does contribute to PM2.5 emissions, although it is unlikely to be any project-related exceedances of the 24-hour or annual average PM2.5 levels compared to the EPA assessment criteria.

Dispersion modelling results indicate that no exceedances of any impact assessment criteria are predicted at any privately-owned receptors as result of the amended project. The AQA does note that, one mine owned receptor (R10) is predicted to experience maximum 24-hour average PM10 concentrations above 50 µg/m3, due to the Project's operations alone. This exceedance is predicted to occur on only one day during the year. However, with the incorporation of the TARPs and other dust management practices, these exceedances would be managed.

In addition, the potential NO_2, CO and HC impacts from flaring are all well below their respective EPA criterion. Results from the odorous emission assessment predict no exceedances of the relevant EPA criterion at the nearest sensitive receivers. However, there may be peak periods where higher concentrations may be detected at the close receptors.

The potential impacts are qualitatively acknowledged in this economic assessment.

Ambient noise impact

The Noise Impact Assessment (NIA) has been undertaken by EMM Consulting, *Tahmoor South Project Noise and vibration impact assessment*, in accordance with a number of NSW Government Guidelines including the EPA's *Noise Policy for Industry* and the *Voluntary Land Acquisition and Mitigation Policy For State Significant Mining Petroleum and Extractive Industry Developments*.

To assess the impacts of the Project the NIA takes the following steps:

1. Measure and determine existing background and ambient noise levels.
2. Measure and predict noise levels produced by Tahmoor Mine, having regard to meteorological effects such as from wind and temperature inversion.
3. Determine project-specific noise trigger levels (PNTL) from intrusive and amenity noise criteria.
4. Compare the measured and/or predicted noise levels from the site with the PTNL.
5. Where the PTNL are exceeded, assess feasible and reasonable noise mitigation strategies.
6. Determine achievable noise limits for the site. Describe the noise reduction measures to be implemented and their proposed timing.

The economic assessment of the noise impacts takes into account the measures taken and the costs incurred by the proponent to reduce noise impacts to the community, in addition, we qualitatively assess the residual noise impacts.

The NIA outlines that the Project will contribute to noise on-site, from the CHPP and dozers and off-site from rail loading activity, compressors and reject haul trucks. The mitigation steps for each of these sources are addressed in the NIA, including the mitigation decision-making matrix used to reduce noise impacts. These mitigation measures include noise controls at source and transmission, along with mitigation at receptors.

Over the period financial year 2020 to 2023 Tahmoor has allocated $12.3 million in NPV terms for noise mitigation works. Consistent with the Technical Notes, the cost of these mitigation steps is included in the capital costs (with an exact figure separately identified).

The costs incurred by the Tahmoor Coal to reduce noise emissions and to mitigate those properties impacted is included in the capital expenditure outlined above.

Surface water

A Surface Water Assessment (SWA) has been conducted by Hydro Engineering & Consulting (HEC), their findings are outlined in *Tahmoor South Project Surface Water Impact Assessment*. The SWA has been undertaken in four parts, including;

1. A baseline assessment – assessing the local water characteristics.

2. A Water Management System and Site Water Balance Report – assessing the impacts of the Project on the site. Taking into account proposed water management systems over the Project life and assessing any risks.

3. Flood Study – Assessing any effects of the Project on flooding in overlying watercourses and floodplains.

4. Surface Water Impact Assessment Report – outline the potential qualitative and quantitative impacts of the Project.

The SWA has been prepared in accordance with Division 4.1, Part 4 of the EP&A Act and incorporates the requirements of the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, and includes detailed agency comments including those from NSW Environment Protection Authority, the NSW Office of Environment & Heritage and Water NSW.

The SWA uses baseline monitoring data to identify and assess potential impacts. In the case of the Project subsidence is the main contributor to these potential impacts. As outlined in the assessment those watercourses that are directly above the longwall panels are exposed to a greater subsidence impact. The SWIA found that the maximum predicted reduction in total flow due to baseflow loss from subsidence is relatively small in terms of mean daily flow, but represents a significant percentage (51.9 per cent) of the average estimated baseflow at Dog Trap Creek (4.85 per cent), a small percentage at Cow Creek, Bargo River and Carters Creek (1.1 per cent to 3.45 per cent) and a low percentage at Tea Tree Hollow and Eliza Creek (less than 1 per cent). The reduction in flow in Tea Tree Hollow would be offset by on-going licensed discharge from LDP1. It is expected that reduction in baseflow would be most noticeable during periods of low flow which would normally be dominated by baseflow.

Regarding the impacts to Thirlmere Lakes the SWA concludes that the water levels would decrease by between 0.01 m and 0.06 m and that the level of change is very small compared to the natural variability in the downstream catchment conditions. This conclusion is drawn from detailed inflow and outflow water modelling of Thirlmere Lakes.

The SWA also assesses the potential impact to the Metropolitan Special Area (MSA) drinking water catchment. The report notes that the Project will involve mining adjacent but not beneath the MSA and the main channel of Cow Creek is located approximately 1 km from the Project longwalls. Subsidence analysis concludes that, at this distance the maximum predicted subsidence, upsidence and valley closure are less than 20 mm. The SWA states that the potential for localised impacts on Cow Creek such as fracturing and surface water flow diversion are extremely low. The SWA concludes that it is extremely unlikely that there could be any identifiable water quality impacts to flow in Cow Creek because longwall mining is sufficiently remote from the creek that the potential for fracturing is extremely low.

HEC also conducted a flood study for the Project, the findings are outlined in Tahmoor South EIS Flood Study. The assessment of flooding identified that minor localised increases in flooding are predicted for Dog Trap Creek (upstream) and Teatree Hollow (upstream). Flooding is unlikely to be increased in the Bargo Township as a result of the Project, with the exception of minor localised flooding at Dymond Road and Wattle Street. This flooding extent would not impact surrounding residential developments.

Tahmoor Coal is taking several steps to reduce its surface water impacts. As discussed in the subsidence section above Tahmoor Coal has reduced the extent of the proposed longwall panels to reduce the potential impacts on the Metropolitan Special Area (MSA) and Dog Trap Creek.

Drainage enhancement works, including provision of additional drainage culverts or pipes under Remembrance Drive near Caloola Road, are proposed to reduce the impacts associated with the predicted increased flood inundation in this location to minimise potential impacts to urbanised areas in the Bargo township in this area.

Groundwater impact

A detailed groundwater assessment (GA) has been completed by Hydro Simulations and is outlined in the *Tahmoor South Project EIS: Groundwater Assessment*. The GA concludes that the predicted average groundwater inflow to the Tahmoor South mine workings will be approximately 5 ML/day. Hydro Simulations therefore recommend that the groundwater licence allocation required to cover the predicted annual groundwater take by the Tahmoor South mine will be 2,700 megalitres (ML). Tahmoor Coal currently holds licences for 1,642 ML/a, suggesting Tahmoor will require an additional 1,058 ML/a entitlement.

The GA also assesses the potential impact to three high priority groundwater dependant ecosystems. These include O'Hares Creek and Macquarie Rivulet, which are expected to experience no drawdown impact or baseflow depletion as a result of the Project. The nearby Thirlmere Lakes is predicted to experience groundwater drawdown of less than 0.02 metres due to the operation of the Project.

The GA also outlines the impacts to bores in the region, outlining the bores that might be affected beyond a 2 metre threshold outlined in the NSW Aquifer Interference (AI) Policy. The groundwater model predicts that the Project alone will impact 38 registered bores and a further 6 registered bores that are already predicted to be affected by historical mining effects beyond the 2 metre drawdown, with a total number of approximately 220 bores effected when considering the cumulative mining impacts in the region. Tahmoor Coal has committed to 'make good' provisions for the bores adversely impacted by the Project. Consistent with the Technical Notes, the cost of these mitigation steps is included in the operating costs (although an exact figure is not separately identified).

Transport/traffic impacts

The Project is expected to generate additional traffic as a result of employee and truck movements from the mine site. The *Traffic Impact Assessment for Tahmoor South Project* (TIA) prepared by Transport & Urban Planning outlines the Project's traffic impact. The TIA analysis was conducted on a previous mine specification that included significantly higher employment levels.

The TIA models the traffic impacts, including movements and wait times for 2020 and 2027. The TIA outlines the potential impacts during the weekday morning peak 7.45am – 8.45am and the evening peak 3.30pm to 4.30pm.

The TIA models the Project's traffic impacts on two junctions alone Remembrance Driveway:

1. Tahmoor Mine access road,

2. Avon Dam Road Rail Bridge to the south of the town of Bargo.

The Project also includes an upgrade to Tahmoor Mine access road and Remembrance Driveway to improve road safety, in particular with regards to rear end collisions.

The TIA concludes that the Tahmoor Mines access road will maintain satisfactory to good operation in terms of level of service and vehicle delay, for both morning and evening peak times and for the two representative years modelled. For example, in 2020, morning peaks times the average delay in seconds increases from the existing 0.9 seconds to 1.2 seconds, an increase of 0.3 seconds. Similar increases are reported for 2020 evening peak times and for 2027.

At the Avon Dam Rail Bridge intersection, it will experience minimal impact in 2020. In 2027 the TIA concludes that in the morning peak this intersection will experience good to satisfactory operation, but will have reduced capacity in the afternoon peak hour, due to increases in background traffic. For example, in 2027 afternoon peak hour delays increase from 19.6 seconds in the base case to 21.8 seconds with the Project, an increase of 2.2 seconds.

The TIA analysis indicates relatively minor increases in wait times, and any increase in wait time cause by the Project is unlikely to have a material impact on residential and commercial road users. As a result, the traffic impacts are qualitatively assessed and are likely to be negligible.

Biodiversity and ecological impacts

A biodiversity assessment has been undertaken by Niche Environment and Heritage (*Tahmoor South Project Biodiversity Assessment Report)* (the BAR). The assessment identified several offset requirements for both vegetation communities and species that will be impacted by the Project. The obligation to mitigation against these potential impacts arise under NSW and Commonwealth laws. This economic assessment measures the costs required to meet these obligations. Tahmoor Coal has advised that these obligations will be met through undertaking a combination of:

1. Establishing Biodiversity Stewardship Agreement sites on land owned by Tahmoor;

2. Purchasing credits; and/or

3. Payment in the NSW Biodiversity Conservation Fund.

Tahmoor Coal advises that the costs to meet these biodiversity credits will be expensed in two stages over a four year period. The biodiversity offset strategy will cost $10.5 million in NPV terms. The cost of meeting the biodiversity requirements are included in the operating costs of the Project.

Aboriginal cultural heritage

Niche Environmental and Heritage has undertaken an Aboriginal Cultural Heritage Assessment for the Project. The assessment, as outlined in Aboriginal Cultural Heritage Assessment Tahmoor South Project – Regulator Document, has been undertaken in accordance with the relevant guidelines, in consultation with several Aboriginal groups and individuals and included a detailed survey of the Subject Area.

As outlined in the assessment there are 41 Aboriginal heritage sites (comprising 40 physical sites and one Aboriginal dreaming story) identified within the broader Project Area. Of these, 30 are located within the Subsidence Study Area. Most of the sites in the Subsidence Study Area (24 of 30) have low scientific significance. Two sites were assessed as having moderate scientific significance and a further four of high scientific significance, see Table 16.

Table 16: Aboriginal Heritage – sites with Moderate – High Significance

Site	Description	Significance rating	Impact
Dogtrap Creek (52-2-1524	Shelter with art	Moderate	Potential subsidence with partial loss of value
Dogtrap Creek (52-2-1527)	Shelter with art	Moderate	As above
Dogtrap Creek (52-2-1523),	Shelter with art	High	As above
Dogtrap Creek (52-2-1525)	Shelter with art	High	As above
Dogtrap Creek (52-2-1528)	Shelter with art	High	As above
Dogtrap Creek (52-2-1529)	Open camp site	High	As above

Source: Niche Environment and Heritage

Of the sites identified in the Project Area, one is within an area proposed to be disturbed by the project for the construction of surface infrastructure (the proposed ventilation fan site TSC2). This site has been assessed as being of low scientific significance and is detailed in the Addendum to the Aboriginal Cultural Heritage Assessment . The sites of moderate to high scientific significance rating have potential to be impacted through subsidence from the longwalls located below the sites, or in close proximity to the sites. None of these sites will be impacted by disturbance for surface infrastructure.

Niche has recommended the development of a Heritage Management Plan to set in place the mitigation and management measures outlined in their Aboriginal Cultural Heritage Assessment. Niche outlines a number of steps that should be included in the Heritage Management Plan, including a communications protocol between Tahmoor and the Registered Aboriginal Parties, a subsidence monitoring program and a Trigger and Action Response Plan specific to each of the site monitored. The cost of the Heritage Management Plan is included in the operating costs of the Project.

The potential impacts with partial loss to Aboriginal heritage are qualitatively acknowledged in this economic assessment.

Historical heritage

Niche Environmental and Heritage has undertaken a Historical Heritage Assessment (HHA) for the Project. This assessment is outlined in Tahmoor South Project Historical Heritage Assessment.

The HHA identified 23 sites within the Subsidence Study Area. These items include "early roads, a mid-to-late nineteenth century homestead, sandstone culverts, a cemetery, numerous timber cottages constructed during the early twentieth century, a railway station, railway bridges and various public buildings including a pub, post office, commercial buildings and a surgery." The majority of these sites are of local significance. One site, the Wirrimbirra Sanctuary is listed on the NSW State Heritage Register and is of State significance for its historical heritage value, research potential, rarity and associative values.

As outlined in the HHA, Wirrimbirra Sanctuary was created in the 1960s to preserve 'Bargo Brush' and promote the use and propagation of Australian native plants. The sanctuary comprises over 200 acres of preserved native bushland, a hut, a well, two rangers' cottages, an office, a bookshop, amenities and a nursery.

The HHA considers both the potential construction and subsidence impacts of the Project, on the historical heritage items identified with the Subsidence Study Area. No impacts are predicted as a result of the construction of surface infrastructure. The study concludes that the potential impacts on historical heritage predominantly relate to indirect impacts from subsidence. Notwithstanding, the Project is expected to have a minimal impact on the historical heritage in the region, with a low to extremely low likelihood of impacts to heritage items if left untreated.

The HHA also includes several recommendations to manage and mitigate the impacts of subsidence on heritage items, these recommendations include:

- Preparing Heritage Management Plans (HMPs) for locally significant heritage items in consultation with land owners and Wollondilly Shire Council; and
- The preparation of a Site-Specific Statement of Heritage Impact report for Wirrimbirra Sanctuary in consultation with land owners and the NSW Heritage Council.

The costs of these steps are included in the subsidence costs, the potential residual impacts are qualitatively acknowledged in this economic assessment.

Visual amenity

Mining projects may impact the visual amenity to the surrounding community by changing the visual character of the surrounding landscape. A detailed visual impact assessment (VIA) has been undertaken to determine the likely visual significance of the Project on the people travelling through or living and working in the area surrounding the Project area. The Tahmoor South Project, Visual Impact Assessment was undertaken by Green Bean Design was undertaken to:

- Assess the existing visual character of the Project
- Determine the extent and nature of the potential visual significance of the Project on the surrounding areas, and
- Identify measures to mitigate and minimise any potential visual impacts.

The VIA was based on desktop study, fieldwork and photography, assessment of visual significance and exploring mitigation measures. The VIA notes that the Project is similar in nature to the existing mining activities located within the Project Area. In addition, due to the tree cover and undulating landform the capability of the landscape to absorb the key components of the Project is considered to be high, reducing the potential magnitude of visual significance.

The VIA concludes the Project alone is considered to have a negligible visual effect and significance. Even where the Project is operating in conjunction with other existing or Projects, it is considered to have a very limited potential to increase the significance of cumulative visual impact.

The VIA also notes that there may be some temporary impacts from construction activities, although, views towards construction activities will be largely restricted by existing tree cover.

Finally, the VIA report proposes a number of mitigation measures to minimise the level of residual visual impacts. These includes,

- Dark-toned structure to minimise reflection and visual contrast
- Reduce the use of large flood lighting
- Landscape mitigation, including tree cover

The costs of these mitigation measures are included in the operating costs of the Project, but are not individually identified.

Loss of surplus to other industries

The Project is not expected to reduce the output in other sectors of the economy operating in the area, and as a result the Project will generate nil loss of surplus to other industries. In general, losses in other sector may arise when resources used in the operation of the Project could be used in other sectors, such as land or water rights.

A detailed agriculture impact statement has been prepared by SLR Consulting that consider these impacts. The Agriculture Impact Statement Tahmoor Mine, Tahmoor South Project (AIS) provides a description of the potential impacts to agriculture. The report considers local climate, hydrology, soil types land use history and water resources. The assessment also includes discussion and analysis of the potential impacts posed by other externalities generated by the Project including noise, air quality, traffic, weed management and biosecurity.

The AIS outlines there are some parcels of land that will be either temporarily or permanently lost to agriculture output. Notably however, there is no land which has been, or is currently used for agriculture, that will be impacted by surface disturbance associated with the Project. Approximately 12 hectares of land will be temporarily lost due to surface disturbance for the additional infrastructure required, including two ventilation shaft sites. SLR Consulting concludes none of this land is currently used or has been used for agricultural production and is either mine disturbed or comprises shallow soils with low inherent fertility.

The AIS also considers the potential impacts from water and water rights. SLR Consulting concludes that surface water flows will have a negligible impact on agricultural enterprises within the region and downstream water quality will not be impacted.

The AIS also considers the Project's groundwater implications and the potential impact to agriculture output, where groundwater entitlements will be purchased from productive agriculture users. Tahmoor Coal advises that these groundwater entitlements exist and will not result in reduced water allocation for agriculture and as a result it is not expected that groundwater will impact agriculture output.

Subsidence

The development involves the construction and operation of underground mining assets and ancillary surface infrastructure. Mine Subsidence Engineering Consultants (MSEC) have undertaken subsidence prediction and impact assessment for the Project. MSEC's analysis concludes the levels of impact and damage to identified natural features and built infrastructure are manageable and can be controlled by the preparation and implementation of a Subsidence Management Plan/Extraction Plan.

The underground operations will generate subsidence impacts to natural features and built infrastructure above and near the longwall panels. As outlined in further detail below, the subsidence attributable to the Project can impact other externalities discussed elsewhere in this report, like Aboriginal and historical heritage, surface water and groundwater.

Tahmoor Coal proposes to directly repair the built infrastructure to mitigate subsidence impacts, including repairing houses, rail lines, roads and other infrastructure. In total Tahmoor has allocated $13.8 million in NPV terms to mitigate against the cost of subsidence impacts. These subsidence mitigation costs are included in the operational costs. The mitigation steps are planned to start in 2023 and will operate for the remainder of the mine plan.

Net public infrastructure costs

As discussed above the Project is expected to generate subsidence that may impact on built infrastructure in the area. Tahmoor Coal has committed to mitigate against these costs, as it does for the existing operation, including those expected impacts to rail, roads, sewers, potable water telecommunications, power and gas. Because of Tahmoor Coal internalising the costs of subsidence mitigation, it is not expected that owners of public infrastructure will be required to undertake further mitigations or repairs.

As a result, we assess the impacts from net public infrastructure costs to be nil.

Residual value of land

In the absence of additional approvals, and as a result of the mining activities currently located on the site of the Project, it is unlikely that further approvals will impact the residual value of land. As such, the residual value of land to be zero.

Appendix B Sensitivity analysis – CBA and LEA

Table 17: Sensitivity analysis of the potential net benefits of the Project (NPV*, $ million**)

	Central Case	Higher Price	Lower Price	Higher Opex	Lower Opex	Higher Capex	Lower Capex	Higher Reservation Wage	Lower Supplier Benefit	Higher Environ. Costs	Worst-case	Best-case	Central Case (4%)	Central Case (10%)
Direct Benefits	$215.0	$316.3	$120.8	$200.1	$229.8	$213.5	$216.4	$215.0	$215.0	$214.8	$128.5	$303.1	$263.8	$177.3
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	$157.8	$203.6	$112.0	$158.3	$157.3	$157.8	$157.8	$157.8	$157.8	$157.8	$111.5	$204.1	$192.1	$131.1
3. Company income tax apportioned	$57.2	$112.7	$8.9	$41.9	$72.5	$55.7	$58.6	$57.2	$57.2	$57.0	$17.0	$99.1	$71.7	$46.2
Indirect Benefits	$450.0	$450.0	$450.0	$482.0	$418.1	$450.0	$450.0	$450.0	$426.7	$450.0	$398.0	$508.5	$541.7	$378.2
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	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$216.9	$259.8	$183.2
3. Net economic benefit to Local suppliers	$233.2	$233.2	$233.2	$265.1	$201.2	$233.2	$233.2	$233.2	$209.9	$233.2	$181.1	$291.7	$281.9	$195.0
Indirect (Environmental costs)	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1	$0.1
Net Benefits	$664.9	$766.3	$570.8	$682.0	$647.8	$663.5	$666.3	$664.9	$641.6	$664.7	$526.3	$811.5	$805.4	$555.4

*Source: EY estimates based on information from various sources. * Estimated as the benefits of the Project case less the Baseline case. ** NPV in 2020 dollars based on a 7 percent real discount rate.*

Table 18: Sensitivity analysis of the potential 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	Lower Supplier Benefit	Higher Environ. Costs	Worst-case	Best-case	Central Case (4%)	Central Case (10%)
Direct Benefits	$4.7	$4.7	$4.7	$5.2	$4.2	$4.7	$4.7	$4.7	$4.7	$4.7	$4.2	$5.2	$5.8	$3.9
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	$4.7	$4.7	$4.7	$5.2	$4.2	$4.7	$4.7	$4.7	$4.7	$4.7	$4.2	$5.2	$5.8	$3.9
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	$132.8	$132.8	$132.8	$137.3	$128.4	$132.8	$132.8	$132.8	$129.6	$132.8	$125.6	$141.0	$159.5	$112.0
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	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$100.3	$120.2	$84.8
3. Net economic benefit to Local suppliers	$32.5	$32.5	$32.5	$37.0	$28.1	$32.5	$32.5	$32.5	$29.3	$32.5	$25.3	$40.7	$39.3	$27.2
Indirect (Environmental costs)	$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
Net Benefits	$137.5	$137.5	$137.5	$142.5	$132.6	$137.5	$137.5	$137.5	$134.3	$137.5	$129.8	$146.2	$165.3	$115.8

*Source: EY estimates based on information from various sources. * Estimated as the benefits of the Project case less the Baseline case. ** NPV in 2020 dollars based on a 7 percent real discount rate.*

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