BIS OXFORD ECONOMICS

GALILEE COAL PROJECT

COST-BENEFIT AND CGE ANALYSIS

MARCH 2022

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March 2022

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BACKGROUND

BIS Oxford Economics (BISOE) has been commissioned by Waratah Coal Pty Ltd ("Waratah") to undertake a Cost-Benefit Analysis (CBA) of the Galilee Coal Project ("the project").

The Galilee Coal Project comprises a new coal mine located in the Galilee Basin, Queensland, approximately 30 km to the north of Alpha in central Queensland in the Barcaldine Regional Council (BRC) local government area.

Waratah proposes to mine 1.1 billion tonnes of "Run of Mine (ROM) coal through the construction of four nine Million Tonnes Per Annum (Mtpa) underground longwall coal mines, two 10 Mtpa open cut pits and two coal preparation plants with raw washing capacity of 28 Mtpa.

The Project is expected to operate for approximately 32 years, with construction starting in 2023, operations commencing in 2025, full operations in 2029 (and running until 2051), and remediation work being undertaken from 2051 to 2054.

Annual Run-of-Mine (ROM) coal production of 55.7 Mtpa (once the operation is fully geared up) will produce 37.9 Mtpa of saleable export highly volatile, low sulphur steaming coal. Note that these results reflect the project outcomes under the assumptions consistent with the New Mine Plan (NMP) outlined in 2021. As detailed in this report, this differs in some respects from the Original Mine Plan (OMP) outlined in 2011 and referred to in the Environmental Impact Statement (EIS) of that year.

The project aims to extract thermal coal for export to South Korea, Japan, Vietnam, Thailand, Indonesia, and China.

FINDINGS

The study compares the revenues from the sale of coal associated with the project to the costs of project construction and operation. A variety of third-party costs (externalities) were also considered.

The scope of the analysis relates to the state of Queensland (Queensland society). Accordingly, costs and benefits were evaluated from this Statewide jurisdictional viewpoint.

The formal scope of this CBA only covers the project mining operations. Transport arrangements (the construction of the rail link and rail and port transport and handling costs) are outside of its formal scope. Nonetheless, results are also presented with such costs included for purposes of comparison.

We find that the project records a positive economic case. Net benefits to Queensland are assessed as $4.1 billion examining mine operations alone (or $2.5 billion if transport costs are included).

The study results are indicated in the figures below.

Fig. 1. Queensland cost benefit analysis results for Galilee Coal Project

Item	Assessed economic value, (Present Value, 7% real) ($m)
Net producer surplus	1,752.5
Royalties	2,010.3
Company income tax (Qld proportion)	217.8
Payroll tax	139.3
Externalities	(31.0)
Net benefit to Queensland	**4,088.8**

Source: BIS Oxford Economics

Fig. 2. Queensland cost benefit analysis results for Galilee Coal Project (including transport links)

Item	Assessed economic value, (Present Value, 7% real) ($m)
Net producer surplus	211.6
Royalties	2,010.3
Company income tax (Qld proportion)	175.8
Payroll tax	150.0
Externalities	(31.0)
Net benefit to Queensland	**2,516.6**

Source: BIS Oxford Economics

In assessing these findings, we note that there remain considerable uncertainties associated with the sale of coal due to recent international concerns about climate change and initiatives to curb the use of fossil fuels. These are separate again to “normal” project risk. With this and other typical risk in mind, we have incorporated a variety of sensitivity tests to examine how changes in a number of variables might affect the project economic case.

1. INTRODUCTION

1.1 BACKGROUND

BIS Oxford Economics (BISOE) has been commissioned by Waratah Coal Pty Ltd ("Waratah") to undertake a Cost-Benefit Analysis (CBA) of the Galilee Coal Project ("the project").

This report is structured as follows

- Chapter 2 presents methodology underlying the CBA
- Chapter 3 measures the Net Producer Surplus (NPS) to the Queensland community from mining operations themselves
- Chapter 4 explores the externalities (third party costs) arising from mining operations
- Chapter 5 reports on the overall CBA results
- Chapter 6 reports on sensitivity tests associated with the project results

1.2 THE PROJECT[1]

The Galilee Coal Project comprises a new coal mine located in the Galilee Basin, Queensland, approximately 30 km to the north of Alpha in central Queensland in the Barcaldine Regional Council (BRC) local government area.

Under current plans (also referred to in this document as the New Mine Plan or NMP) Waratah proposes to mine 1.1 billion tonnes of "Run of Mine (ROM) coal through the construction of four nine Million Tonnes Per Annum (Mtpa) underground longwall coal mines, two 10 Mtpa open cut pits, and two coal preparation plants with raw washing capacity of 28 Mtpa.

The Project is expected to operate for approximately 32 years, with construction starting in 2023, operations commencing in 2025, full operations in 2029 (and running until 2051), and remediation work being undertaken from 2051 to 2054.

Annual Run-of-Mine (ROM) coal production of 55.7 Mtpa (once the operation is fully geared up) will produce 37.9 Mtpa of saleable export highly volatile, low sulphur steaming coal.

Note that these results reflect the project outcomes under the assumptions consistent with the New Mine Plan (NMP) outlined in 2021. As detailed in this report, this differs in some respects from the Original Mine Plan (OMP) outlined in 2011 and referred to in the Environmental Impact Statement (EIS) of that year. The project aims to extract thermal coal for export to South Korea, Japan, Vietnam, Thailand, Indonesia & China[2]. All these countries are parties to the Paris Agreement on climate change.

[1] This description draws on that provided in Waratah Coal (2021), *Draft Environmental Management Plan (EM) Mine*.

[2] We note that there may also be some potential for domestic use. The Galilee Power Station immediately east of the Mine Lease Application (MLA) area is currently undergoing the approvals process. Should the Power Station

The project owners are based in Queensland. Waratah Coal, the project proponent is a privately owned Australian Coal Exploration and Coal development company that is a fully owned subsidiary of Mineralogy Pty Limited (Mineralogy).

Processed coal will either be transported by a new railway system approximately 453 km in length that runs from the Galilee Basin to the existing Port of Abbot Point or transported via the existing railway system to Gladstone ports, with a new rail link connecting the mine to existing rail infrastructure at Alpha. The project proposes to use future or existing coal terminal, stockpiling and loading facilities within the Port of Abbot Point and Gladstone ports.[3] Rail and port transport and handling will be undertaken by third parties.

The formal scope of this CBA only covers the project mining operations. Transport arrangements (the construction of the rail link and rail and port transport and handling costs) are outside of its formal scope. Nonetheless, results are also presented with such costs included for purposes of comparison.

An Environmental Impact Statement (EIS) for the project was released in 2011, with a Supplementary Environmental Impact Statement (SEIS) released in 2013. The Queensland Coordinator-General issued a review of the project in 2013.The project has been approved by the Co-ordinator General with conditions.[4]

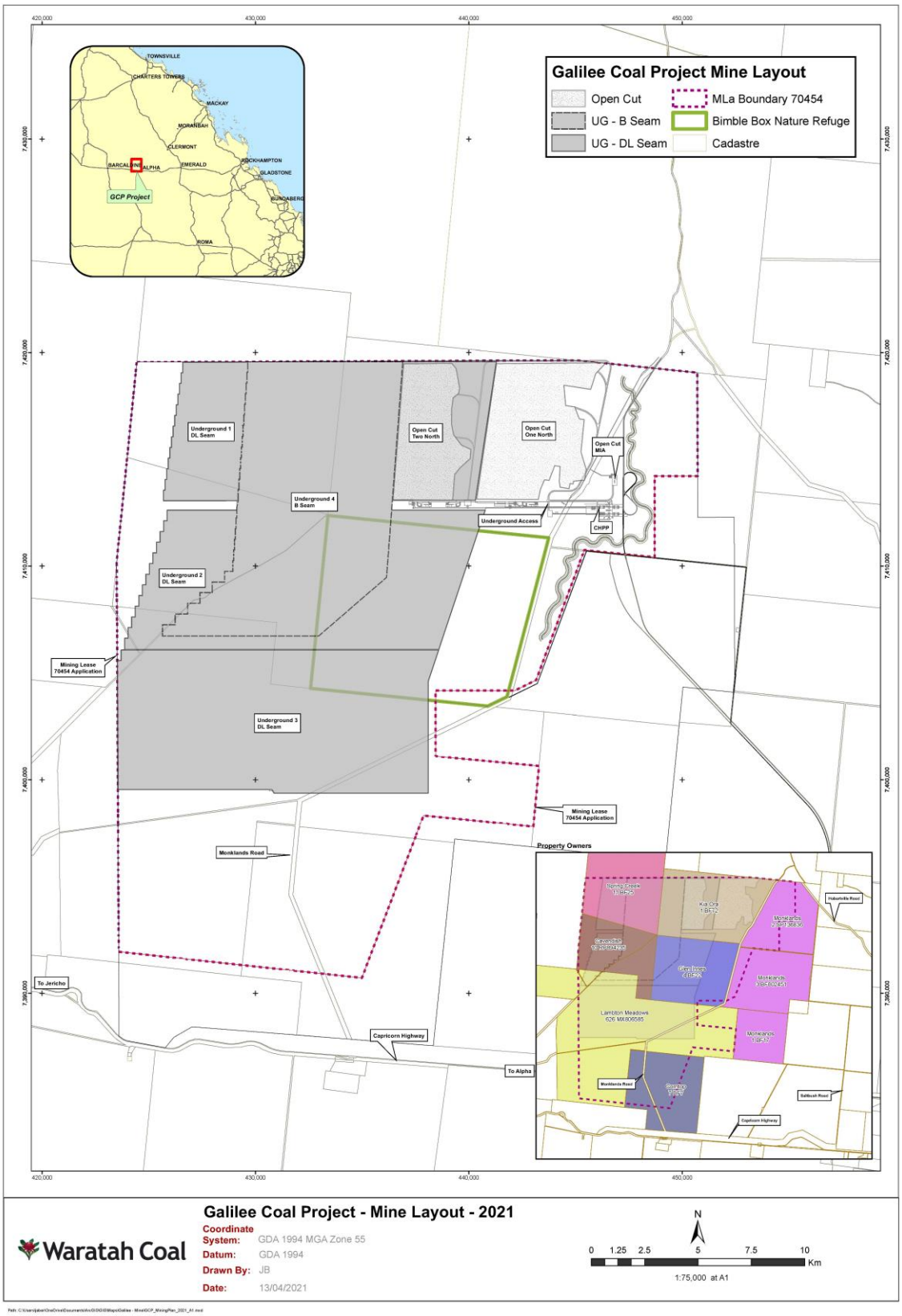
A development of recent note is that Waratah proposes to amend the Original Mine Plan (OMP) described in the EIS and SEIS to forego open cut mining on the Bimblebox Nature Refuge (BNR) and maintain only underground mining in this area. This development is discussed in further detail in the following chapters.

be approved, between 2.4 and 4.8 Mtpa from the mine would be supplied to the Power Station. However, approval is uncertain at present and accordingly we have assumed that the project coal is exported. This assumption was also adopted in James King (2021), *Analysis of Galilee Coal Project* ("the King report").

[3] The Abbot Point State Development Area facilities are the subject of other approvals processes and, as such, are not considered as part of the project, whilst the Gladstone port facilities already have approvals and are in operation.

[4] "Galilee Coal Project (Northern Export Facility)", Queensland Government. https://www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/galilee-coal-project and "Assessment Process Notice: Notification of Publication of draft EIS", Australian Government – Department of Agriculture, Water and the Environment, accessed October 11, 2021. http://epbcnotices.environment.gov.au/referralslist/referral-details/?id=8b737a12-4c67-e511-b4b8-005056ba00ab#.

Fig. 3. Galilee Coal Project Mine Layout map (New Mine Plan)



2. METHODOLOGY

2.1 THE FRAMEWORK OF THIS ANALYSIS

In other jurisdictions such as NSW, specific guidelines for the cost-benefit assessment of mining projects have been developed. These provide a good guide to the analysis of such projects

Queensland does not appear to have a similar set of guidelines specific to the cost-benefit analysis (CBA) of mining operations.

Some broad principles of assessment of mining projects are laid down in Queensland state legislation such as the *Mineral Resources Act 1989 and* the *Environmental Protection Act 1994*.

Section 318AK of the *Mineral Resources Act 1989* refers to the public interest, stating that[5]

The "public interest" is a consideration of each of the following—

(a) government policy;

(b) value of commodity production (including time value);

(c) employment creation;

(d) total return to the State and to Australia (including royalty and rent), assessed on both a direct and indirect basis, so that, for example, downstream value adding is included;

(e) social impacts;

(f) the overall economic benefit for the State, or a part of the State, in the short and long term.

Section 40 of the *Environmental Protection Act 1994* states the following[6]:

40 Purposes

The purposes of an EIS and the EIS process are as follows—

(a) to assess—

> *(i) the potential adverse and beneficial environmental, economic and social impacts of the project; and*
>
> *(ii) management, monitoring, planning and other measures proposed to minimise any adverse environmental impacts of the project;*

(b) to consider feasible alternative ways to carry out the project;

[5] *Mineral Resources Act 1989* – as at 20 October, 2021 at http://classic.austlii.edu.au/au/legis/qld/consol_act/mra1989200/. Accessed 22 November, 2021.
[6] *Environmental Protection Act 1994* at https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1994-062. Accessed 22 November, 2021.

(c) to give enough information about the matters mentioned in paragraphs (a) and (b) to the proponent, Commonwealth and State authorities and the public;

(d) to prepare or propose an environmental management plan for the project; [s 41] Environmental Protection Act 1994 Chapter 3 Environmental impact statements Current as at 9 September 2021 Page 67 Authorised by the Parliamentary Counsel

(e) to help the administering authority decide an environmental authority application for which the EIS is required;

(f) to give information to other Commonwealth and State authorities to help them make informed decisions;

(g) to meet any assessment requirements under—

> *(i) the Commonwealth Environment Act for a project that is, or includes, a controlled action under that Act; or*
>
> *(ii) a bilateral agreement; Note— For what is a controlled action under the Commonwealth Environment Act, see section 67 (What is a controlled action?) of that Act. For assessment requirements of controlled actions, see the Commonwealth Environment Act, chapter 4, part 8 (Assessing impacts of controlled actions). For bilateral agreements, see the Commonwealth Environment Act, chapter 3 (Bilateral agreements).*

(h) to allow the State to meet its obligations under a bilateral agreement.

However, these do not constitute specific guides to the conduct of the CBA itself. It should be noted that a CBA is a quite specific form of analysis which may have a narrower and more technically defined focus than broader public interest tests.

Documentation such as:

- Queensland Government (2015): *Project Assessment Framework*; and
- Queensland Government (2021) Cost *Benefit Analysis Guide: Business Case Development Framework*

lay down some general principles for CBA however and we have adopted these broad principles for this analysis.

We have also adopted the approach laid down in the NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals* (“the NSW Guidelines”) and the *NSW Government (2018) Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*. These constitute a more specific starting point and useful guide to the CBA of mining projects in particular.

A related question is the jurisdiction or society over which the CBA is to be conducted. The NSW Guidelines define the public interest and society as

relating to the households of NSW.[7] Following the NSW Guidelines, we have assumed that (unless otherwise noted in the analysis) the relevant jurisdiction (or society) of interest for the analysis is the State of Queensland. This is consistent with the practice in other jurisdictions such as NSW and the State based (and focussed) nature of legislation such as *Mineral Resources Act 1989* and the *Environmental Protection Act 1994.*[8]

2.2 CBA DEFINITION AND SCOPE

Formally speaking a CBA requires a base case and an option case.

The base case here reflects the situation should the project not proceed. In that case the area will be left undisturbed by the project and existing agricultural, social, economic, and ecological values will not be affected.

In addition, project benefits such as gross revenues (to be divided between proponents and government through royalties and taxation) will not accrue to society.

The option case reflects the impact of the project on these values.

Our contracted scope for the CBA, as agreed with Waratah Coal Pty Ltd, includes the mining operations themselves. It formally excludes the construction of the rail link transporting the coal mined to market and payments to rail and port operators for coal transport and handling. Nonetheless, we have included the capital costs of rail link construction payments to rail and port operators for transport services as a part of a separate panel of results. These results indicate the impact of adding these costs to the total costs of the mining operations themselves[9]. (Note however that these results exclude any externalities associated with rail construction and rail and port operations).

For the purposes of clarity, unless otherwise indicated, we define the "Galilee Coal Project" (or the GCP or "the project") in this CBA as relating to the mining operations only. We refer to "the project plus transport links" when referring to the project results including the rail and transport costs as discussed below.

2.3 OLD MINE PLAN (OMP) AND NEW MINE PLAN (NMP)

The original Environmental Impact Statement (EIS) and Supplementary Environmental Impact Statement (SEIS) included what is now known as the

[7] NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals, p. 1* "Consistent with the approach to evaluations in other areas of State Government decision making, the public interest in these guidelines is focused on the collective public interest of households in NSW." The NSW Guidelines (p.9) also that that "A CBA estimates and compares the total benefits and costs of a project to members of a specified community. These Guidelines consider the community of interest as NSW, requiring benefits and costs to be estimated where possible as those that accrue to the NSW community."

[8] We note that the *Mineral Resources Act 1989* also refers to the "total return to the State and Australia" in the context of its public interest test. The precise meaning of "total return" in the context of the technical requirements of a CBA is not clear. However, we note that many of the project costs and benefits are synonymous with Australian ones in any event (with few costs and benefits accruing to Australia outside of Queensland). The main exception to this would appear to be the division of company income tax revenues as discussed below.

[9] The CGE modelling addresses economic activity from a broader standpoint, including an allowance for construction costs of the rail link with transport operating costs treated as endogenous to that model.

Old Mine Plan (OMP).[10] Subsequent to this, a New Mine Plan (NMP) was developed. As CBA and CGE need a central case to base their analysis on and the supplied financial data for this work, related to the NMP, the NMP has been used as the basis for the current analysis.

However, we have indicated features of both the OMP and NMP below and provided some qualitative discussion of the differences.[11]

2.3.1 Old Mine Plan (OMP)

The OMP, as detailed in the 2011 EIS included the following key features.[12]

- 1.4 billion tonnes of raw coal will be mined from Waratah Coal's existing tenements, Exploration Permit for Coal (EPC) 1040 and EPC 1079.
- Mine development involving the construction of four nine Million Tonnes Per Annum (Mtpa) underground long-wall coal mines, two 10 Mtpa open cut pits. two coal preparation plants with raw washing capacity of 28 Mtpa.
- The annual Run-of-Mine (ROM) coal production will be 56 Mtpa to produce 40 Mtpa of saleable export highly volatile, low sulphur, steaming coal to international markets.
- The two surface mining pits producing 10 Mtpa total will be located in in the B seam resource
- The two surface mining pits producing 10 Mtpa total will be located in the C and D seam resources
- one long wall mine in the B seam producing 9 Mtpa;
- three long wall mines in the C and D seam resources producing 27 Mtpa total;

[10] See Queensland Government, State Development Infrastructure, Local Government and Planning (2011) *Galilee Coal Project's environmental impact statement documents* ("the EIS") at https://www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/galilee-coal-project/eis-documents ; Queensland Government, State Development Infrastructure, Local Government and Planning (2013) *Galilee Coal Project (Northern Export Facility) Supplementary information to the EIS* ("the SEIS") at https://www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/completed-projects/galilee-coal-project/supplementary-info-to-eis

[11] As indicated below, given a fully revised EIS consistent with the NMP is not available, we have referred to the EIS, SEIS and Coordinator General's Report as the basis of the estimating a variety of environmental valuations. However, some additional data relevant to the potential impact of the NMP has been produced during 2021-22. Where relevant and/or where updated data are provided we have incorporated as much of this more recent material as practical and as made available to us at the time of writing. Waratah Coal have indicated to BIS Oxford Economics that the NMP may lessen environmental impacts. See Waratah Coal Pty Ltd (2021), First information Response to BIS Oxford Economics, 8 June 2021.

[12] EIS, Executive Summary, Note we have confined this description to comparison of the mine plans themselves rather than any accompanying transport infrastructure. Key changes relate to the mine plan.

- raw coal stockpiles at the underground mines;
- haulage roads to deliver raw coal from the surface mines to crushing and stockpile facilities;
- three overhead conveyor systems to transport raw coal to the coal processing plants;
- three raw coal stockpiles to feed the coal preparation plants while providing blending capability;
- two coal preparation plants consisting of four 1,000 tonnes per hour (tph) modules each;
- two product coal stockpiles handling product coal to rail load out facilities;
- 8 two railway turning loops each with a single coal load out facility;
- topsoil stockpiles and out of pit overburden spoil sites to create initial surface mining pit space;
- a water management structures Including dams, levee banks and sediment traps;
- tailings dams and coarse spoil disposal areas integrated into the mine spoil pile areas;
- refuelling and maintenance facilities;
- access roads, power lines and other services located in a central services corridor transgressing the entire resource area; and
- a mine office, communications, and associated amenities.

The project was to be developed over three years with an operational life of 30 years.

We also note the corrections to Waratah's response to our second information request in the email from Hall & Wilcox, dated 3 March 2022, which is included in Appendix 1.

2.3.2 New Mine Plan (NMP)

On 6 May 2021 and 7 October 2021 BISOE received details of the New Mine Plan (NMP). Advice received by BISOE about the changes to the project as proposed by the NMP include the following:

- Open cut 1 south from the property known as “Glen Innes” is to be removed
- Open cut 2 south from Glenn Innes is to be removed
- The camp site is removed
- Underground 3 surface facilities from Glenn Innes are removed
- Ramps within final void areas are to be included
- The MLA (Mine Lease Application) area is to be amended to cover Underground 1, 2, 3 and 4 surface facilities, CHPP and Rail load-out
- The mining lease application 70454 boundary is to be amended
- The Malcolm Creek Diversion Channel is to be modified based on inpit/outpit waste facility area

This advice is included in Appendix 1 and Attachment 1.

Under the NMP, saleable coal ramps up to 37.9 million tonnes per annum (Mtpa) in Year 9 (2029) and stays that way till Year 19 (2039). After Year 19, ROM coal production reduces to 24.3 Mtpa until 2051.

Saleable coal totals 761.8 Mt in total over the lifetime of the project which is a reduction from the OMP.

This contrasts to an assumption of 40 Mtpa of saleable coal under the NMP. Total coal volumes under the OMP and NMP over the lifetime of the project are detailed in the figure below.

Fig. 4. Coal volumes

Type of coal	Old Mine Plan	New Mine Plan
Total Coal (ROM) – Million tonnes (Mt)	1,400	1,120.3
Saleable Coal (Product) – MT	1,003.4	761.8

Source Waratah Coal

More formally, as detailed in Waratah Coals 2021 EM Plan, the NMP has the following features[13]:

[13] Waratah Coal Pty Ltd (2021) Draft Environmental Management Plan (EM Plan) Mine

- Two open cut mines comprising:
  - one open cut mine comprising one surface mining pit (North) in the B seam producing 10 Mtpa total
  - one open cut mine comprising one surface mining pit (North) in the C and D seam resources producing10 Mtpa total
- Four underground mines comprising:
  - one long wall underground mine in the B seam producing 9 Mtpa
  - three long wall underground mines in the DU and DL seam resources producing 27 Mtpa total
- raw coal stockpiles at the location of the underground mines
- haulage roads to deliver raw coal from the surface mines to crushing and stockpile facilities
- three overland conveyor systems to transport raw coal to the coal processing plants
- three raw coal stockpiles to feed the coal preparation plants while providing blending capability
- two coal preparation plants with a raw washing capacity of 28 Mtpa
- two product coal stockpiles handling product coal to rail load out facilities
- topsoil stockpiles and out of pit overburden spoil sites to create initial surface mining pit space
- water management structures including raw water and environmental dams, creek diversions, levee banks/bunds, drainage channels and sediment traps
- Tailings Storage Facilities (TSF) and coarse spoil disposal areas integrated into the mine spoil pile areas
- refuelling and maintenance facilities
- access roads, power lines and other services located in a central services corridor transgressing the entire resource area
- a Mine Industrial Area (MIA) incorporating mine support activities such as, rail freight unloading and bunkering, welding shops, light vehicle servicing, specialist maintenance contractors' workshops and offices, warehousing, bulk fuel and other mine consumables storage, tyre fitting and repair, training and conference centres
- facilities including: main workshop, stores, administration buildings, a mine office, communications,
- security building, emergency services building, tyre bay, ancillary mining vehicle workshop, vehicle wash facilities and associated amenities
- fuel, oil, and explosives storage facilities.

While the current modelling approach uses the NMP as the basis of its analysis we have provided an additional discussion of the differences between the OMP and NMP below.

2.3.1 Basis for this analysis

The financial modelling work undertaken by James King (2021) *Analysis of Galilee Coal Project* (and used as the basis for much of the current CBA) takes into account the NMP in its estimation of the project financials.

Of particular material note is the information supplied to BIS Oxford Economics on 6 May 2021 in which it was indicated that open cut operations would not now occur within the area of the Bimblebox Nature Refuge (BNR), technically located on the property known as "Glen Innes". Under the NMP mining will occur in this region but through means of an underground mine. Accordingly, under the NMP, 3,926 ha of originally envisaged open cut clearing within the BNR will not now occur.[14] This is a material change to the OMP (in which clearing of this section of the BNR was to take place to allow for open cut mining operations).

More broadly, we note the 2011 EIS and 2013 SEIS findings but also the proposed changes to operations detailed in the NMP detailed above. We have referred to the EIS, SEIS and Coordinator General's Report as the basis of the estimating a variety of environmental valuations. However, where relevant and/or where updated data are provided we have incorporated as much of this more recent material as practical and as made available to us at the time of writing. This includes material relating to the BNR, the supplementary material relating to the Offsets Plan, Greenhouse Gas Assessment and in the Draft Environmental Management Plan (EM Plan) Mine ("the revised EM Plan") [15]. We have also examined the various supporting documents which have been released in 2021-22 and made available to us during the course of current legal proceedings. These are detailed in the course of the discussions below.

2.3.2 Note on comparing the OMP and NMP

As indicated the basis for this analysis is the NMP. However it is worth summarising some of the key differences between the OMP and NMP.

[14] Correspondence received by BIS Oxford Economics on 6th May 2021 and additional information supplied to BIS Oxford Economics on 8th June 2021

[15] Waratah Coal Pty Ltd (2021) *Offset Plan* ; Waratah Coal Pty Ltd (2021) *Draft Environmental Management Plan Mine ;* ERM Australia Pacific Pty 2021) *Greenhouse Gas Assessment*

Fig. 5. Comparison of OMP and NMP

Item	Old Mine Plan	New Mine Plan
Total Coal (ROM) – Million tonnes (Mt)	1,400	1,120.3
Saleable Coal (Product) – MT	1,003.4	761.8
Mining operations		Open cut 1,2 to be removed Underground 3 surface facilities from Glenn Innes are removed The excavator and three draglines from these pits will be relocated to Open Cut 1 North and Open Cut 2 North The MIA (Mine Industrial Area) area is to be amended to cover Underground 1, 2, 3 and 4 surface facilities, CHPP and Rail load-out Ramps within final void areas are to be included The Malcolm Creek Diversion Channel is to be modified based on inpit/outpit waste facility area
Treatment of BNR	Roughly half the BNR (3,926 ha) would be lost to open cut clearing.	There would be no loss of 3,926 ha to open cut mining. There may be subsidence which would be subject to rehabilitation.
Workforce	2,500 construction personnel with ramp up to 2,000 operational personal over 2 years	2,500 construction personnel with ramp up to 2,000 operational personnel over 4 years

Source Waratah Coal

Diagrams of the OMP and NMP are also reproduced below

Fig. 6. Galilee Coal Project Mine Layout map (New Mine Plan)

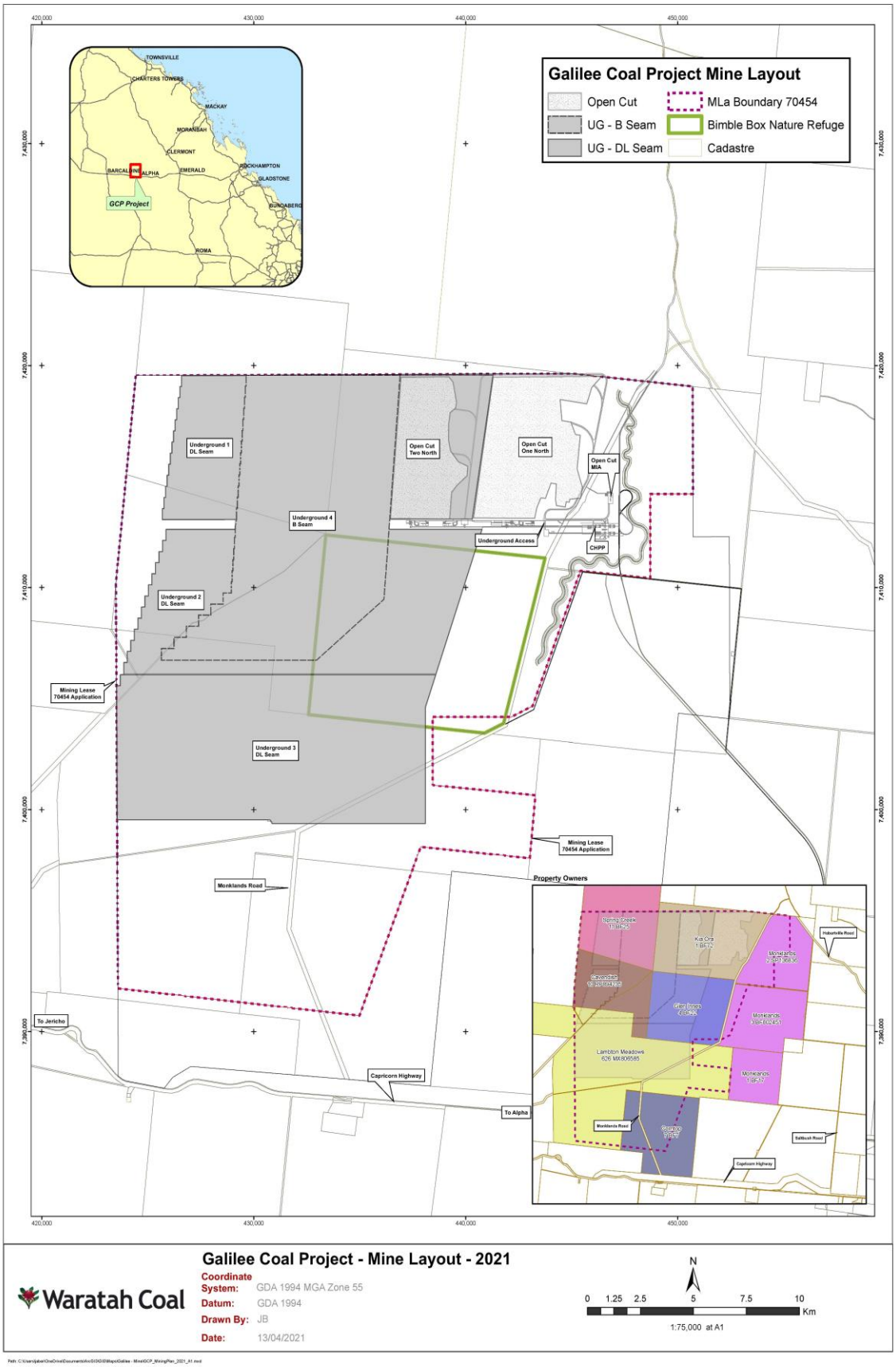
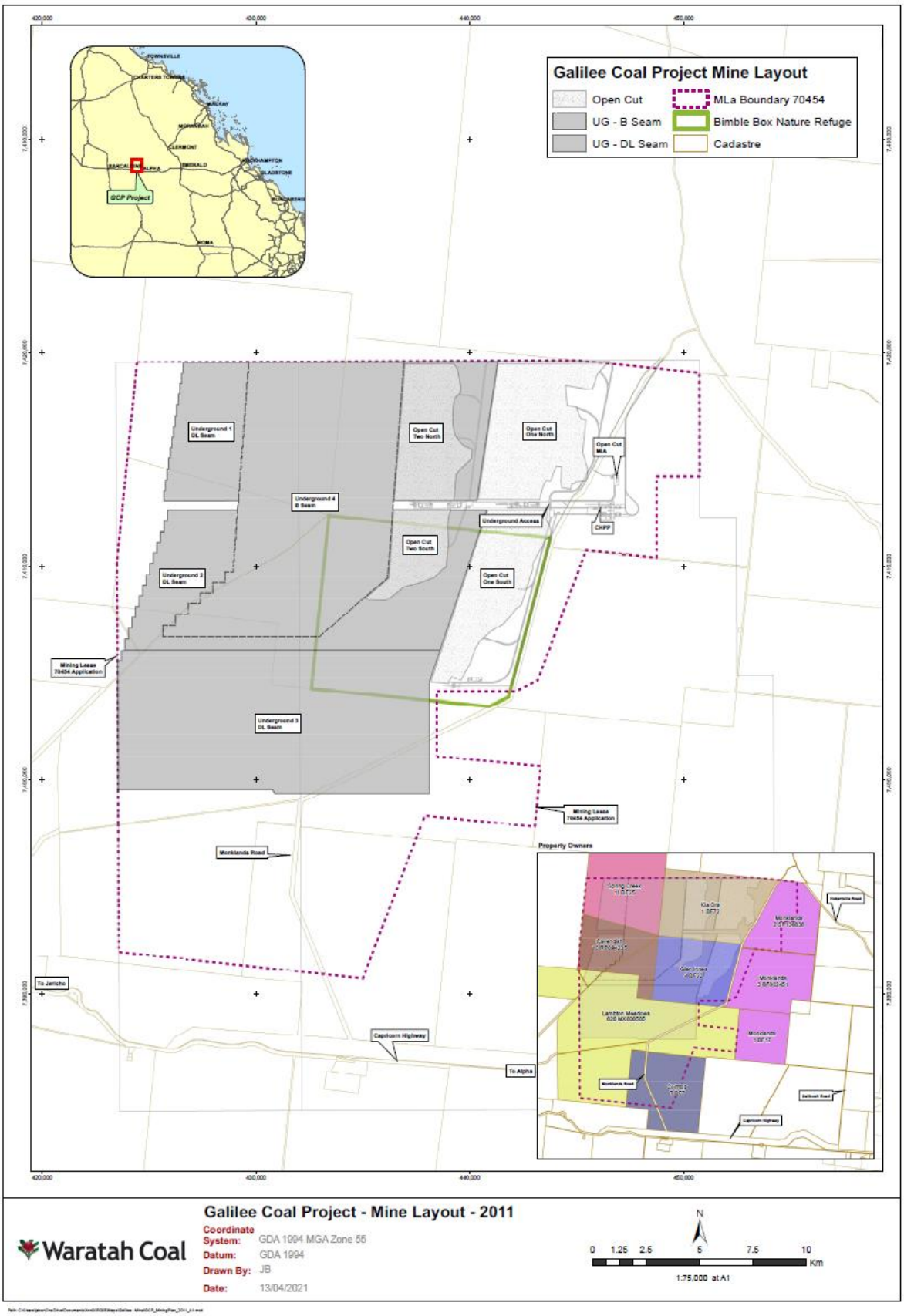


Fig. 7. Galilee Coal Project Mine Layout map (Old Mine Plan)



As indicated a key difference between the OMP and the NMP is that the OMP involves a larger amount of coal being extracted over the life of the mine.

An additional key difference is the treatment of the BNR, and scale of open cut mining operations. Under the OMP open cut mining takes place across a portion of the BNR and 3,926ha of land clearing in the BNR being undertaken under the OMP. This area equates to roughly half of the total area of the BNR.

While we do not have data on the OMP or what its application would be like in the present day we would make the following suggestions on what impact an assessment based on the OMP would have on key variables. Note that an overall caveat on this is that these are only inferences. We would require specific data to enable quantification of such effects: However, under an OMP assessment we infer the following:

- **Costs** - The larger quantity of total coal mined under the OMP could be expected to result in higher operating and capital costs (compared to the NMP).

- **Revenues** - The increased quantity of saleable coal under the OMP s could be expected to increased total project revenues relative to the NMP (everything else being equal).

- **The BNR**- As indicated the OMP would have a much larger impact on the BNR with half the Refuge being cleared for open cut mining operations.

- **Other local externalities** - A larger open cut mining profile under the OMP could potentially impact on externalities such as noise, air pollution and visual amenity, although the materiality of these impacts is uncertain in CBA terms. (Note that while the current assessment is based on the EIS and SEIS which included the original open cut profile of the OMP, we have also discussed these documents in the context of more recent evidence as indicated below.) Conversely Waratah Coal have indicated that the NMP may lessen such impacts.[16]

- **Greenhouse gases** - The larger quantity of coal mined under the OMP could be expected to produce higher GHG emissions and costs

- **Worker accommodation**- The location of worker accommodation at will be in the town of Alpha, as is the case for the NMP (though we note under the original EIS this was to be located in the vicinity of the mine).

While, as indicated, the impact of the OMP has not been formally modelled, it is possible to estimate the cost of the additional impacts on the BNR, using a similar approach to estimating terrestrial ecology and biodiversity below. This is discussed in more detail in that section. However, we estimate if under the OMP mining operations resulted in:

- The loss of 3,926 ha of the BNR

[16] Waratah Coal Pty Ltd (2021), First information Response to BIS Oxford Economics, 8 June 2021

- The loss of one threatened species (assumed to be the black throated finch)
- The loss of 1% of the regional population of two non-threatened species

Then this would result in an additional externality cost of $55.5 million . When combined with other terrestrial ecology externality costs incorporated into the existing analysis, terrestrial externalities then rise to a total of $56.3 million, Note however that the OMP may have a range of other terrestrial ecology externalities outside of the BNR, not accounted for in that calculation..

In terms of externalities in general, as indicated, we have continued to use the EIS and SEIS as a guide to key issues. However, where possible we have supplemented this with more recent information and have also discussed these documents in the context of more recent evidence as indicated below

2.4 PRIMARY MARKETS AND SECONDARY MARKETS (INDIRECT EFFECTS)

The NSW Guidelines allow for the inclusion of some indirect benefits including:

- *Benefits to landowners* – who may be paid an amount exceeding the opportunity cost of their land.
- *Benefits to suppliers* – who may enjoy an increased producer surplus due to supplying the project.
- *Benefits to workers* – who may enjoy a higher wage then the minimum (reservation) wage they would be paid for working elsewhere in the mining sector.

Generally speaking, however, most CBAs do not allow for secondary markets (or indirect effects) and assumes that markets function efficiently. In essence, the traditional basis of CBA is that the primary market of the initiative in question (such as the extraction and sale of coal by the Galilee Coal Project) captures all the material impacts of a given initiative. This principle is set out in standard texts.[17]

Accordingly, and consistent with a standard approach to CBA the current analysis has assumed the following

- *Benefits to landowners* – It is assumed that landowners are compensated for any property acquisition (and/or disruption) consistent with the opportunity cost of the land. Information supplied by Waratah has indicated that there may, in fact, be some premium paid to acquire the land and/or to compensate other owners who may be affected by mining operations.[18] However we note that there may be objections about the acquisition price and/or compensation paid and that the

[17] See Boardman, A., *et. al*. (2008) *Cost-Benefit Analysis: Concepts and Practice* . See also Bureau of Transport Economics (1999). *Facts and furphies in benefit-cost analysis: transport* . This publication reiterates the same principle in a transport context but with wide applicability in infrastructure and other forms of CBA.
[18] Waratah Coal Pty Ltd, 7 October 2021, *Response to Second Information Request for Galilee Coal Project* ("the Second Information Response")

properties have not yet been purchased. In practice we have therefore assumed that the land has been valued at opportunity cost.

- *Benefits to suppliers* – Consistent with the default assumptions of CBA we have assumed that the project will deliver no additional surplus to Queensland suppliers above and beyond what they would have received under the base case. Accordingly, no additional producer surplus benefits to suppliers (beyond the project proponents) have been allowed for.

- *Benefits to workers* – It has been assumed that workers do not receive an additional wage premium above and beyond what they would have received elsewhere in the mining industry and therefore there are no labour surplus benefits. This issue is also discussed below.

Note, however, that allowance is made for a variety of externalities (as distinct from secondary market effects). These are detailed in the relevant chapter below.

On a related point, note that CBA is quite distinct from other types of Economic Impact Analysis (or EIA) such as Computable General Equilibrium (CGE) modelling. CBA can be considered to be a form of partial equilibrium analysis. In addition it is focused on measures of economic *efficiency* (do the benefits of the initiative outweigh its costs to society?) and allows for the inclusion of non-market commodities e.g. noise, pollution. In contrast, CGE is focussed on economic *activity* and market outputs such as employment and GDP. [19]

As its name suggests CGE can allow for general equilibrium effects as well as dynamic effects A CGE has also been separately undertaken and the results are documented separately to this report. BIS Oxford Economics commissioned the Centre of Policy Studies (CoPS) at Victoria University Melbourne in order to undertake this work.

Material furnished to CoPS in order to undertake this work includes:

- James King (2021) *Analysis of Galilee Coal Project* ("the King report") and accompanying spreadsheet.
- BIS Oxford Economics draft Galilee Coal Project: Cost Benefit Analysis (December 2021) and the accompanying spreadsheet
- Waratah Coal (2021) *Draft Environmental Management Plan (EM Plan) Mine*
- Waratah Coal's responses to the first, second and third information requests

We have provided a brief discussion of the CGE results in the final chapter of this report.

2.5 WAGE PREMIUMS AND UNEMPLOYMENT

The NSW Guidelines make the starting assumption that labour has a zero wage premium (i.e. that labour working for a mining project will not receive a

[19] The distinctions between CBA and EIA are also noted in Queensland Government (2021) *op. cit.*

higher wage than it would receive working for another mining project). However they do allow for the *possibility* that labour may have a positive wage premium (sometimes also referred to as a labour surplus or benefits to workers).

In essence, the wage premium could reflect the higher productivity associated with a given mining project. However, in practice, the tests set down by the NSW Guidelines for proving that a positive wage premium exists are stringent ones.

Accordingly, and given the lack of any evidence to the contrary, this CBA assumes a zero wage premium for the GCP – i.e. there are no additional benefits to workers from the project.

A working assumption of CBA is that labour is an opportunity cost in the first instance. Just like land and capital, the use of labour for the project means that it now cannot be used elsewhere in the economy. The use of labour for a project such as the GCP therefore constitutes an opportunity cost.[20]

Standard CBA therefore commences from the relatively conservative position that labour is fully employed, unless it can be proven that a given project or initiative will indeed employ substantial numbers of unemployed workers. Accordingly, we have not allowed for any additional benefits from the employment of workers as a part of the CBA. Should such evidence emerge it could be incorporated into the analysis.

2.6 LOCAL AREA AND DISTRIBUTIONAL ISSUES

As indicated the CBA is undertaken at the State (Queensland) level. Accordingly the effects measured are from the State-level perspective rather than a local area perspective *per se.* The key issue for the CBA is how the project affects Queensland society as a whole.

This is relevant in considering its findings. For example revenues from the project may be distributed throughout Queensland as a whole rather than within the local area both through proponent earnings and royalties. Likewise, from a Statewide perspective, the costs of the project (such as the call on land, labour and capital resources) will represent a cost to Queensland as a whole rather than just being incurred in the local area.

The CBA differs in this respect from the CGE analysis. The CGE analysis undertakes assessment at both the local area and State levels.

Distributional issues are a related question. In the first instance, CBA is a form of efficiency as opposed to equity (or distributional) analysis. Its concern is whether society as a whole is better off from a given project rather than how the gains will be distributed within society.

These issues are interconnected with the primary and secondary markets discussed above. For example, there has been discussion in the EIS and SEIS about the impacts of the project on housing markets in the local area. However,

[20] In this context note the comment in Queensland Government (2021) *Cost Benefit Analysis Guide: Business Case Development Framework, Further guidance*, p.17 “A common trap is counting costs as benefits e.g. the use of resources such as labour is often counted as an employment benefit. However, this almost always has a cost (i.e. an opportunity cost) if such resources can be used elsewhere in the economy.”

from the perspective of a CBA this is a local, distributional issue involving a secondary market (housing), not an issue about whether Queensland society is better off due to the project in net economic welfare terms at the Statewide level.[21]

2.7 QUALITATIVE ISSUES

Related to the above are qualitative or social issues. Some of these were identified in the EIS and SEIS. These might include the effects on small towns such as Alpha arising from an influx of workers. For example Chapter 16 of the EIS has identified concerns such as the increased potential for domestic abuse and drug use from sudden population movements.

While there is some debate on the monetisation of social impacts, in the main these are typically dealt with through qualitative analysis. We note that this has already been undertaken in Volume 2, Chapter 16 and Appendix 23 of the EIS and Volume 1, Chapter 12 and Appendix 30 (the Social Impact Management Plan) of the SEIS.

Nonetheless, note that there has been some allowance for the increased call on government resources due to issues such as population shifts, mainly through the potential need for the establishment of new facilities. This is detailed in the discussion of externalities below.

2.8 TERMS, VALUES AND TIME PERIOD

Unless otherwise indicated, all terms and values are in real Australian 2021 dollars and are expressed in Present Value (PV) or Net Present Value (NPV) terms. Conversions from US dollars to Australian dollars have been made at a constant rate of 1.33, consistent with the King report. A 7% real discount rate has been used consistent with Queensland Government guidance.[22] An analysis period of 2021-2054 has been used for the purposes of the analysis.

2.9 OVERVIEW OF CBA

An overview of the costs and benefits assessed in the CBA is provided in the figure below.

[21] See also *Ibid*, p.5. This notes that “The CBA should be at a whole-of-system, whole-of-state level, with the entire liability to the state.”
[22] Ibid

Fig. 8. CBA cost and benefit components

Item	Benefit component	Cost component
Net producer surplus	Gross mining revenue	Capital costs
		Operating costs
		Land acquisition and compensation costs
		Make good costs
		Rehabilitation costs
		Local contributions
		Company tax
		Payroll tax
		Royalties
Royalties	Royalties payable to Qld government	
Payroll tax	Payroll tax payable to Qld government	
Externalities		Terrestrial ecology and biodiversity
		Groundwater*
		Surface water*
		Aquatic ecosystem*
		Air quality
		Noise*
		Waste*
		Visual amenity*
		Indigenous heritage*
		Non-indigenous heritage
		Traffic and transport*
		Additional government and community investment
		Greenhouse Gas Emissions (Scope 1 and 2)

Source: BIS Oxford Economics

*Indicates qualitative factor or no additional quantifiable cost (incorporated into existing project costings).

3. PRODUCTION COSTS AND BENEFITS

3.1 BACKGROUND

This section deals with the production costs and benefits relating to the operations of the project.

The data inputs for the analysis presented in this section of the report are derived primarily from James King (2021) *Analysis of Galilee Coal Project* ("the King report") and accompanying spreadsheets.[23]

However, we have also had reference to a number of other reports, particularly in reference to applying these base values in the King report to various sensitivity tests given concerns about the future of the coal industry and coal exports. These sensitivity tests are detailed in Chapter 6 of this report. Selected other data used in the report include:

- Official review documentation such as the EIS, SEIS and Queensland Coordinator General's Report ("the CGR")[24]
- Waratah Coal's (2021) *Draft Environmental Management Plan (EM Plan) Mine* ("the 2021 EMP")
- Waratah's responses to information requests made by BISOE (the Frist, Second and Third Responses to Information Requests).
- The world coal price (steaming coal) data series from the Oxford Economics Global Economics proprietary databank.
- Various data from the Australian Bureau of Statistics (ABS).
- *World Energy Outlook 2021* published by the International Energy Agency (IEA)

Other than our proprietary data series, Oxford Economics 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 or volumes demanded, sensitivity analyses have been conducted to test the robustness of the assessment to these key inputs.

[23] King (2021) *op. cit.* Note that the King report is a financial analysis, and these are typically undertaken in nominal (inflation adjusted) terms. In contrast economic analysis such as the CBA in this report is undertaken in real terms at constant prices. Nonetheless, the King report also includes constant price data and we have used this in our calculations.

[24] The State of Queensland, Department of State Development, Infrastructure and Planning, (2013) Galilee Coal project (Northern Export Facility) Coordinator-General's evaluation report on the environmental impact statement ("the CGR")

3.2 MINING OPERATIONS

The period covered by our analysis of the GCP is the 34 years from 2021 to 2054. Land acquisition and construction will take place over the period 2023-2028 with coal output commencing in 2025 and ending in 2051. End of surface mine rehabilitation will take place over the period 2052 to 2054 although the mine will carry out progressive rehabilitation over the lifetime of the project.

We note the following based on the analysis presented in the King report, which is consistent with the NMP.

The project is designed to extract 1.12 billion tonnes of coal to produce about 761 million tonnes of saleable coal over the project lifespan.

Annual production will ramp up to 37.9 Mtpa of saleable coal by 2029 and will remain at this level till 2039. From 2040-2051 it will reduce to 24.3 Mtpa of saleable coal ROM coal will total some 55.7 Mtpa during the period 2029-2039. This will be supplied from mining of approximately 20 Mtpa of raw coal from two open pit mines and mining of 36 Mtpa from four underground mines

As noted in the King report, the relevant coal deposits are at suitable depth for open pit mining for part of the resource and for underground longwall mining for a separate part. The coal will be processed at the mine site in a coal preparation (washing) plant that will be developed to produce a saleable thermal coal product

Specifications of the coal to be mined are shown in the figure below, as reported in the King report.

Fig. 9. King report: Project specifications

Item	Units	Project coal			Newcastle base grade coal	
		B 4800	*DU 5500*	*DL 5750*	*6000*	*5500*
Ash	%	20.00	10.00	6.40	20.00	20.00
Energy	kcal/kg	4800	5500	5750	6000	5500
Energy	GJ/tonne	20.10	23.03	24.07	25.12	23.03
Base price	US$ per tonne				85.00	65.00

Source: King (2021)

The King report notes that:

> *Compared to the average of major Australian thermal coals, the saleable (final) coal product of the project would have moderate ash content, relatively low sulphur, and energy content ranging from 4800 to 5750 kcal/kg*[25]

[25] King (2021) *op. cit.*

3.3 PRODUCTION COSTS AND BENEFITS

The following analysis sets out the estimates underpinning the costs and benefits associated with the project, including capital expenditure, output, price assumptions, and operating cost estimates. These assumptions are used to estimate the net producer surplus associated with the project.

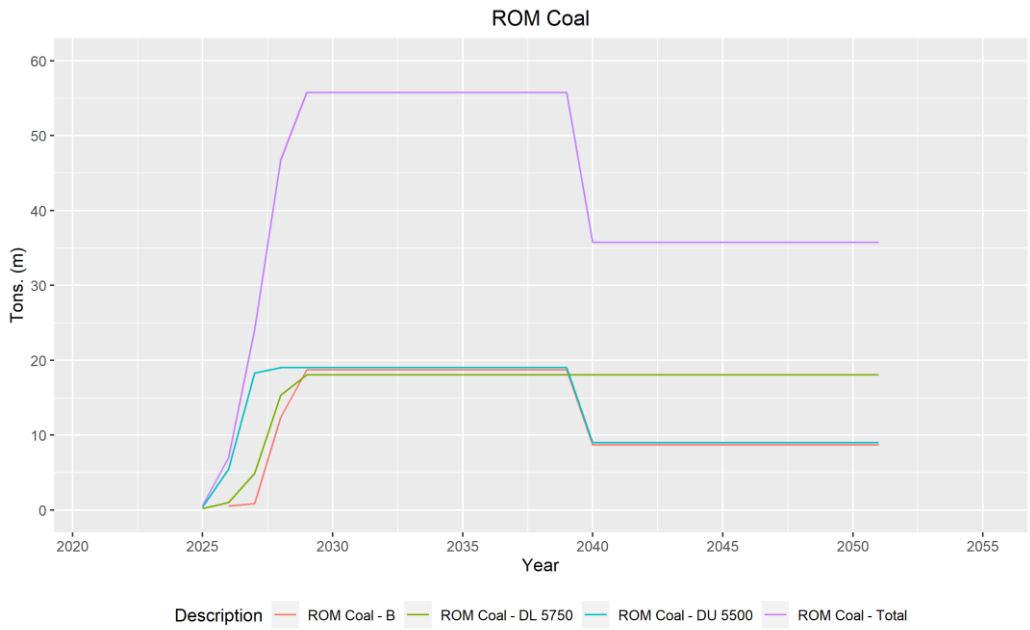
As indicated, the scope of our analysis technically excludes the capital and operating costs of the rail link and transport costs associated with the project. Nonetheless, the King report includes data on the costs associated with the rail link and we have presented the results in addition to those of the mine itself.

3.3.1 Production Assumptions

The estimated production figures for the project are sourced from the King report and Waratah and are summarised in the figure below. Production is expected to be 1,120.34 Mt of ROM coal during the period 2025 to 2051, under the current mine schedule. Construction and development is expected to take place over the period 2023 to 2028. Mining itself commences in 2025 and ramps up over several years. After 2028, extraction rates plateau to 55.7 Mtpa of ROM coal (37.9Mtpa of saleable coal) before declining to 35.7 Mtpa of ROM coal (24.3Mtpa of saleable coal) in 2040 until the end of project operations in 2051.

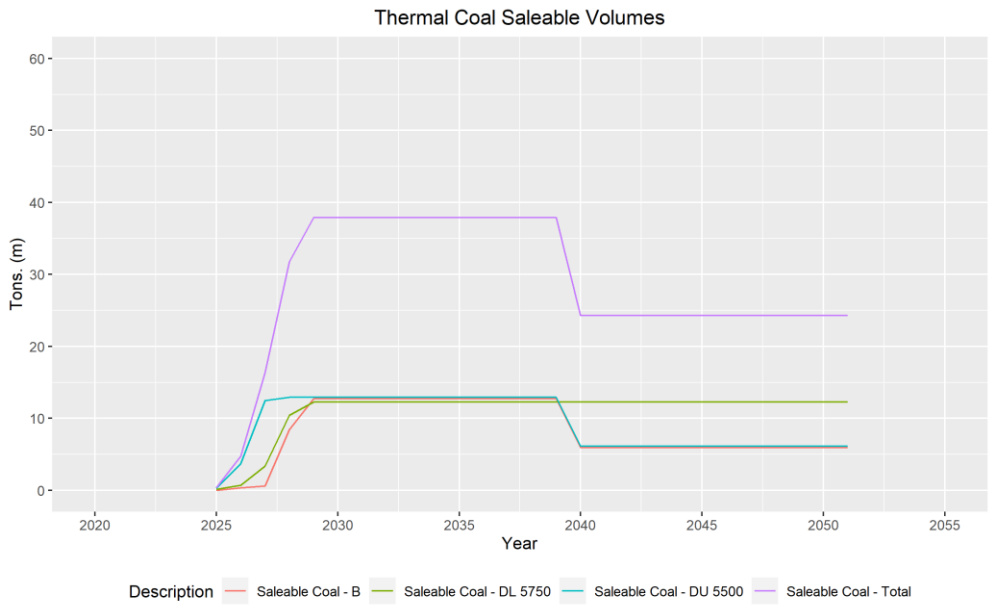
All of the expected saleable coal output is expected to be thermal coal.

Fig. 10. ROM coal production 2025-2051



Source: King (2021)

Fig. 11. Saleable coal 2025-2051



Source: King (2021)

3.3.2 Price Assumptions

Prices from the King report have been used as the basis of the analysis.

As per that report, the prices include allowance for the differential grades of coal being mined (and the proportion of such coal being mined relative to the total). Namely:

- Grade B 4800 coal is estimated to trade at an average 26% discount to Newcastle base grade 6000 coal
- Grade DU 5500 coal is estimated to trade at an average 14% discount to Newcastle base grade 6000 coal
- Grade DU 5750 coal is estimated to trade at an average 10% discount to Newcastle base grade 6000 coal

Using this basis over the life of project mining operations (2025 to 2051) the thermal coal price for the project's saleable coal is estimated to average approximately A$ 95 per tonne in real terms.

There is however considerable debate over global demand (and prices for coal) given current climate change initiatives along with other potential uncertainties. We have recognised this by exploring a number of price and volume sensitivity tests in chapter 6 of this report. When considering price changes, these tests apply different base price levels adjusted for the coal grade prices discounts indicated above.

In particular, percentage increases and decreases of price levels of up to +/- 30% have been supplemented by additional sensitivity tests, using forecasts of coastal China prices from the latest edition of the *World Energy Outlook* from the International Energy Agency (IEA), based on their Stated Policies Scenario

(STEPS), [26] announced pledges scenario (APS),[27] and net zero emissions scenario (NZE).[28]

3.4 DIRECT NET BENEFITS

3.4.1 Projected Revenue and Project Financials

Based on the data outlined above, the Project is expected to generate real revenue over its life of just over $72.632 billion in undiscounted real 2021 Australian dollars. This result reflects coal output of 761,828 tonnes over the lifetime of the project and an average price of $95.34/tonne in real terms. This equates to $25.5 billion in PV terms.

3.4.1 Residual value of capital and land

No allowance has been made for the residual value of capital or of land as a part of the project assessment.

3.4.2 Capital Costs

Major capital investment is to take place between 2023 and 2028, which corresponds with the large capital outlays for the coal preparation plants and underground mining infrastructure.

Over the period of the project the total capital expenditure of the mining operations (excluding rail construction costs) is $4,823.0 million in real 2021 undiscounted dollars. This equates to $3,520.7 million in PV terms. If transport costs are included, capital costs rise to $4,665.2 million in PV terms.

Although no specific replacement costs are allowed for as a separate line item, capital sustaining costs have been incorporated in operating costs.[29]

3.4.3 Land acquisition and/or compensation payments

In addition to the capital costs cited above, land acquisition costs of $100 million in undiscounted terms will also be incurred in the course of the project. The Second Information Response indicates that the land acquisition figure of $100 million includes all property purchase and compensation payments (totalling $55 million) as well as payments for offset land totalling $45 million). This equates to $87.3 million in PV terms in total (assuming acquisition occurs in 2022).

[26] According to the IEA, the STEPS "reflects current policy settings based on a sector-by-sector assessment of the specific policies that are in place, as well as those that have been announced by governments around the world." IEA (2021) *World Energy Outlook*, *2021*, p. 27.

[27] The AP scenario "assumes that all climate commitments made by governments around the world, including Nationally Determined Contributions (NDCs) and longer term net zero targets, will be met in full and on time". *Ibid*, p. 27.

[28] The NZE scenario sets out a narrow but achievable pathway for the global energy sector to achieve net zero CO2 emissions by 2050. *Ibid*, p. 27.

[29] As described in Waratah Coal Pty Ltd, 7 October 2021, *Response to Third Information Request for Galilee Coal Project* ("the Third Information Response").

Under the NMP four properties will be purchased (Kia Ora and three Monklands properties) while compensation for disturbance will be paid to four others (Spring Creek, Cavendish, Lambton Meadows and Glenn Innes). In addition, a property previously marked for purchase (Corn Top) will not now be purchased.[30]

A further discussion of land acquisition issues is provided in the chapter dealing with externalities.

3.4.4 Mine operating costs

Based on the King report, mine operating costs are estimated to be $9,980.3 million in PV terms. If transport costs are included, operating costs rise to $16,653.8 million in PV terms.

3.4.5 Other costs

Apart from the mine operations itself, other costs include make good provisions of $29.3 million, rehabilitation expenses of $20.7 million, and local contributions of $1.0 million (all in PV terms).

3.4.6 Royalties

Royalties for the extraction and sale of coal over the lifetime of the project have been estimated at $2.0 billion in PV terms. These royalties were estimated by applying current Queensland royalty rates to the annual estimated coal prices per tonne of saleable coal, detailed above and in the King report.[31]

Fig. 12. Royalties by project coal grades

Estimation of royalties by coal type				
Estimate	**B**	**DU 5500**	**DL 5750**	**Total**
Coal production (Mt)	323.88	360.47	435.99	1,120.34
Saleable coal (Mt)	220.24	245.12	296.47	761.83
Gross mining revenue ($)	18,469.49	23,864.23	30,298.67	72,632.39
Total royalties ($ PV, 7% discount rate)	484.69	716.48	809.09	2,010.26

Source: King (2021) and BIS Oxford Economics

Note: BI Oxford Economics estimates based on information provided in the King report. All AUD amounts are NPV in 2021 AUD, based on a 7% real discount rate.

[30] Second Information Response, *op. cit*. The Second Information Response refers to three properties being compensated but correspondence received by BISOE 8 June 2021 indicates that an additional property, Lambton Meadows will also receive compensation.

[31] For a description of these see "Mineral royalty rates", Business Queensland, accessed 27/09/2021, https://www.business.qld.gov.au/industries/mining-energy-water/resources/minerals-coal/authorities-permits/payments/royalties/calculating/rates and "Public Ruling MRA001.2 Determination of coal royalty", Queensland Treasury, 4 January, 2021, https://www.treasury.qld.gov.au/resource/mra001/.

3.4.7 Company tax

Company tax payments made to the Australian Government are levied on the profits generated under the project. The King report uses a company tax rate of 30% to estimate the tax payments made to the Australian Government under the assumption that all the profit generated by the mine is subject to company tax in Australia. Additional deductions are also made for depreciation as well as a deduction for loan interest payments.

We have adopted the estimates made in the King report into the current analysis. As some of the depreciation deduction relates to the rail link, we have removed this component of the tax deduction in our assessment of the project mining operations only (but have retained it in the assessment of the project with transport links).

Company tax has been estimated at $1,076.3 million in PV terms. If the rail link is included, this falls to $869.2 million (as more depreciation is claimable as a tax deduction).

3.4.8 Payroll tax

In addition to company tax, payroll tax will also apply to the project. Although the King report does not allow for such tax, we have undertaken an assessment of it for purpose of this report.

Queensland payroll tax is levied at 4.95% for employers who have a wage bill exceeding $6.5 million.

Employment data provided by Waratah as a part of the First Information Response to BISOE indicates that some 2,500 personnel will be involved in the construction of the mining facilities in 2023-2024, and 1,000 in 2025.[32] The mining workforce will increase from 500 in 2025 to 1,000 in 2026-2027 and 2,000 from 2028 to the end of operations in 2051 with 50 people employed doing residual work 2052-2056.

While a breakdown of wage data was not provided, ABS data indicating the average weekly ordinary time earnings in the mining sector ($139,064) and in the construction sector ($88,145) as at May 2021 has been applied to mining and construction workforce number respectively to generate a project wage bill.[33] The Queensland government's Final Liability Payroll Tax Calculator has been used to determine payroll tax payable across the lifespan of the project.[34] This was estimated at $375.5 million in real terms or $139.2 million in PV terms.

Allowance was also made for the addition of the railway workforce (1,000 personal over the years 2023-25) in the "project plus transport costs" assessment. [35] This brings total payroll tax to $150.0 million in PV terms.

[32] Waratah Coal Pty Ltd (2021), First information Response to BIS Oxford Economics, 8 June 2021

[33] ABS (2021) Average Weekly Earnings, Australia May 2021

[34] See "Final Liability Payroll Tax Calculator" http://amun.osr.qld.gov.au/sap/osrqld/wd_prt_calc_adj# accessed 26 November 2021.

[35] EIS, Appendix 24, p.vi

3.4.9 Net Producer Surplus to Queensland

The net producer surplus (NPS) of the project represents the private benefit, generated by the initiative.

As indicated, we have followed the NSW Guidelines in order to assess the project's net producer surplus and allocate its value to Queensland.

The process adopted was as follows:

- Assess project revenues
- Assess project costs – i.e. capital, land acquisition and operating costs (including environmental remediation costs, rehabilitation costs and local contributions)
- Assess taxes (company tax and payroll tax)
- Assess royalties

Project costs, taxes and royalties were deducted from project revenues to derive a net producer surplus.

The Second Information Response indicates that the project owners are based in Queensland. It further indicates that all project revenue flows would be retained in Queensland other than revenue flows to contractors and their employees, the majority of which will be retained in Queensland.

The NPS would therefore be retained in Australia.

However, the NSW Guidelines stipulate that any Australian producer surplus must also be allocated according to a state population share. Given the data provided in the Second Information Response, it may be that a large portion of the producer surplus is indeed retained in Queensland itself. Nonetheless we have followed the NSW Guidelines as a conservative approach to estimation and allocated the Australian NPS according to Queensland's population share to derive the Queensland NPS.

The share of the NPS attributable to Queensland was therefore determined by allocation of the Australian NPS by Queensland's national population share (20.2%). This produced a NPS of $1,752.5 million in PV terms. If the transport component of the project is included, this falls to 211.6 million in PV terms.

This result is indicated below. Note that the NPS is not the final net benefit to Queensland society as a whole. This is calculated in Chapter 5 when state taxes and royalties, along with the State share of Federal company tax are added back to the NPS along and externalities are included to produce a net benefit to Queensland for the project.

Fig. 13. NPS to Queensland

Item	$million (PV)
Total benefits	**25,533.1**
Gross mining revenue	25,533.1
Total Costs (ex tax and royalties)	**13,639.4**
Capital costs	3,520.7
Mine operating costs	9,980.3
Make good expenses	29.4
Rehabilitation expenses	20.7
Purchase costs for land	87.3
Local contributions	1.0
Tax	**1,216.2**
Company Tax	1,076.9
Payroll Tax	139.2
Royalties	**2,010.3**
Royalties	2,010.3
Net producer surplus	**8,667.2**
Qld. share of population	**20.2%**
Value of net producer surplus attributable to Qld.	**1,752.5**

Source: BISOE estimates based on data provided by Waratah Coal. Figures are reported on 2021 NPV AUD based on a 7 percent real discount rate.

Fig. 14. NPS to Queensland (including transport links)

Item	$million (PV)
Total benefits	**25,533.1**
Gross mining revenue	25,533.1
Total Costs (ex tax and royalties)	**21,457.4**
Capital costs	4,665.3
Mine and transport operating costs	16,653.8
Make good expenses	29.4
Rehabilitation expenses	20.7
Purchase costs for land	87.3
Local contributions	1.0
Tax	**1,019.2**
Company Tax	869.2
Payroll Tax	150.0
Royalties	**2,010.3**
Royalties	2,010.3
Net producer surplus	**1,046.3**
Qld. share of population	**20.2%**
Value of net producer surplus attributable to Qld.	**211.6**

Source: BISOE estimates based on data provided by Waratah Coal. Figures are reported on 2021 NPV AUD based on a 7 percent real discount rate.

4. EXTERNALITIES

4.1 INTRODUCTION

In addition to the project costings mentioned above there may be additional costs to society arising from the project's operations. These are considered below.

4.2 LAND ACQUISITON AND AGRICULTURAL IMPACTS

4.2.1 Background

The mine site lies some 30km north of the town of Alpha. The mine site is currently largely cattle grazing land, although 25% of the mine footprint is classified as Nature Refuge and Conservation Area (the Bimblebox Nature Refuge or BNR). Land tenure consists of a mix of leasehold and freehold land along with forest reserves. Registered Native Title Claims (RNTCs) affect 90% of the proposed mining lease area.[36]

Crown land under leasehold tenure comprises 55% of the land within the proposed mining lease. These leases would be revoked once the mining lease is granted.[37]

The original EIS also indicated that areas required for the operation of the mine will be disturbed and that land acquisition will be required in order to proceed with open cut mining and the installation of infrastructure in particular. Mining operations will therefore require the acquisition of land in order to proceed. The EIS states that four allotments of land within the lease are freehold and would require compulsory acquisition or sale in the event that the project proceeds.[38] (Note that land acquisition requirements have changed under the NMP, as indicated below).

Generally speaking, the market value of land should represent the opportunity cost of that land given that alternative uses are forgone for the duration of the project. In this case the (commercial) alternative use value would consist of agricultural activity (grazing). The sale price of the property would normally represent the agricultural use value which is forgone in order for the project to proceed.[39]

We also note the following in respect of acquisitions:

- The original EIS indicated that the proposed mine site was located on eight beef cattle properties (one of which was managed as a wildlife refuge with sustainable cattle grazing – i.e. the BNR). Project infrastructure and open cut mining was to be placed on three of the properties with four properties to be acquired in all. Underground

[36] EIS Vol. 2, Chap. 4, pp.142-146

[37] EIS Vol.2, Chap 4., p.153

[38] EIS Vol.2, Chap 4., p.153

[39] This is also implicitly referenced in the EIS, Volume 2, Chapter 4, , p.153. Note that environmental usage and valuation is discussed elsewhere in this report.

mining would occur on the remaining properties with far lesser physical impacts.[40]

- The other properties would overlie underground mining and existing land uses such as grazing could largely continue within the proposed mining lease.[41] There may be some physical impacts through the construction of power, water channels and access road facilities with impacts on the relocation of existing property infrastructure and the fragmentation of grazing lands. There may be some subsidence though this will be monitored. Impacts associated with changed grazing will be addressed through relocation or construction of new infrastructure. Compensation will be provided to properties on the mining lease.[42]

- Mitigation and management measures will also be put in place to minimise local disruptions.[43]

- Cattle enterprises on the mining lease and their neighbours will benefit from improved power and communications and piped water should there be a reduction in water quality.[44]

- The mine may also affect other households near the mine footprint. Waratah will undertake negotiations with landholders near the mines footprint to minimise disruption.[45]

- Neighbouring properties may be impacted to some degree by dust, noise, vibration, and visual amenity impacts and those in close proximity could have some decline in agricultural productivity. However mitigation and rehabilitation efforts will reduce such impacts. Such properties will also be offered some financial compensation and may have access to improved power and communications.[46]

- Average subsidence of up to a maximum of 1.3m to 1.6m across the mine site may occur although this could reach 3.27m at some points. This could result in a change in drainage patterns and some cracking in clays. There is also potential for increased soil erosion and some potential for soil contamination through soil disturbance and/or chemical spillage into soil and waterways through mining operations. Waratah has committed to management and mitigation efforts to deal with these issues including appointment of a third party reviewer to assess contaminated land. [47]

[40] EIS Vol 2, Chap 16, pp. 395-396.
[41] EIS Vol. 2, Chap. 4, pp.153
[42] EIS Vol. 2, Chap. 4, pp.155 ; EIS Vol.2 , Chap 16 p.396
[43] EIS Vol. 2, Chap. 4, pp.154
[44] EIS Vol.2 , Chap 16 p.396
[45] EIS Vol. 2, Chap. 4, pp.153
[46] EIS Vol.2 , Chap 16 p.396
[47] EIS Vol. 2, Chap. 3, pp.134-138. We also note subsequent evidence on issues of subsidence and contamination, discussed below and in particular the *Joint Statement of Evidence to the Land Court of*

- As indicated above, the Second Information Response provides additional updated data in respect of property acquisition and compensation.

- Under the NMP four properties will be purchased (Kia Ora and three Monklands properties) while compensation for disturbance will be paid to four others (Spring Creek, Cavendish, Lambton Meadows and Glenn Innes). Glenn Innes overlies the Bimblebox Nature Refuge (BNR). In addition, a property previously marked for purchase (Corn Top) will not now be purchased.[48]

- Waratah notes that one of these properties (Spring Creek) was sold at an average price of $432/ha. It has used $1,500 per hectare as the purchase price for the four properties to be acquired. Compensation for disturbance to the other three is to be paid at $500/ha (i.e., the full per hectare value of the Spring Creek.). Landowners will be able to stay and work on properties for which compensation is offered. Both purchase and compensation costs are therefore at a substantial premium according to Waratah's Second Information Response. The total amount of acquisition and compensation costs equates to $55 million.

- In addition, 24.237 ha of offset land (purchased at a cost of some four times Spring Creek's value or $2,000/ha) will be purchased. After rounding by Waratah, the cited purchase price was $45 million.

- Land acquisition (and compensation) costs of $100 million in undiscounted terms will therefore be incurred This equates to $87 million in PV terms in total (assuming acquisition and compensation occurs in 2023).

4.2.2 Coordinator-General Report findings

In 2013, the Queensland Coordinator-General undertook a report on the EIS and SEIS ("the CGR"). making the following commentary in respect of land related issues[49]

4.2.2.1 Land and soils

In terms of land and soils the CGR noted that:

Queensland on Subsidence Impacts by Dr Ross Seedsman and Dr Philip Pells, 6 January 2022 (COM 0065.0001)

[48] We note the qualifications contained in *Affidavit of Nui Bruce Harris*, 21 June 2021 (WAR 0291.001), paras 103-107 and para 245. These indicates that these arrangements are subject to successful property compensation and purchase negotiations with affected landowners. In the event that such negotiations are not successful, the mine plan can and will be amended to avoid operations on restricted lands.

[49] Queensland Government (2013) Galilee Coal Project (Northern Export Facility) *Coordinator-General's evaluation report on the environmental impact statement* August 2013, p.53-57

An assessment of good quality agricultural land and land suitability determined that no good quality agricultural land or strategic cropping land existed within the mine area.

…Under the DME 1995 land suitability guidelines, the mine area land is classified as Class 4 -5, marginally suitable or unsuitable for agriculture. The area is currently used for cattle grazing on native and improved pasture together with nature conservation in the case of the BNR. Waratah has committed to rehabilitate the area for beef cattle grazing at the completion of mining.

Going on to note in respect of soils and land suitability that :

I am satisfied that the mitigation and management strategies outlined in the EIS, SEIS and EM Plan will allow impacts to be suitably managed

And in terms of rehabilitation in general that

I am satisfied the mine decommissioning and rehabilitation proposal has been outlined to a degree that will allow effective closure of mine operations and transfer to other land uses. The SEIS has adequately addressed issues raised in the EIS comment period by evaluating relevant case studies of successful rehabilitation of open-cut mines and management of post-mining landscapes. Specific criteria for decommissioning and rehabilitation success will need to be detailed in the Mine Closure Plan and draft EM Plan for all mine components, considering the results of ongoing rehabilitation monitoring, trials and research programs. Waratah has committed to preparing a Landscape Rehabilitation Plan in consultation with relevant Government agencies and the local community as well as a Rehabilitation and Decommissioning Plan. I have stated a condition in Appendix 1, Schedule F requiring the preparation of a rehabilitation management plan.

4.2.2.2 Subsidence

In terms of subsidence, the CGR noted that:

The SEIS reports that the total area to be affected by subsidence may be in the order of 34 000 ha over a 30-year mine life period. This impact area is confined principally to non-remnant vegetation (improved pasture) and 'least concern' remnant vegetation, with a small area of 30 ha of 'of concern' vegetation in the north-west of the site.

Potential subsidence impacts could include redirection of surface flows, ponding, surface tension cracking, soil erosion, water quality and groundwater impacts. All of these effects have the potential to impact surface ecological values….

The SEIS proposed that types of remedial works would include ripping and compacting compression cracks and creating run-off outlets from internally ponded areas formed through panel subsidence. The remedial works would extend to post subsidence blanketing and compacting of some water courses, preventing inflow of run-off into underground mining areas and maintaining environmental surface flows. Materials which have been investigated for use in compacted blankets include silty alluvium and impervious clay. On completion of remedial works, land will be returned to grazing or original activities

Going on to note that:

I am satisfied that Waratah has properly investigated the likely levels of subsidence associated with its underground mining operations. I note its commitment to implement a subsidence management strategy to manage the effects of subsidence.

4.2.3 Expert Report of Dr Pells

Updated evidence on the impacts of subsidence was provided in the *Expert Report of Dr Philip Pells* (YVL 0285,001) dated 29 November 2021.

This work indicated that:[50]

- Maximum total subsidence above individual mines will be higher than in previous subsidence reporting work (undertaken in March 2013) and may range from 1.2-2.3m for Mines 1 and 2. Subsidence could reach 2.5-5m above Mine 4.
- Differential subsidence (as opposed to total subsidence) could be less than that estimated in the March 2013 work
- As indicated by Dr Seedman (see below) subsidence cracks could be much greater than the maximum of 20mm referred to in the SEIS and could reach 150mm.
- These cracks may be many tens of metres deep. Fracturing will also occur.
- Abiotic and biotic components of the ground above long wall mines would be affected by the cracking and fracturing. However he cannot say with certainty what the impacts on vegetation, animals, sub-terranean creatures and watercourses might be.
- Given surface cracking extends many tens of metes, ripping and compaction to a depth of one metre cannot remediate damage to soils and underlying weathered rock.
- The adaptive management measures outlined in the existing Subsidence Management Plan (contained in WAR 0194.0001) are ill-defined and cannot be implemented to address existing or future environmental damage.

4.2.4 Expert Report of Dr Seedsman

Additional evidence on the impacts of subsidence was also provided in the *Statement of Evidence to the Land Court of Queensland on Subsidence impacts* by Dr Ross Seedsman (WAR 0442,0001) dated 5 November 2021.

This work indicated that:[51]

- Maximum vertical subsidence has been adequately estimated, but the estimate of the subsidence above chain pillars is too low. The impact on the surface water flows is likely to be less than considered in the SEIS. The magnitude and extent of surface cracking in has been underpredicted.

[50] YVL 0285,001 pp.10-14
[51] WAR 0442,0001 pp.2-3

- The vertical extent of longwall fracturing has been under-predicted and is likely to extend to the surface for all mining depth. The dominant impact on the BNR will be the formation of surface cracks which will be wider than considered in the SEIS, however the habitat will not be destroyed. The thickness of the Rewan Formation is not as important as the presence of the Clematis Sandstone above the proposed longwalls.

- The conditions relating to subsidence are included in Schedule F of the Draft Environmental Authority (Draft EA) and all relate to a Subsidence Management Plan. Subsidence Management Plans such as the one outlined in conditions F26 – F35 are appropriate to manage subsidence impacts and enabling administering authorities to assess performance.

- The proposed conditions regarding a Subsidence Management Plan are sufficient for a mature mining district where there has been knowledge of subsidence established by earlier mining.

- Subsidence Management Plans are somewhat reactive and what is possibly needed are some more proactive components.

- The dominant impact will be surface cracking along the edges of each extracted longwall panel. To return the surface back to its current usage - cattle grazing - will require surface ripping, compaction, and seeding. Some self-repair is possible (after rainfall) but the hazards to cattle and the workforce presented by the larger cracks will require specific intervention by the mine. An offset mining layout would reduce but not eliminate these hazards.

- The Draft EA is adequate for surface subsidence impacts. It is noted that there is a condition (*C58: no impact to groundwater levels within the groundwater aquifers defined in Table C13: Groundwater Quality and triggers and Limits is to occur other than where authorized under an approval of the Water Act 2000)* which should allow adequate management of the groundwater impacts.

- The whole habitat of the Bimblebox Nature Refuge will not be destroyed. The subsidence impact will result in the formation of surface cracks that may result in some limited damage to vegetation.

4.2.5 Joint Expert Report of Dr Seedsman and Dr Pells

The *Joint Statement of Evidence to the Land Court of Queensland on Subsidence impacts* by Dr Seedsman and Dr Pells (COM 0065.0001) dated 6

January 2022 sought to jointly examine the subsidence issues.[52] The following were key findings:

This work indicated that:[53]

- The predictions of subsidence magnitude above the central parts of the longwall panels are reasonable although probably on the low side of the likely range.
- The predictions of subsidence above the chain pillars between adjacent longwalls are too small.

- Physical damage to the ground (subsidence damage) is understated in the EIS and SEIS.

- Maximum subsidence measurements will be greater than given in the EIS and SEIS, but differential subsidence will be significantly less.

- Subsidence impacts at the surface this will include open tension cracks which may extend downwards for many tens of metres, but which could be clogged with soil in-wash with the passage of time and rainfall. Between this surface zone and the coal seams the rock mass will been cracked as a result of the longwall extraction but the cracks will have been closed to some degree.

- There is a high probability that the tensile surface, and near surface cracking, would cause substantial physical damage: to
    - 1) buildings, sheds and concrete water tanks
    - 2) roads,
    - 3) dams
    - 4) bores, cased or non-cased

- Their expertise does not extend to assessment of the effect s of decreased near surface moisture and increased soil suctions on flora and fauna.

- Given that subsidence comprises lowering of the ground surface by between 2 m and 4 m, and subsidence damage includes cracking and dilation of the rock strata, areas impacted by subsidence cannot be returned to their previous physical and chemical situation.

- However, given that outside the BNR land use has already been substantially altered by grazing and infrastructure. appropriate earthworks, and remedial work on infrastructure, can return such areas to their pre-mining uses.

- They do not have expertise to determine the extent to which surface cracking represents a hazard to the flora and fauna. However, if

[52] Joint Statement of Evidence to the Land Court of Queensland on Subsidence impacts by Dr Ross Seedsman and Dr Philip Pells 6 January 2022, (COM 0065.0001)
[53] *Ibid*, pp.10-13

mitigation is required the machine earthworks used for the cleared lands are unlikely to be compatible with the environmental values of the BNR.

4.2.6 Bill Thompson evidence

An additional expert report, *Individual Statement - Soils, Land Use and Rehabilitation* (WAR 0499.0001) authored by W.P. (Bill) Thompson, and dated 21 January 2022 also considered a variety of subsidence, contamination and rehabilitation issues relevant to the project including the BNR.[54]

This indicated that further information was required on soils in order to develop various management plans. It indicated that existing data was not fit for purpose to adequately develop management plans aimed at providing rehabilitation of the mine site to its former condition.[55] It also called for the development of a subsidence management plan prior to the commencement of operations before conclusions could be reached on the nature of the post-mine landscape. However, it stated that given access to adequate soil and land use data, subsidence and rehabilitation plans should be adequate.[56]

It went on to indicate that [57]

- the requirement to leave affected land conditions as per pre mine should be achievable
- offsets under the OMP may need to be retained in order to offset lesser areas of vegetation impacted under the NMP
- subsidence on existing pasture lands can be remediated using existing pastureland management methods
- effects on vegetation in the BNR will vary with offsets needing to cover this vegetation loss
- Where BNR vegetation remains intact in contrast to the advice of other subsidence experts drawdown of available soil moisture will not negatively affect vegetation

In addition, it went on to note: [58]

- Subsidence would be limited to the long wall mining area within the MLA where topsoil and subsoil management as required under the draft EA would minimize impact with land conditions and soil quality equal to pre mine conditions, given adequate rehabilitation periods.

- As groundwater levels will decline due to mining there will be limited potential for the release of contaminants to topsoils and subsoils through watertables.

[54] Individual Statement - Soils, Land Use and Rehabilitation W.P. Thompson, 21 January 2022 (WAR 0499.0001)
[55] *Ibid*, p. 4, pp.20-21
[56] *Ibid*, p. 4, p.19
[57] *Ibid*, pp.4-5
[58] Ibid pp. 13-17

- The BNR will experience some loss of vegetation as a result of rehabilitation activities, though the extent of this is uncertain

- As the BNR will no longer be affected by open cut mining, and the effects of long wall mining are less then open cut the original offset arrangements should be sufficient under the NMP.

4.2.7 Our assessment

We have assessed these issues as follows:

- As indicated, data provided to BISOE through Waratah indicates that the four purchased properties will be compensated at a rate of approximately $1,500 per ha while compensation will be payable to others at a rate of approximately $500/ha. [59] (We note these rates are slightly lower after rounding down by Waratah).

- By way of context, we note the median sale price of rural land in the Barcaldine Regional Council (BRC) area in 2019 was $317 per ha.[60]

- As indicted, only four properties would need to be acquired for the purposes of the mine while agricultural activity could continue on four others (albeit with some disruption) as they would lie atop underground mining activity.

- We have adopted the $100 million in land acquisition costs (including compensation and offset costs). As indicated these rates may be at a premium price (given Waratah's information described above). However, we have assumed they represent full opportunity costs (and noting that the properties have yet to be acquired some landowners may object to prices or compensation offered).

- In addition, Waratah indicates a post-mining residual value of $27.5 million for the four acquired properties.[61] The Second Information Response indicates that this represents their value at the end of the project (in notional terms).

- However, we have omitted the $27.5 million in residual land value at the end of the project. This is consistent with the King Report's exclusion of residual capital values.

- The King report also notes undiscounted costs of $180 million for land remediation work (to take place from 2052-54) and undiscounted make good costs for water and soil remediation of $80 million (in total for both). These are allowed for in our estimates in the preceding chapter.

[59] Communication received by BISOE 8 June 2021
[60] Rural Bank (2020) Australian Farmland Values 2020: Queensland
[61] Communication received by BISOE 8 June 2021

- We have generally assumed (with the caveat noted below) that any other costs associated with issues such as subsidence, potential contamination, erosion and other impacts on agricultural productivity and commercial operations are covered through Waratah's management and mitigation measures (which in turn will be incorporated into capital and operating costs). This is in accordance with advice received from Waratah by BISOE as well as the conclusion of the CGR which accepted that Waratah's measures were adequate.[62] Waratah Coal's (2021) revised *Draft Environmental Management Plan (EM Plan) Mine* also outlines such measures.

- Likewise, (also as indicated by Waratah and consistent with the CGR's findings) rehabilitation measures and make good provisions are assumed to cover the above costs (along with groundwater, environmental and other issues discussed in the following chapters).[63]

- Impacts on surface and groundwater are discussed in the following sections. The make good provisions of $80 million apply to both soil and groundwater while the remediation measures and are also relevant to remediation of environmental impacts

- However, we caveat the above (and these figures) by noting in particular, the subsidence issues raised by the recent expert evidence given above. These include arguments that the extent of subsidence will be higher (in some respects) then that estimated in the EIS/SEIS ,questions about the ability of any management plan to provide remediation measures, along with questions about the impact of subsidence on vegetation in areas such as the BNR.

- Against this however is the statement in COM 0065.0001that man-made structures and agricultural land could be successfully rehabilitated . Bill Thompson's evidence would appear to suggest the same in principle (though calling for better soil data in order to make practical management plans). Thompson's evidence also noted that BNR vegetation would not be affected by moisture drawdowns (while acknowledging some uncertainties about the effect of subsidence on BNR vegetation).

- Balancing these issues, we suggest that the subsidence costs incorporated into this report's management, mitigation, rehabilitation and make good measures be treated as preliminary and subject to further confirmation. In particular, as suggested by Thompson, an additional subsidence management plan may be required before final costings can be confirmed.

[62] CGR pp.56-57; Communication received by BISOE 8 June 2021; Second Information Response. Note that we do allow for additional environmental externalities as a sensitivity test in discussing ecological values below.
[63] Ibid

- In addition, we have also allowed for impacts of additional losses to the BNR due to subsidence (or other reasons) in our discussion of the BNR below through the use of sensitivity tests. Sensitivity tests relating to higher capital and operating costs presented later in this report may also be seen as inclusive of issues such as additional subsidence costs (among other issues).

- We have explored the issues of air and noise pollution, visual amenity and heritage impact externalities in the sections below.

We have summarized our approach to property and related land impact costs in the table below. This is intended for completeness only. As indicated, these costs have already been incorporated (i.e., internalized) into the mine production costs in the previous chapter.

Fig. 15. Summary of approach to property acquisition/compensation, make good and remediation costs ; other potential land impacts

Item	Assessed economic cost , undiscounted ($m)	Comments
Land (acquisition including compensation and offsets)	$100	Full opportunity cost of all land covering the mine site, regardless of whether it is purchased or compensation paid. Also incorporates the value of offset land purchases ($45 million). Information from Waratah indicates the land was purchased at a premium but we have conservatively assumed it equates to full opportunity cost.
Residual value of land	-	Residual value of purchased properties assessed at $27.5 million post project – excluded from assessment consistent with residual capital exclusions.
Remediation costs	$180	Also covers environmental remediation as noted below
Make good soil and groundwater arrangements	$80	Covers both soil and groundwater make good costs
Air and noise pollution, visual amenity, heritage impacts	See below	Costings contained in relevant sections below
Other costs (subsidence, contamination, erosion, productivity impacts)	-	Assumed to be incorporated into project operating and capital costs as per advice from Waratah and broadly consistent with CGR acceptance of Waratah's measures. We note the findings of the various expert reports and that additional subsidence planning work may be required before these costings can be confirmed.

Source: BIS Oxford Economics

We also note that:

- some landowners have previously indicated the proposed purchase price is not sufficient compensation; and/or
- there have been arguments that the mining operations will adversely affect agricultural land outside the immediate area of the acquisition properties

We are not able to independently verify the veracity of these arguments. However, we note Waratah's comments regarding the payment of premium

prices for land acquisition and compensation and the median sale price of rural land in the BRC cited above.[64]

Sensitivity tests (of up to +30%) in a separate chapter also explore the impact of higher project costs and externalities in general. These would incorporate some potential for additional risks and costs above and beyond those costed in the analysis.

4.2.8 Other impacts

As noted above there may be air pollution, noise, dust, and visual amenity impacts on properties not directly acquired by Waratah for open cut operations and/or on neighbouring properties. We have discussed these issues in the relevant chapters below.

4.3 TERRESTRIAL ECOLOGY AND BIODIVERSITY

Connected to the issue of land acquisition above is the issue of the project's impacts on local ecology and biodiversity.

The project is located within the Desert Uplands bioregion. This bioregion encompasses an area of about 70 300 km^2 with vegetation consisting mainly of eucalypt, acacia woodlands and spinifex. Much of the area is under leasehold and is used for cattle and sheep grazing. There are no Nationally Important Wetlands or Wetlands of International Importance within the area of the proposed mine.[65]

The EIS noted a total mine open cut and clearance footprint of14,600 ha under the OMP, 69% of which is located on buffet grass of low ecological value.[66]. It called for the clearing of 4,594.68 ha of remnant vegetation within the Desert Uplands (or 0.3% of the vegetation extent within the total bioregion).[67] This included 3,926 ha (or 52%) of remnant vegetation within the Bimblebox Nature Refuge (BNR).[68] Considerable concerns were expressed at the time of the EIS and SEIS about the loss of roughly half the BNR, in particular. Additional concerns were expressed about the threat to the Black-throated finch (BTF) in particular given an established sighting in the BNR. This species is listed as endangered.[69]

The EIS noted that no *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed, Threatened Ecological Communities (TECS) or *Vegetation Management Act 1999* (VM Act) Endangered or Of Concern communities would be impacted by the mine.

[64] Waratah Coal Pty Ltd, 7 October 2021, *Response to Second Information Request for Galilee Coal Project*
[65] CGR p. 23
[66] EIS Vol. 2, Chap 6 p.209
[67] EIS Vol. 2, Chap 6 pp. 187-188
[68] *Ibid* p.190.
[69] *Ibid* p.184

While noting that clearance would involve 4,595ha of Least Concern remnant vegetation, it indicated that It stated that the clearance would have high impacts on:[70]

- RE 10.3.27 listed as Of Concern under Department of Environment and Resource Management (DERM) Biodiversity Status
- RE 10.3.32 listed as Least Concern under both the DERM Biodiversity Status mapping and the VM Act
- The large-podded tick-trefoil
- The BNR; and
- The Desert mouse

The large-podded tick-trefoil in particular is listed as a near-threated species under the NC Act. Some 21-33 individuals were located within the mine clearance footprint, equal to over half the population within the study area. The closest known other populations were 50 km distant from the site.[71] We note that EIS calls for a Significant Species Management Plan for the large-podded tick-trefoil along with the use of offsets.[72]

In addition the clearing was deemed to have Medium Impact on a variety of other Regional Ecosystems and species including the BTF (if breeding at the time of clearing).[73]

The EIS noted a range of proposed mitigation measures, stating that while the mine would have large impacts on the large-podded tick-trefoil, desert mouse and BNR, this would be managed through mitigation plans and offsets.

4.3.1 Mitigation, offsets and rehabilitation

The EIS commits to a variety of mitigation measures for flora and fauna during construction and operation. It also refers to a Mine Rehabilitation and Closure Plan and a Significant Species Management Plan for the large-podded tick-trefoil.[74] It also commits to a Biodiversity Offset Plan .

In the case of the BNR the EIS notes that offsets are required for unavoidable loss under Commonwealth and Queensland legislation under the *Environmental Protection and Biodiversity Conservation Act* 1999 and the Queensland Governments Environmental Offsets Policy (QGEOP), 2008. A number of key offset principles are committed to including the use of like for like offsets and location within the vicinity of the BNR. The EIS also states that a BNR offset will be twice the total BNR area (16,000 ha) with the intent it becomes a future protected area. [75]

The EIS indicated that Waratah would undertake a Mine Rehabilitation and Closure Plan including 70% cover of native and introduced flora species within each stratum as occurring on adjoining reference sites of the same land use

[70] *Ibid* p.109
[71] *Ibid* pp. 175-176
[72] *Ibid* p.206
[73] *Ibid* p.209
[74] *Ibid* p.206-8
[75] *Ibid* pp. 208-210

type and 70% of habitat features on adjoining reference sites of the same land use/faunal habitat types [76]

Based on data supplied to BISOE by Waratah indicates that expenditure of $180 million (undiscounted) is also committed to end of mine life rehabilitation (from 2052-54) though this work may cover a variety of purposes apart from terrestrial ecosystem restoration *per se*.[77]

4.3.2 CGR conclusions

It is worth considering the findings of the CGR in quantifying the costs associated with the project in terms of ecology and biodiversity. In reviewing the EIS and the SEIS the CGR noted the following in respect of flora, fauna and the BNR.

4.3.2.1 Flora

Direct clearance of 4,595 ha of remnant vegetation is estimated which is confined to the 'least concern' category under the VM Act. Subsidence may also impact up to 34 000 ha of remnant vegetation over the life of the mine

I acknowledge that indirect impacts to vegetation communities may also arise from subsidence of areas overlying the underground component of the mine. The extent of these impacts is difficult to quantify at this stage. However, I accept the EIS findings that these impacts are likely to be minor, localised and largely confined to 'least concern' communities and previously cleared areas and can be effectively monitored and managed through an adaptive subsidence management plan in accordance with State guidelines.

In regard to listed threatened flora species under the NC Act, I am satisfied that impacts will likely be confined to a limited number of populations of 'near threatened' large-podded tick-trefoil plants on the BNR although it is accepted that other listed species may be encountered.[78]

4.3.2.2 Fauna

I consider that the EIS and SEIS adequately identify likely impacts on native fauna. An extensive amount of survey effort by both Waratah and other parties has identified 15 threatened species under the NC Act and/or the EPBC Act that either do occur or could reasonably occur within the study area and surrounds and could be impacted. These impacts could be significant at the immediate local level as native vegetation habitat is progressively cleared from east to west in advance of mining. However, whilst habitat will be removed from cleared areas, significant habitat will remain in adjacent areas that will continue to provide habitat, albeit at lower value. Subsidence may also result in some losses in the longer term. I conclude that connectivity with native vegetated areas to the west and south-west will not be compromised but the existing disjointed connectivity to riparian areas to the north-east will be further compromised by the diversion eastwards of Lagoon Creek.

[76] *Ibid* pp.206-207
[77] Correspondence received by BISOE 8 June 2021.
[78] CGR p.33

I consider that the proposed mitigation and management measures including a commitment to rehabilitate to pre-existing conditions as far as practicable, are appropriate to manage impacts and that the long-term viability of species or their geographical distributional range is not threatened

On the question of the BTF, I note that extensive survey activities undertaken in the study area since 1998 by Government agencies, consulting ecologists and Birdlife Australia have failed to detect the species, apart from a single reported sighting in May 2011 by a member of Birdlife Australia. On balance, having regard to this earlier survey effort and the follow up survey work undertaken by the proponent immediately post sighting, I support the finding in the SEIS that the reported flock sighted is unlikely to be part of any resident or breeding population in the local region. I do not discount the possibility however that the flock may have been momentarily in the area following the earlier favourable wet season.

Waratah has outlined and committed to implement a range of mitigation measures that I believe will adequately manage impacts to native fauna…

The proponent has also committed to offset the extent of disturbed primary habitat of threatened fauna species as part of its offset proposal[79]

4.3.2.3 BNR

Through the EIS process, Waratah has assessed the values of the BNR, identified impacts, proposed mitigation measures and committed to provide compensation for significant residual impacts by way of offsets. I am satisfied that the work has been properly conducted and that project alternatives to avoid and minimise impacts to the BNR have been considered…

…On the information before me, the value of the BNR lies not so much in the individual flora and fauna values, which in themselves are not considered of outstanding value or are unique, but in the value of a relatively large tract of intact native vegetation, native fauna habitat and its educational and research value. I note that while the BNR is mapped as being of 'state significance' under the DEHP Biodiversity Planning Assessment, the bulk of the Desert Uplands Bioregion has such a classification…I am also mindful that flora and fauna ecological values similar to those on the BNR exist on nearby properties such as Lambton Meadows, Corntop and Saltbush together with others further to the west and east of the mining site and elsewhere in the bioregion.

On balance, I recognise the values of the BNR but do not consider them sufficiently high or unique to find that the project should not proceed in the interest of saving the BNR. I do however, recognise the loss that would result from the disturbance of the BNR and will require Waratah to compensate the State for the lost biodiversity, conservation and educational values by including in its offset proposal a direct offset area of at least the size of the BNR and of at least equivalent ecological value capable of being secured as a nature refuge or higher conservation tenure. DEHP has advised me that suitable offset areas exist, some of which have significantly higher ecological values. Waratah has

[79] CGR, p.34

committed to provide an offset area twice the size of the BNR (16 000 ha), should this be required by me.[80]

4.3.3 Assessment

The following facts are relevant when considering these issues:

- Based on the OMP the CGR suggested that flora and fauna impacts would be modest, and managed through offsets and mitigation measures.

- Information supplied to BIS Oxford Economics on 6 May 2021 in which it was indicated that Waratah proposed that open cut operations would not now occur within the area of the BNR (technically located on the property known as "Glen Innes"). Mining would occur in this region but through means of an underground mine. Accordingly, under the NMP 3,926 ha of open cut clearing within the BNR would not now occur.[81]

- Updated information on the mine footprint, clearing and subsidence issues was provided in the Second Information Response and in Waratah's updated *Draft Environmental Management Plan (EM Plan) Mine* (September 2021) ("the 2021 EMP").

- The 2021 EMP notes the area over which vegetation will be cleared or subject to subsidence. Along with the Second Information Response it indicates that only 796.7 ha of remnant Least Concern vegetation will now be cleared. The remainder of cleared land (9,546.2 ha) would comprise of pasture grass and other areas already cleared of native vegetation.[82]

- In addition it indicates that under the NMP, with no open cut mining in the BNR the potential total subsidence area would be 26,462.2 ha. Of this:
    - a further 173.8 ha of Of Concern remnant vegetation may be affected by subsidence.
    - the remainder of the area which may *potentially* be affected by subsidence would comprise of 14,707 ha of Least No Concern vegetation (LC) under the VM Act, and 11,581.4 ha of pasture grass and land already cleared of native vegetation.[83]

- The Second Information Response indicates that allowance has been made to mitigate the entire subsidence area. It indicates that the NMP will include board and pillar options which would result in minimal subsidence under structures such as houses.

[80] CGR p.37

[81] Correspondence received by BIS Oxford Economics on 6th May 2021 and additional information supplied to BIS Oxford Economics on 8th June 2021

[82] Waratah Coal (2021) *Draft Environmental Management Plan,* September 2021 "(the 2021 EMP"), pp.76-77

[83] Ibid. The Second Information response cites a slightly larger area (27,265 ha) of potential subsidence.

- The Second Information Response also indicates that to the extent that subsidence might affect the BNR it would not be expected to impact on vegetation even in worst case scenarios in the northeast of the Refuge. It also indicates that subsidence mitigation will occur on BNR land. and that further information may be provided in forthcoming subsidence and flora reports.

- Information supplied to BIS Oxford Economics on 8 June 2021, indicted that an offset area of 24,237 ha, costing $48.5 million would nonetheless still be acquired. (The Second Information Response rounds this down to $45 million.)

In addition Waratah has indicated in correspondence to BIS Oxford Economics that mitigation costs are built into project capital and operating costs.[84]

The incorporation of mitigation measures (as noted in the EIS, SEIS, 2021 EMP and the CGR), the proposal to undertake underground rather than open-cut mining in the BNR and the establishment of offsets may be seen as some internalisation of some of the ecosystem externalities cited above (i.e. through higher project costs).[85]

Based on this information and the CGR, it is therefore difficult to conclude that the operations of the mine within the defined footprint will involve the loss of endangered species from the Desert Uplands overall. It is also unclear if the activities within the mine clearing area would have long term large scale effects on the *overall populations* of other species.

At the same time there are legitimate community concerns about ecological impacts. Many of these centre around the BTF - although we note the CGR's scepticism regarding its permanent presence in the BNR and the fact that Waratah's NMP means that BNR itself will no longer be the subject of open cut mining. In addition, the CGR noted the potential for subsidence affecting an area greater than that cleared for the mine and its potential for impacts on ecosystems, although these effects would likely be localised and minor. As noted in the CGR and the Second Information Response, mitigation measures may well help to address this, though there must be some uncertainty as to what extent.

These uncertainties were also alluded to in WAR 0442.001, WAR 0499.0001, YVA 0265.0001, and COM 0065.0001 which suggested that there was potential for subsidence impacts on the BNR (particular in respect of vegetation), through there was disagreement as to what extent.

Consideration of valuing the cost therefore needs to balance these issues.

Work by Blamey et al (2000) established community values for the preservation of remnant vegetation in the Desert Uplands based on a 1997 survey of Brisbane households. This established a value of $11.39 per household to

[84] Correspondence received 8th June 2021.

[85] We note that Blamey *et al.* recorded the value of a avoiding a1% loss of the population of a non-threatened species in the Desert Uplands as equal to $1.69 per household in 1997. However, there appear to be no data indicating the overall percentage change in non-threatened populations in the mine clearance footprint, relative to the populations of these species as a whole.

maintain a threatened species in the Desert Uplands biogeographic region (i.e. avoid its loss) and $3.68 to avoid each 1% loss in the area of unique ecosystem within the region.[86] In addition the value of avoiding a1% loss of the population of a non-threatened species in the Desert Uplands was estimated at $1.69 per household.

Updating these values to 2021 terms, indexed to national CPI, and grossing up to the number of households in Queensland (1.99 million at the 2016 census) produces values of:[87]

- $40.20 million for the loss of an endangered species within the Desert Uplands
- $12.99 million for each 1% loss of area of unique ecosystems within the region
- $5.96 million for the 1% loss of a non-threatened species

However, there appear to be no data indicating the overall percentage change in non-threatened populations in the mine clearance footprint, relative to the populations of these species as a whole.

We have therefore taken the following approach in balancing both the efforts undertaken by Waratah to mitigate the ecological impacts of the project, the NMP which avoids open cut mining in the BNR and the remaining uncertainties about the long term impacts of the project on terrestrial ecology.[88]

1. *Estimating the value of the lost remnant vegetation due to clearing* – As indicated the lost area totals 796.7ha. This equates to 0.05% of the Desert Uplands bioregion. The equivalent cost to society of the loss of this area was estimated as $676,000 by applying ecosystem loss values based on Blamey et al above. The value of a 1% ecosystem loss ($12.99 million) was applied and adjusted for the smaller size of the affected area.

2. *Estimating the potential loss of Of Concern vegetation due to subsidence* – The same approach as outlined for the removal of remnant vegetation was applied to the 173.8 ha of Of Concern vegetation which may be affected by subsidence. This added $147,000 to the loss estimates.

This produces an ecosystem cost of approximately $0.8 million (or $0.7 million in PV terms) which we have incorporated into project costings.

[86] Blamey et al. (2000) "Valuing remanent vegetation in Central Queensland using choice modelling", *Australian Journal of Agricultural and Resource Economics* 44-3

[87] Australian Bureau of Statistics (ABS) 2016 Census QuickStats at https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/3?opendocument ; ABS 2021 *Consumer price index Australia, June 2021* at *https://www.abs.gov.au/statistics/economy/price-indexes-and-inflation/consumer-price-index-australia/jun-2021*

[88] We also note that a joint expert report on terrestrial ecology, prepared in conjunction with current proceedings, has now been released. However, we have not been able to incorporate its findings into our analysis given that the timing of this release coincided with the finalization of our analysis.

As indicated, the cost of ecosystem offsets i($45 million) is also already incorporated into project land acquisition costings.

In addition we have undertaken two sensitivity test incorporating some of the risks and concerns the project imposes on the ecosystem, highlighted above.

These can be seen as indicative. Sensitivity Test One assumes that despite the removal of open cut mining from the BNR, subsidence and other disturbance nonetheless causes vegetation and species loss. The assumptions include:

- *Species loss* - the loss of one species (which may be taken as the BTF). This equates to $40.2 million; plus

- *Non-threatened species loss* - the permanent loss of 1% of the entire regional population of the two non-threatened species upon on which the project was deemed to have high impacts, under the OMP (i.e. the Desert mouse and the “near threatened” large-podded tick-trefoil) irrespective of mitigation efforts, offsets, and the presumably reduced impacts under the NMP. This equates to $11.9 million (2x $5.96 million); plus

- *Additional incorporation of subsidence impacts* - The loss of vegetation across 3,926 ha of the BNR (i.e. the area originally assumed to be lost to open cut mining) due to subsidence. This was equated to the loss of about 0.3% of the vegetation extent within the total bioregion).This is despite the mitigation efforts noted above. This equates to about $3.3 million (using the methodology described above).

The loss of all three components is estimated as equating to $55.5 million (in undiscounted terms).If the additional externalities calculated above are included the figure rises to $56.3 million.

Sensitivity Test Two assumes that remediation can deal with impacts on vegetation in the BNR but that disturbance associated with operations nonetheless causes species loss and that subsidence nonetheless occurs elsewhere :

- *Species loss* – As per Sensitivity Test One; plus

- *Non-threatened species loss* – As Per Sensitivity Test One; plus

- *Additional incorporation of subsidence impacts* - The loss of an additional area of vegetation,(treated as an area of unique ecosystems). This was equated to the loss of remnant vegetation in the area of 14,707ha of Least No Concern (or about 1% of the vegetation extent within the total bioregion).This is despite the mitigation efforts noted above and the classification of the remnant vegetation itself as an area of Least No Concern. This equates to about $13.0 million (using the methodology described above).

The loss of all three components under Sensitivity Test Two is estimated as equating to $65.1 million (in undiscounted terms).If the additional externalities calculated above are included the figure rises to $65.9 million.

This could be seen as a higher end estimate of species and vegetation loss given the conclusions above, the fact that the BTF is the only species officially listed as endangered, the uncertainties over the BTF presence in the mining footprint, the uncertainties over the nature and extent of subsidence, mitigation efforts and the fact that the surface of the BNR itself will be preserved under the NMP.

While notable, the loses under either Test would not substantively impact on the overall *economic* case for the project as discussed in chapter 5.

The sensitivity tests are also incorporated into our sensitivity tests section.

We provide a summation of our terrestrial ecosystem costings and of the sensitivities described above in the figure below

Fig. 16. Estimated ecosystem externality costs

Ecosystem externality	$ million (2021 dollars, undiscounted)
Lost remnant vegetation due to clearing	$0.7
Lost Of concern remnant vegetation due to subsidence	$0.1
Total	**$0.8**
Sensitivity Test One	**$$ million (2021 dollars, undiscounted)**
Loss of one threatened species (assumed to be BTF)	40.2
Loss of 1% of two non-threatened regional species (assumed to be Desert Mouse and large podded tick-trefoil)	11.9
Additional subsidence effects on BNR (3,926 ha)	3.3
Sub-total sensitivity effects (only)	*$55.5*
Total (incorporated externalities plus sensitivity effects)	**$56.3**
Sensitivity Test Two	**$$ million (2021 dollars, undiscounted)**
Loss of one threatened species (assumed to be BTF)	40.2
Loss of 1% of two non-threatened regional species (assumed to be Desert Mouse and large podded tick-trefoil)	11.9
Additional subsidence effects on Least No Concern vegetation	13.0
Sub-total sensitivity effects (only)	*$65.1*
Total (incorporated externalities plus sensitivity effects)	**$65.9**

Source: BIS Oxford Economics
Figures subject to rounding

4.4 GROUNDWATER

4.4.1 Background

The project lies to the east of the Great Artesian Basin (GAB) and on the edge of the Highland Groundwater Management Area. A licence is required in order to take water and a permit is required for the drilling of bores.

The EIS suggests that there will be little to no impact of the mine on the GAB. However groundwater inflows to the mine would be very substantial as would be expected from such a major project. The SEIS estimates that groundwater

inflows to the mine would be in the order of 23 GL/annum for the underground mines and 2.6 GL/annum for open cut mines.[89]

Surface and underground voids created by mining could act as groundwater sinks and cause temporary changes in groundwater direction. This could result in final groundwater levels 10m lower then currently is the case. There is a risk that salinity levels in the voids could increase and that this could flow into the broader groundwater system [90]

More broadly the EIS indicated that mining could lower the surface of aquifers and create a cone of depression extending 11-30km from the mine. This could impact bores within that radius where a connection is present between aquifers.

Subsidence of up to 3.3m noted above also has potential to allow for the infiltration of rainwater into aquifers, increasing dewatering. Potential for contamination also exists due to coal rejects, leaking disposal facilities and fuel and chemical spills. However the potential for spills to affect groundwater was deemed to be low in the EIS. The existing groundwater in question was also deemed to be saline and unusable as livestock drinking water. [91]

In response Waratah has outlined a mitigation plan including a willingness to enter agreements with landowners regarding water usage and make good arrangements if local groundwater is impacted by the project.[92]

The SEIS also referred to more refined modelling including a drawdown range of 20km north, 10km south and 15km east with the western extent not leaving the mine lease.[93] It also reiterated its commitment to make good arrangements should any impacts occur. [94] Groundwater mitigation, monitoring, control and commitments were also indicted in the 2021 EMP.[95]

The CGR also noted that existing bores could be adversely affected by the project. The SEIS desktop bore study identified 236 registered bores within a one metre drawdown contour of which 123 were within a 5 metre drawdown contour. However many of these may not be private water bores but be investigation bores or Department of Natural Resources, Mines and Energy (DNRM) monitoring bores and many may not be impacted depending on the intake screens in relation to depressurised aquifers.[96]

The CGR also noted the following[97]:

- *Base water levels* - Further data was required on base water levels and that Waratah had committed to update and improve its modelling and to undertake regular reporting to the DNRM.

[89] CGR *op. cit.* p.44
[90] Ibid
[91] EIS Vol. 2, Chap. 8, pp.247-248
[92] Ibid
[93] SEIS Vol.1 Part C, p.225
[94] SEIS, Vol.2 Appendix 44, p.4171
[95] 2021 EMP, pp.160-165
[96] CGR pp.44-45
[97] CGR pp.45-48

- *Bores* - A more detailed survey of bores in use and aquifers being accessed was required in order to identify user impacts. DNRM sought commitments from Waratah to enter into make good arrangements with landowners prior to commencing mining and Waratah has committed to conduct the relevant survey and enter into make good arrangements.

- *Cumulative impacts* - The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) expressed concerns over the ability of Waratahs modelling to predict cumulative groundwater impacts given the multiple projects occurring in the Galilee Basin. The CGR made recommendations to DNRM and Department of the Environment and Heritage Protection (DEHP) to develop a regional water balance model for both groundwater and surface water and to develop water quality monitoring.[98]

- *Rewan Formation (impacts on GA*B)– Concern was expressed by the IESC about the integrity of the Rewan Formation to act as a barrier between the GAB and the Permian coal measures. However the DNRM advised that the project modelling of drawdowns and potential impacts on GAB is fit for purpose. It notes that there is evidence of only minor faulting in isolated parts of the mine region and that the project modelling is adequate to manage risks on the GAB from mining operations.

- *Groundwater dependent ecosystems (GDEs)* – DNRM expressed concerns about the thoroughness of sampling work by Waratah. However subsequent sampling indicated only two common stygofauna taxa which would not be significantly affected.

- *Tailings and final void arrangements* – The concerns of the IESC that 7% of overburden samples had the potential to be acid forming were raised. However Waratah's commitment to a detailed tailings disposal plan and a final void management plan as a part of its rehabilitation plan along with groundwater and containment cell monitoring were also noted.

Waratah's Second Information Response indicated it was not expecting significant impact from drawdown and that make good allowances for groundwater may not be drawn on. It also indicated that the project had excess water which could be provided through make good provisions or through the drilling of new bores. This could be done through the piping of water to affected properties (or the provision of new bores).

By its estimation, the maximum cost of new bores would be $3 million (based on a maximum of four bores per property, 15 affected properties and a maximum cost of $50,000 per property).

[98] CGR p.120

4.4.2 CGRs conclusions

The CGR noted the following conclusions on groundwater

Having regard to all the information and advice before me, I believe it reasonable to conclude that the Rewan Formation will act as an effective aquitard and that mine dewatering will not significantly impact on the GAB aquifers and associated springs in the GAB intake beds and the springs further west in the Barcaldine Springs Complex.

However, having regard to the views of the IESC, I have adopted a precautionary stance and recommended to DNRM that additional monitoring of the Clematis Sandstone/Dunda Beds/Rewan Formation interface be undertaken by the proponent before and during mining operations and that appropriate trigger levels be set for management action should there be unexplained changes to water levels and/or water quality in the Clematis Sandstone aquifer. …

…I acknowledge the concerns raised variously by the IESC and DNRM on aspects of the modelling relating to the limited water monitoring data set and model conceptualisation. I have considered each of these concerns and conclude, based largely on the advice of DNRM that the work done is adequate to identify potential impacts and risks from the proposed mining operation. I accept the need for the modelling work to be further refined and updated in the light of additional water monitoring data and the need for an effective monitoring program to identify trends prior to any problems arising. …

…I accept that a more detailed existing user bore survey needs to be undertaken to identify users likely to be impacted by mining and the need for Waratah to enter into 'make good' arrangements prior to mining activity commencing.…

In regard to GDEs, I am satisfied that there is little risk of significant impacts to GAB springs and species that may utilise this habitat. I accept Waratah's findings that vegetation GDEs do not exist on site and if they did would not be impacted by groundwater drawdown as any such communities are likely associated with perched watertables and not the regional watertable at greater depth which is not available to such communities. I accept that stygofauna has limited abundance and diversity on the mine site and is represented off-site and will not be subject to significant impacts.

I have considered the issues of tailings management and final voids management elsewhere in this report and stipulated conditions for the preparation of appropriate management plans… I am satisfied that these measures will properly manage any seepage of contaminants to groundwater.

4.4.3 Work by Merrick and Hair

Additional evidence on groundwater issues, relevant to the NMP was suppled in late 2021 through the *Statement of Evidence to the Land Court of Queensland on Groundwater Modelling* by Dr Noel Merrick (WAR 0436.0001)

and the *Statement of Evidence to the Land Court of Queensland* by Mr Ian Hair (WAR 0474.0001).[99]

In terms of WAR 0426.0001, the work took into account changes to the EIS associated with the NMP. These included:[100]

- removal of Open Cut South and Open Cut South Two pits,
- completion of open cut mining in 14 instead of 24 years and
- full fracturing to the land surface above the B, DU and DL underground mines

The third of these items was noted as a worst case scenario . We note the following selected conclusions that:[101]

- *There is predicted to be no additional impact to the Clematis Sandstone (the relevant GAB aquifer), under conditions of worst-case fracturing between the coal seams and land surface.*

- *There is predicted to be no more than about 10 m drawdown in the Dunda Beds and the Rewan Formation (the GAB aquitards), under worst-case conditions. This would have no additional effect on bores identified in the SEIS as likely to be impacted.*

- *Slightly more drawdown is simulated adjacent to the final voids for the two northern open cut areas. However, water levels will recover there when the pit voids are no longer dewatered and are allowed to reach an equilibrium pit lake water level.*

- *Groundwater levels across the Bimblebox Nature Refuge would be up to 100 m higher as a result of removal of open cut mining from that area.*

- *The effect of the revised mine plan on the Bimblebox Nature Refuge is beneficial to a significant degree by removal of excavation from the mine plan and by maintenance of much higher groundwater levels compared to the original mine plan.*

- *There would be negligible additional effect on groundwater conditions at the Bimblebox Nature Refuge as a consequence of worst-case fracturing above underground coal seams. The SEIS groundwater model had already assumed complete fracturing in that part of the underground mining footprint coincident with the Bimblebox Nature Refuge, except for a small area in the south-western corner of the Refuge.*

[99] the *Statement of Evidence to the Land Court of Queensland on Groundwater Modelling* by Dr Noel Merrick , 18 October 2021 (WAR 0436.0001) We also note Dr Merrick's Statement of Evidence to the Land Court of Queensland on Groundwater – Response to DES Letter Request 24 January 2022 (WAR 0502.0001)
[100] *Ibid*,p.14
[101] *Ibid* pp.14-15

Dr Merrick also indicated that:

"full fracturing to land surface across the entire underground mining footprint is a worst-case scenario, and that the modelling of this circumstance would overestimate the likely impacts of underground mining on groundwater conditions."[102]

Iain Hair's statement noted that:[103]

- *The open cut and longwall mines will create a drawdown in phreatic and potentiometric groundwater levels around the operations. 1 m and 5 m drawdown contours will extend across MLA 70454. Modelling results suggests drawdown extending about 20 km from active mining to the north (for 1 m drawdown), 10 km to the south, and 15 km to the east. The western extent (towards the GAB) remains within MLA 70454. Modelling indicates that a small remnant lowering of groundwater levels will be maintained around mining operations.*

- *Drawdown will not extend to GAB aquifers because of the thickness and extent of an effective aquitard in the Rewan Formation and Dunda Beds sequences to the immediate west of the mine.*

- *Groundwater flow directions will change. Mining operations will lower groundwater levels and create a "sink" in the groundwater regime. Groundwater flow will reverse and will be towards the mining operations Though drawdown will partially recover following the end of mining as pumping stress ceases, water levels in open cuts will remain below regional groundwater levels, thereby permanently maintaining flow towards the open cut pits.*

- *Altered flow conditions will have no impact on groundwater quality. Altered flow will draw water to bores laterally from areas further from the mine, east and west of the MLA; areas which will have the same groundwater quality. Bores will continue to draw water of the same quality.*

- *The most notable impact on water bores is expected to be destruction by being mined out by open cut operations, and impairment from subsidence as they are undermined by longwall mining. Securing alternate water supply through Make Good Agreements is the only plausible option for landholders whose bores are physically affected.*

4.4.4 Assessment

We note the debates on groundwater and the findings of the CGR above as well as WAR 0436.0001, WAR 0474.007 and WAR 0502.001. Key issues relate to questions of geological risk, contamination, and the impacts of

[102] *Ibid,* p.15

[103] *Statement of Evidence to the Land Court of Queensland* by Mr Ian Hair (WAR 0474.0001), 12 November 2021, paragraphs 4.11-4.18

groundwater usage. Waratah has committed to a management and monitoring program in respect of all three. Our assumption is that this would be incorporated into their capital and operating expenditure as outlined in the King report and in Waratah's past communications to us (including the First and Second Information Responses).

There may be potential additional costs to landowners due to contamination and the drawdown of groundwater affecting local bores (though we note the findings of WAR 0474.0001 that changes to flow *per se* would not have impacts on groundwater quality). This is especially so given the large quantity of groundwater the project intends to use.

As indicated, information in the King Report indicates that make good costs for soil and land are estimated at $80 million in undiscounted terms. The Second Information Response also suggests any impact from drawdowns could be managed through use of the project's excess water balance, and is accounted for within make good provisions, as indicated above. Given the CGRs findings, the findings in WAR 0436.0001, WAR 0474.007 and WAR 0502.001, and Waratah's commitments we have therefore assumed that these cover the relevant costs to landowners arising from these issues. This is also consistent with WAR0474.001's commentary about the need for make good agreements to address issues faced by landowners with affected bores. Likewise dealing with some long term issues (such as void management) would form part of mine rehabilitation costs.

However, as with all costings there is a risk that the estimations may be affected by unexpected factors. Accordingly, we have undertaken sensitivity test for externalities as described in chapter 6.

4.5 SURFACE WATER

4.5.1 Background

Waratah's Second Information Response also indicated that there was no need to purchase water as the project will have an excess supply of water. The 2021 EMP also indicated that the NMP had resulted in an updated water balance model, indicating that there would be a surplus of water produced at the mine beyond that required for mine needs. Some of this could be provided to landowners as a part of make good arrangements, to the town of Alpha or other regional industrial and agricultural users.[104]

Nonetheless, the project will have substantial changes on surface water flows. According to the EIS, revised modelling undertaken for the SEIS and the CGR, key changes (and risks) include:[105]

- Clearing of vegetation and topsoils resulting in sediment movement
- *Potential chemical spillage into waterways* – These would most likely involve fuel, thought the risk of fuel spills is deemed to be low.

[104] 2021 EMP, p.166

[105] EIS Vol. 2, Chap. 9, pp.263-266 ; CGR, pp.48-51

- *Seepage of contaminated water such as tailings water or pit process water* - There is potential for seepage of chemical containing metals and salts which could then find its way into local creeks.

- *Subsidence* –Depressions could cause changes to local drainage systems.

- *The diversion of Malcolm Creek around the mine site* – The project proposes to divert Malcolm Creek (which currently runs through open cut mining areas). Concerns were raised about the long term stability of this although subsequent work by Waratah shortened the diversion to only 800m less than the current creek. Lagoon and Saltbush creeks are also to be diverted.

- *The potential effects of flooding from creek diversions* – The diversion may lead to increased water velocities and the potential for local flooding.

As with other project impacts, Waratah has proposed a mitigation and management plan through Environmental Management Plans (EMPs) to deal with the above effects including the development of surface and storm water management plans and an Erosion and Surface Control Plan (ESCP).[106] Subsequent to the EIS this was enhanced. Key points of the proposed water management system included.[107]

- A Subsidence Management Plan to manage the impacts of subsidence along with mitigation works. These would reduce the impacts of subsidence on Lagoon Creek (with flows reduced by only 21% in 50 percent of years) and Jordan Creek Flows reduced by 3% in 50 percent of years).

- All water requirements to be met through groundwater inflows to underground and open-cut mines and via aquifer pre drainage requirements

- Additional water to be made available to meet make good arrangements with property owners and supplement Alpha's water supply.

- The mine will have a positive water balance for most of its operating years and will dispose of mine affected water via sprinklers. (As indicated the 2021 EMP also indicated that the positive water balance could be diverted as a part of make good or other arrangements.)

- Spoil material will be benign and runoff suitable for stage in sediment dams. Water discharges will only occur from sediment dams during high intensity rain periods or prolonged wet periods. Contaminated water will not discharge

[106] EIS Vol. 2, Chap. 9, pp.263-266
[107] CGR, p.49-51

The 2021 EMP also referred to Waratah's updated mitigation, control, monitoring and commitments.[108]

Waratah's Second Information Response also referred to its mitigation efforts (including diversion drains, environmental dams and waste facilities) as being included in its capital and operating costs.

4.5.2 CGRs conclusions

The CGR noted the following:

I note concerns from the IESC regarding the adequacy of the site water balance and the volume of raw water required to maintain planned operations. With additional estimated groundwater available, I am satisfied that the project's raw water demands can be met. The site Water Management System has been updated to account for increased groundwater inflows into underground operations. Regarding discharges to receiving waterways I have set a condition in Appendix 1, Schedule C to ensure impacts can be managed…. Results of future groundwater monitoring and updates to the groundwater model will need to be included in updates to the site water balance model. In regard to the diversion of Malcolm Creek, I have made a recommendation to DNRM that a condition of the water licence require the proponent to prepare a strategy for the long term management of the creek, post mining.[109]

4.5.3 Vitale evidence

Additional and updated consideration of surface water issues was detailed in Dr Andrew Vitale *Statement of Evidence to the Land Court of Queensland on Surface Water* (WAR 0486.0001) released on 22 December 2021.[110]

WAR 0486.0001 took into account the NMP (also referred to as the revised mine plan) noting that:[111]

- The impacts of the project on surface water can be reduced to acceptable levels through compliance with the Draft Environmental Authority (Draft EA) plan conditions and implementation of the mitigation strategies included in the Draft EM Plan the revised Draft EM Plan (and Appendix 5 of the CGR). This was deemed to be adequate;

- Project impacts on surface water will be reduced under the NMP compared to the OMP, with significantly less ground disturbance within the BNR, reduced impacts to stream flow quantity and quality and significantly improved outcomes and reduced risk for the diversion of Malcolm Creek.

[108] 2021 EMP, pp.191-209
[109] CGR pp.52-53
[110] *Statement of Evidence to the Land Court of Queensland on Surface Water* , Dr Andrew Vitale, 22 December (WAR 0486.0001)
[111] Ibid, p.32

- The impacts of the Project on surface water can be reduced to acceptable levels through compliance with the Draft Environmental Authority (Draft EA) plan conditions and implementation of the mitigation strategies included in the Draft EM Plan the revised Draft EM Plan (and Appendix 5 of the CGE. This was deemed to be adequate;

- Further assessment and implementation of options to manage the large excess volumes of mine affected water that will be generated by the dewatering of the underground mines is required prior to the commencement of mining (after the granting of the Mining Lease) to provide greater certainty that the Project will be able to comply with the conditions of the Draft EA that relate to surface water

- Further consideration of the design basis for the box-cut and in-pit waste dump sediment dams is warranted to ensure that discharges from the sediment dams will occur in accordance with the conditions of the Draft EA. This may require larger sediment dams than the preliminary design basis proposed in the SEIS or a drainage strategy that directs rainfall runoff from successfully rehabilitated spoil areas around the sediment dams and ensures segregation of stormwater flows from rehabilitation areas and active spoil disposal areas. This poses engineering issues which can be addressed during the detailed design of the mine following the granting of the Mining Lease;

- The project will have no impact on the springs of conservation significance in the Barcaldine Spring Complex further to the west of the Project for either the Current Mine Plan or the Revised Mine Plan.

- The dewatering of the underground mines will provide a reliable source of water for the Project that is not susceptible to climate change impacts;

- The Project will generate sufficient excess water to provide a reliable supply of make-good water to landholders whose existing water supplies are adversely impacted by the Project; and

- The conditions of the Draft EA and revised Draft EA are adequate to manage the surface water impacts of the project and to enable the administering authority to assess compliance with the conditions relating to surface water management.

4.5.4 Assessment

As is the case with groundwater usage given the comments of the CGR, Waratah's mitigation and management commitments and the Vitale Report, our assumption is that most of the additional costs of disturbance to surface water resources (externalities) are effectively internalised through their capital and operating expenditure costs as outlined in the King report and in Waratah's communication to us in the First and Second Information Responses.

We note that these costs may change in the future given the Vitale Report's indication that additional engineering work may be required for sediment dams.

However, assessing the cost of such future potential work is beyond the scope of this analysis.

As is the case with groundwater, there may be additional costs to landowners Given the CGRs findings and Waratah's commitments, as well as the 2021 EMP's indication that the project's positive water balance could be diverted to local landowners, and the Vitale report's similar observations, we have assumed that these cover the relevant costs to landowners. We assume that the allocated $80 million referred to above also covers these costs. arising from these issues. Likewise dealing with some long term post-project surface water restoration issues would form part of mine rehabilitation costs.

As these costs have already been included in the assessment of impacts on land above we have not allowed for additional surface water costs in this section.

4.6 AQUATIC ECOLOGY

The project sits primarily within the Belyando River sub-basin of the Burdekin River Key streams identified on the mine site include Tallarenha Creek, Beta Creek, Malcolm Creek, Pebbly Creek, Spring Creek and Lagoon Creek. These are ephemeral streams experiencing flows of short duration following rain events and extended periods of no surface flow. The south west of the site drains to Jordan Creek and discharges into the Alice River some 40km downstream of the mine.[112]

The EIS undertook an assessment of the freshwater aquatic ecology at the mine site including a literature review and field investigations of aquatic ecology. Additional work was undertaken for the SEIS.[113]

This work found some impacts of grazing pressures on existing aquatic ecology and that aquatic communities were of limited diversity.[114] Key points include:

- The area has limited fish diversity with any project impacts likely to result from increased turbidity rather than barriers to fish passage.
- There are various species of macro-crustaceans in the area including the Red Claw Crayfish and increased turbidity may affect such species via reduced algae food sources.
- Most macro-invertebrates in the area are pollution tolerant, though to ensure community diversity good management of mine runoff and vegetation clearing will be required during the project.
- Aquatic plant cover and diversity are generally low in the area with the exception of Spring Creek and SPC Dam.
- In terms of local water quality, electrical conductivity, Ph levels, turbidity and dissolved oxygen per cent were also deemed to be outside recommended ranges but in line with other local studies.
- Potential impacts to near mine aquatic ecosystems may arise from erosion, mine runoff, land clearing, changes to water quality and turbidity.

[112] CGR p.39
[113] EIS, Vol.2, Chap 7, SEIS Vol. 2 Appendix 19
[114] CGR p.39

- Activities with the highest risk for aquatic ecosystems include the diversions to Lagoon Creek, Malcolm Creek and Saltbush Creek, land clearing, on-site chemical storage contaminated water storage and altered draining patterns arising from subsidence. [115]

The 2021 EMP indicates a number of mitigation measures to be put into place to deal with such impacts along with commitments to minimise impacts.[116] In addition the Second Information Response indicates that:

- mitigation measures would be internalised in the King report costings
- good management practise will mitigate all potential impacts
- sediment would be caught by the Burdekin Dam (if discharged) limiting impacts on other water systems
- while there is a small area (24.4 ha) of impacted wetlands this would be covered through the offsets costed above

The CGR noted the following in terms of aquatic ecosystems.

I consider the likely impacts to aquatic ecosystems have been adequately identified in the EIS and SEIS. I note concerns from the IESC regarding the adequacy of baseline sampling for the project and that Waratahs' proposal to adopt interim water quality objectives used by the adjacent Alpha Coal mine is reasonable until site-specific objectives can be developed. The development of management plans with specific measures to minimise impacts associated with construction and operational activity have been outlined in the EIS, SEIS and draft EM Plan. I am satisfied the implementation of these plans, combined with an ongoing monitoring program will allow impacts to be mitigated to acceptable levels. [117]

Accordingly we have not allowed for any additional costings in respect of aquatic ecosystems and have assumed such costs will be internalised into existing project costs.

4.7 AIR QUALITY IMPACTS

4.7.1 Background

The EIS and SEIS both refer to the air quality impacts of the project which will involve significant emissions of particulate matter (PM) during the extraction of coal. Given the size of the project (56 Mtpa of ROM coal) emissions can be expected to be substantial.

We note that both the EIS and SEIS were produced under the OMP. The 2021 EMP noted that air quality assessments may be revised with reference to the NPM.[118] We have noted the evidence given by Simon Welchman in this regard (see below). However as indicated below, this does not appear to materially change the findings presented in the EIS and SEIS for CBA purposes. Accordingly, the results of the EIS and SEIS are also discussed below.

[115] CGR pp.39-41
[116] 2021 EMP pp.191-209
[117] CGR pp.41
[118] 2021 EMP, p.15

The EIS produced estimates of the Total Suspended Particle (TSP) and Particulate Matter of less than 10 micrometres or less (PM_{10}) based on dispersion modelling and with reference to Environmental Protection (Air) Policy 2008 (the EPP (Air) guides). Detailed emissions from the mine in Year 19 of production (the worst case conditions) were also estimated.[119] The SEIS extended this analysis to Years 5,10 and 15 years and particles of 10 micrometres or less ($PM_{2.5}$) for Year 19.[120]

The EIS indicates that dust and TSP concentrations are not expected to exceed guidelines beyond the mine boundary, PM_{10} concentrations will exceed 24 hour concentration guidelines beyond the mine boundary) and a five sensitive receptors in the region of the mine. While two of these are within the mine boundary and one is in the area of another mine, if these receptors are inhabited any exceedance of EPP (Air) guidelines will impact human health and wellbeing. $PM_{2.5}$ concentrations will exceed it when background concentrations are included beyond the northern mine boundary.[121]

No exceedance of guidelines is predicted for the nearby towns of Alpha and Jericho. The EIS also states that mitigation measures will be put in place, including an Air Quality Management Plan and Environmental Management Plan to ensure that air quality will not degrade human health or the health of terrestrial fauna and outlines measures to be put in place during construction and operation.[122]

Waratah also proposes to purchase or acquire or relocate a number of neighbouring sensitive receptors (properties) to avoid significant impacts. However, nearby sensitive receptors that do not meet acquisition criteria for air quality impacts include Lambton Meadows, Hobartville and Cavendish. Air quality monitoring will be conducted there with potential that Waratah may purchase the properties if concentration exceed EPP (air) guidelines.[123]

4.7.2 CGR findings

The CGR stated that:

Waratah has proposed to meet air quality objectives to ensure the project does not adversely impact human health or ecological health of terrestrial flora and fauna {its} commitments…Where significant impacts to air quality cannot be avoided I acknowledge that acquisition or relocation of a number of sensitive receptors may be necessary. In addition, ongoing monitoring at remaining

[119] EIS, Vol. 2, Chap. 10, p.274-75 ; p.286

[120] SEIS Vol. 1, Chap 6, pp.327-328

[121] EIS, Vol. 2, Chap. 10, p.287

[122] EIS, Vol. 2, Chap. 10, p.286-87

[123] CGR, p.62 . We note the qualifications contained in *Affidavit of Nui Bruce Harris*, 21 June 2021 (WAR 0291.001), paras 103-107 and para 245. These indicate that these arrangements are subject to successful property compensation and purchase negotiations with affected landowners. In the event that such negotiations are not successful, the mine plan can and will be amended to avoid operations on restricted lands. In respect of para 245 in particular, this indicates that Waratah will acquire or relocate sensitive receptors at Kia Ora, Monklands, Spring Creek and Glenn Innes. If negotiations to acquire or relocate these sensitive receptors are not successful, operations will be managed so as to note cause adverse environmental impacts beyond those approved and conditioned in the EA.

sensitive receptors is required to assess whether further acquisitions or relocations are required for receptors that are not predicted to trigger acquisition criteria. [124]

4.7.3 Welchman evidence

Recent evidence presented to the Land Court of Queensland, supplied by an Environmental Engineer, Simon Welchman including *Statement of Simon Welchman*, dated 6 January 2022 (WAR 0490.001), and *Statement of Simon Welchman* (WAR476.001) dated 16 November 2021, has supplemented the previous EIS, SEIS and CGR data.[125]

In terms of WAR0490.001, we note the findings that:[126]

- The NMP may produce higher concentrations of PM_{10} and $PM_{2.5}$ at some locations due to changes in the mine plan. This may be due to changes in the mine plan producing greater mining intensities in northern areas compared to the EIS/SEIS. Differences in meteorological data compared to the EIS/SEIS may also explain this.

- However in terms of PM_{10}, an annual cumulative assessment of $\mu g/m^3$ at nearby sites indicates that the NMP would produce lower results for all homesteads in the area then recorded in the SEIS apart from four and a number that were proposed to be purchased by Alpha Coal and Waratah Coal.

- We also note that in terms of $PM_{2.5}$ we note that the cumulative assessments WAR 0490.001 also produce equivalent or lower cumulative estimates of $\mu g/m^3$ under the NMP than was the case for the SEIS apart from four locations (Jericho, where the reading was 1.3 vs 1.0 under the OMP, Salt Bush (0.1 vs 0), Speculation (0.1 vs 0) and workers camp (0.1 vs 0).The last of these will no longer be located at the mine site but in the town of Alpha under both the OMP and NMP.

Given that:

- levels are at or below those recorded in the EIS/SEIS for $PM_{2.5}$ at all but four locations; and
- that the difference would appear to be small at those four and the workers camp site will now be relocated to Alpha under both the OMP and the NMP,

it is unlikely that there would be a material difference with air pollution results derived based on the SEIS in terms of the CBA.

In addition, we note that the data provided in the Welchman Statement for $PM_{2.5}$ include data relating to cumulative annual concentrations of $PM_{2.5}$ under boteh the EIS and SEIS .Unlike the SEIS the Welchman Statement and

[124] CGR pp.62-63
[125] *Statement of Simon Welchman*, 6 January 2022 (WAR 0490.001), *Statement of Simon Welchman* (WAR476.001) 16 November 2021
[126] WAR 0490.001, pp.3-10

Welchman Report do not provide detailed annual detailed total annual $PM_{2.5}$ emissions for a given year of operations (Year 19 of production in the case of the SEIS). Accordingly, we retail the Year 19 $PM_{2.5}$ emissions provided by the SEIS for our calculations of air pollution in our assessment below.

In terms of WAR0476.001, we note the findings that:[127]

- The viability of livestock grazing in rehabilitated land would not appear to be affected by the presence of coal dust
- Odour is not a significant issue.
- While predicted maximum 24 hour concentrations under the NMP exceed air quality objectives at four sensitive receptors for PM10 objectives can be achieved with application of an Air Management Plan
- Predicted average annual concentrations of $PM_{2.5}$ comply with air quality objectives at all sensitive receptors.
- The Draft EA conditions are generally appropriate to manage air quality impacts, although the cited criteria should be updated and amended to reflect the updated policies outlined in the *Environmental Protection (air) Policy 2019*

4.7.4 Assessment

We note the conclusions of the dispersion modelling, the CGR, the mitigation efforts by Waratah, WAR 0.476.0001, WAR 0490.0001 and the fact that there is no exceedance of guidelines in nearby towns.

Nonetheless, we note the potential for exceedance in neighbouring properties. This may be ameliorated by subsequent purchases although this, however the broader point remains that there is a level of risk. In addition, concerns have been expressed about the impacts of mining on local areas despite mitigation efforts in the past. Work by PAEHolmes (2013) states that [128]

The current approach to air quality management in Australia focuses on reducing exceedances of ambient air quality standards at specific locations1. The standards are designed to protect health. However, for PM_{10} and $PM_{2.5}$ there is no evidence of threshold concentrations below which adverse health effects are not observed

Likewise recent work by Hendryx et al. (2020) based on 2017 community monitoring station data has found statistically significant evidence of higher levels of PM_{10} concentrations in (predominately rural) mining communities in NSW and Queensland then in non-mining communities.[129]

We have therefore taken the following approach to assessing air quality impacts of the project:

- As with other externalities and based on advice from Waratah we assume that monitoring and management costs are incorporated into capital and operating costs. However we allow for the fact that there

[127] WAR 0476.000, pp. 9-16

[128] PAE Holmes (2013) *Methodology for valuing the health impacts of changes in particle emissions – Final Report*, NSW EPA

[129] Hendrix et. al. (2020), "Air Pollution emissions 2008-18 from Australian Coal Mining: Implications for Public and Occupational Health, *International Journal of Environmental research and Public Health*, 2020, 17, 1570

may nonetheless be additional externalities from particulate concentrations which have not been internalised (i.e. costed).

- While noting the discussion of TSP and PM10 we note the discussion of PAEHolmes 2013 that $PM_{2.5}$ remains the best index for assessing the quantitative effects of health effects of particulate matter .[130]

- Likewise work by PAEHolmes (2013) indicates that damage costs per tonne of $PM_{2.5}$ equate to $120 per tonne of $PM_{2.5}$ in rural Queensland (in 2011 prices at population densities of 0.4 people per square km).[131]

- Converting to 2021 dollars (based on national CPI) this equates to $139 per tonne.

- The current population density of Barcaldine LGA is 0.1 people per square km.[132] However the mine may result in a significant influx of people to the BRC. We have therefore used the population density of 0.4 people per square kilometre as an estimate of local population density during the lifetime of the mine.

- Year 19 emissions of $PM_{2.5}$ indicated in the SEIS were 1,231.880 tonnes and the King report indicates 55,736 million tonnes of ROM coal produced in that year[133]. This implies 0.000022 tonnes of $PM_{2.5}$ per tonne of ROM coal. We have used the King report production data and this conversion factor to assess $PM_{2.5}$ costs across mine life.

- Applying this results in a total cost of $3.4 million and a PV of damages of $1.2 million across the life of the mine.

4.8 NOISE IMPACTS

4.8.1 Background

Acoustic quality objectives which are conduce to wellbeing including study, sleep and relaxation are defined in the *Queensland Environment Protection (Noise) Policy 2008* (“ EPP(Noise)”).

The EIS and CGR provide details of the project’s potential noise and vibration impacts during construction, operations and decommissioning to the project. The key points can be summarised as follows:[134]

[130] PAE Holmes *op. cit.,* p.5
[131] *Ibid* p.36
[132] ABS, “Regional Data by Region” at https://dbr.abs.gov.au/region.html?lyr=lga&rgn=30410
[133] SEIS Vol1, Chapter 6. Pp.326-328. As noted, WAR0490.001 and WAR476.0001 do not provide detailed total annual $PM_{2.5}$ emissions for Year 19 of production. In addition, as indicated, the differences between the results presented in the SEIS and these documents do not appear to be material in CBA terms. Accordingly, we have continued to use the SEIS figures.
[134] EIS Vo. 2, Chap. 11, p.301-315, CGR pp.63-65

- Noise impacts from operations would be expected at the properties of Eureka, Lambton Meadows, Salt Bush ,Cavendish, Kia Ora, Monklands and Hobartville. However the last three of these will be acquired or relocated. Of these Monklands will be the most significantly affected.

- There will be no significant noise impacts on Alpha from the mine.

- Waratah will incorporate a number of noise amelioration, monitoring and mitigation measures into its Environmental Management Plan (EMP), This includes modifying proposed earthworks , attenuating noise from crushers and consulting with property owners.

- With the implantation of amelioration and mitigation measures noise emissions from the mine operations and blasting will comply with relevant guidelines and noise criteria and there is limited potential noise from construction. Blasting will occur four times per week during the day to avoid sleep disturbance. There will be minimal impacts from mine access road vehicles on residences through haulage road surfaces should be maintained to control for noise.

- The impact of aircraft noise on residential properties from increased air traffic will be negligible.

- In general the impacts of mine operations, blasting, construction and haul and access roads can be managed to comply with the criteria in the EPP (Noise) Guidelines due to large distances between sources and residences and allowable time of day construction activities.

- There may be impacts for Alpha airport upgrading however these have not been incorporated as they will be undertaken by a separate party.

4.8.2 CGR findings

The CGR concluded the following

I have considered the EIS submissions and how the SEIS responded to the issues raised. I am satisfied that the EIS has adequately assessed noise and vibration impacts for the project. I am satisfied that through the implementation of measures outlined in the draft EMP and compliance with the draft EA noise and vibration conditions, the predicted impacts of the project on sensitive receptors can be managed within acceptable limits.

4.8.3 Elkin evidence

Some additional and updated commentary on the impacts of the NMP was provided in *Statement of Evidence to the Land Court by Shane Robert Elkin* (WAR 0481.001) dated 28 November 2021.

This document indicated that:[135]

- Predicted operational mining noise levels indicate that a nominated (night-time) noise criterion of 35 dBA LAeq is achieved at all assessed receptors under four assessed operational scenarios for neutral and adverse weather conditions, except at Kia Ora and Monklands.

- A DES draft EA limit of 33 dBA at night is predicted to be exceeded at Glenn Innes by 1 dBA and 2 dBA during adverse noise propagation weather conditions only. Higher exceedances are predicted at Kia Ora and Monklands.

- A maximum LA1 noise level of 43 dBA was predicted at Glen Innes Homestead for worst-case noise emission during the night-time under adverse weather conditions. This noise level exceeds the draft EA criterion of 40 dBA LA1 by 3 dBA.

- Predicted airblast overpressure levels show that the 115 dBL criterion (10% exceedance allowance) can be achieved, as well as the 120 dBL limit (1% exceedance allowance), at all but the two closest sensitive receptors to the pits, namely Kia Ora and Monklands.

- Predicted ground vibration levels achieve the 5mm/s (10% exceedance allowance) and 10 mm/s criteria for all MIC scenarios, except at Kia Ora and Monklands

- Mitigation measures will be required to achieve compliance with the EA based on both the OMP and NMP .

- Through the use of (common practice) noise and blasting mitigation measures the OMP and NMP Galilee Coal Mine Project can be operated to meet the draft EA and noise and blasting criteria. recommended by Mr Elkin

Mr Elkin notes that:[136]

> *These 1 or 2 dBA exceedances are negligible because a difference of 1 to 2 dBA in noise levels is imperceptible to the human ear; therefore, there would be no perceptible difference in effect at Glen Innes comparing overall noise levels of 33 dBA Leq (draft EA criterion) to the predicted noise levels of 34 and 35 dBA Leq. A change in noise level of 3 dBA is considered "just noticeable".*

While noise exceedances are higher at Kia Ora and Monklands, we note also that these properties are proposed to be acquired under the NMP.

[135] *Statement of Evidence to the Land Court by Shane Robert Elkin* 28 November 2021 (WAR 0481.001), pp.1-6
[136] *Ibid.* p.6

4.8.4 Assessment

As is the case for several other externalities noted above, and based on advice from Waratah and the CGR conclusions, (while noting the EA stipulations of WAR 0481.0001) we assume noise costs are effectively incorporated into capital and operating costs through mitigation measures.

The EIS indicates that the main noise impacts would be felt on seven properties, as noted above. We note that three of the most noise affected properties will in any event be acquired by Waratah or relocated (and that in the case of Lambton Meadows and Cavendish note that compensation is payable by Waratah).

Likewise, while WAR 0481.0001 indicates that Kia Ora and Monklands will be the most noise affected properties under the NMP, we note that these properties are proposed to be acquired for the project.[137]

The Second Information Response likewise indicated that acquisition and compensation costs would effectively incorporate noise disturbance costs (and that was potential for reduction given increased underground mining under the NMP).

Under the findings of the EIS, relating to the OMP, some assessment could have been made for the remaining two properties (Eureka and Salt Bush). However international work by Navrud (2002) suggests noise annoyance costs equate to $59 per dB(A) per household per year (in 2021 Australian dollar terms) for the 55-64 dB range.[138]

Given estimated exceedances of 1-3 dB for Eureka and Saltbush, the impacts over the project lifetime would therefore have been negligible.

Likewise, under the NMP, given that exceedances at Glenn Innes are 1-3 dB and that 3 dB exceedance is cited to be “barely noticeable” impacts over the project lifetime would likewise be negligible.

We also note that airblast and ground vibration levels are within exceedance limits according to WAR 0481.0001.

Accordingly no additional allowance for noise impacts has been estimated as a part of the quantified CBA.

4.9 WASTE

Construction and operation of the project will involve the production of three main types of waste.

[137] We note the qualifications contained in *Affidavit of Nui Bruce Harris*, 21 June 2021 (WAR 0291.001), paras 103-107 and para 245. These indicate that these arrangements are subject to successful property compensation and purchase negotiations with affected landowners. In the event that such negotiations are not successful, the mine plan can and will be amended to avoid operations on restricted lands.

[138] Navrud, S. (2004) *The Economic Value of Noise Within the European Union - A Review and Analysis of Studies,* Acustica 2004*,* Guimarães – Portugal. Note these are based on a study of road traffic noise (though the precise source may matter less than the limited noise impacts of the project). These values have been converted from an original 23.5 Euro per dB per household per year (2001) using Australian National CPI and current exchange rates (1 Euro equates to $A 1.57).

- General waste – This includes hydrocarbon waste, food and food packaging wase, wood, scrap metal and sewage
- Waste rock – Including overburden, interburden and waste coal
- Tailings – Including rejects, spoil and mine waste

The EIS and SEIS both examine the issue of waste while the 2021 EMP provides details of the waste management plan and accompanying commitments. [139]

As is the case elsewhere it is worth considering the conclusions of the CGR in assessing the issue of waste management.

With respect to general waste, the CGR concluded that:

> *Based on mitigation measures and management plans outlined in the Mine EMP and WMP, I am satisfied that general and regulated waste would be effectively managed over the life of the project.*

In terms of waste rock, the CRG noted that:

> *In general terms, I accept that the waste rock characterisation deficiencies identified in the EIS have been addressed in the SEIS and that provided that the outlined ARD management strategies are appropriately implemented, there will not be any significant impact to the surrounding environment.*

While in terms of tailings, the CRG noted that:

> *I am satisfied that the proponent has adequately examined options for disposal of coarse rejects and tailings and that the management proposals outlined in the SEIS and mine EM Plan will ensure that impacts can be properly managed.*

In practical terms, it might be expected that waste management costs would be subsumed within the project's general operating costs, as well as mine rehabilitation and make good costs.

Nonetheless, we note that some objections to the project have referred to the potential for arsenic contamination as well as topsails stability and contamination in general.

In response to this, Waratah has indicated in the Second Data Response that mitigation would form part of its general operating costs and that arsenic contamination and topsoil stability and contamination are part of progressive rehabilitation and make good costs. It has also indicated that a consultant (Bill Thompson) will be preparing a forthcoming report on this issue.

Given the CGR conclusions above, and in the absence of any further information on additional waste costs, we have assumed that waste costs are indeed internalised within existing costs and have not assessed any additional externality costs for waste. However, should any information on potential additional waste costs arise as a result of Bill Thompson's reporting, it may be necessary to add in additional waste costs to the analysis.

[139] EIS, Vol. 2, Chap. 12, SEIS, Vol. 1, Chap 8, 2021 EMP, pp.46-74

4.10 VISUAL IMPACTS

The EIS undertakes a review of the site's visual impacts on the surrounding area. This indicates that the mine itself would be relatively hidden and isolated component of the project given its location within a low range of hills. Mapping of 38 households in the region found that eight would have a visual impact of which four would have a low impact , two moderate and two high (Monklands and Hobartville).[140] However we note that both of the properties with high visual impacts will be either acquired or moved as a result of mining operations.

There is also potential for dust clouds due to mining operations and the potential for night pollution "glow" on surrounding towns of Alpha and Jericho and for large distances of their surrounds. [141]

We note the EIS comments that dust and night glow impacts will be managed through mitigation and design efforts[142]. We also note the CGR summary of Waratah's commitments including[143]:

- *topography changes will be minimal to maintain visual landscape character and existing vegetation will be maintained where possible. Endemic plant species mixes will be used to provide buffering and will be established pre-construction and maintained during project development to ensure effective screening by the commencement of operations*

- *the most highly impacted of the homesteads will be buffered by extensive planting, mounding or both with consultation with their owners*

- *flood and site lighting should be designed by a lighting specialist to ensure that surrounding areas do not experience light pollution from the rail*

- *where all other mitigation measures fail to alleviate the visual impact, homesteads identified as having high visual exposure will be relocated to a less sensitive location further from the rail*

- *existing topsoil from the site should be stripped and placed into temporary stockpiles prior to construction to provide additional visual buffering*

- *grade separated crossings will include planting on batters to create vegetated regions at these crossings. The Clermont Alpha Road will gain a 1km vegetation buffer between road and rail to maintain the visual landscape character of the area*

[140] EIS Vol.2, Chap. 5, p.161
[141] *Ibid* pp.161-163
[142] *Ibid*, p.163
[143] CGR p.202

- *the rail alignment will be designed to cross level crossings of minor roads at right angles and not be aligned parallel to roads on approach*

- *vehicle wash-downs will continue as standard practice and wash-downs will be located at strategic points along the rail alignment and at all entry points from construction camps*

- *the working rail corridor will be limited to as little as topography permits (generally around 40-50m), and any clearing outside this width during development will be revegetated using 'best-practice' re-vegetation techniques.*

Given these commitments and Waratah's advice, noted above, that mitigation and management costs are incorporated into project capital and operating expenditure it has been assumed that these costs are effectively internalised. Accordingly, no additional assessment has been made for visual amenity impacts.

4.11 INDIGENOUS HERITAGE

The EIS indicates that no publicly available archaeological surveys have been undertaken in the mine area and only a few undertaken in its vicinity. It also indicates that no sites listed in the Aboriginal Cultural Heritage Database and Register were identified in the mine area, although several were located in its vicinity. However the lack of sites registered in the mine area this does not mean that no sites exist, as not all sites in the general vicinity are registered on the Aboriginal Cultural Heritage Register. [144]

The EIS indicates that Waratah is committed to avoiding or minimising any impacts on indigenous cultural heritage. As noted in the CGR[145]:

- *Waratah Coal commits to continued engagement and negotiations with endorsed Aboriginal Parties; and, to developing (where not already developed) and implementing approved Cultural Heritage Management Plans (CHMP)*
- *Waratah Coal commits to notifying the Coordinator-General of the completion and registration of any Cultural Heritage Management Plans that are being finalised after the Coordinator-General's Evaluation Report has been issued*
- *control strategies in the EIS will be implemented to manage known and potential cultural heritage sites and values located within the Project site*
- *conduct regular cultural heritage education sessions/trainings to employees*
- *Waratah Coal commits to appointing an Indigenous Liaison Officer during construction and for this position*

While noting the commitments above, in summary there is no data in the EIS or SEIS confirming indigenous impacts. Impact on indigenous heritage sites could

[144] EIS Vol.2, Chap 14, p.374
[145] CGR p. 218

impact on the wellbeing of the local indigenous community. However at present there is no firm indication of this and monetisation of such impacts may not be appropriate. Accordingly, no assessment of indigenous impacts has been undertaken for this analysis.

4.12 NON-INDIGENOUS HERITAGE

The EIS and SEIS both refer to surveys and assessment of non-indigenous local heritage. This work indicates that the mine will have impacts on Kia Ora, Glen Innes and Monklands homesteads and the surrounding lands. However the only area currently identified to have historic significance is Monklands. [146]

The SEIS mentions that consideration be given to the relocation of Monklands homestead as a part of any compensation package to its owners.[147]

As indicated above we assume that the opportunity cost of Monklands commercial value is included through its sale price. However it is unclear if the homestead will be relocated. The heritage value of Monklands could be lost if there is no relocation case and this would constitute an additional cost to society above and beyond its loss as a commercial entity.

Assuming that the non-indigenous heritage value of Monklands would be indeed occur and constitute an additional project cost we have adopted the following approach

- Work undertaken by the Allen Consulting Group in 2005 indicates that Australian willingness to pay per household was $5.53 per person (household) each year for every 1,000 non-indigenous heritage places protected.[148]
- Inflating these to 2021 values indexed to national CPI produces an estimate of $7.95 per 1,000 heritage places.[149]
- Given 1,987,313 Queensland households at the time of the 2016 census this produces an overall Queensland value of $15.8 million per 1,000 places.[150]
- Applied to a single place (Monklands) this implies a value of $15,806 for the loss of historic heritage.[151]

Assuming that the loss of the property occurs upon land acquisition in 2023, we have accordingly assessed a discounted loss of $13,806 for historic heritage due to the project.

[146] EIS, Vol. 2, pp.379-385
[147] SEIS Vol.1, Chap. 11, p.426
[148] The Allen Consulting Group (2005) Valuing the priceless: the value of historic heritage in Australia
[149] ABS (2021) Consumer price index, *op. cit.*
[150] Australian Bureau of Statistics (ABS) 2016 Census QuickStats at https://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/3?opendocument
[151] We note that Monklands technically consists of three properties, however it has been considered as a single place for purposes of the analysis.

4.13 TRANSPORT AND TRAFFIC

4.13.1 Road traffic

Construction and operation of the project will have some impact on traffic on traffic on local roads . These impacts were referred to in the EIS and updated in the SEIS.[152] The SEIS also included an updated Traffic Engineering Report indicating the impacts of the construction and operation of the mine.[153] Along with roads internal to the project itself, particular impacts could be expected on local roads such as the Capricorn Highway and the Claremont -Alpha Road

The CGR noted these reports concluding that while there would be increases in traffic volumes in the local area an "A" level of service would be maintained on local roads during both construction and operation and that intersections could handle the increased traffic efficiently, although some design requirements would be necessary for the Saltbush Road/Capricorn Highway intersection.. However it also indicated that a pavement analysis suggest that proponent contributions would be required to rehabilitate and maintain the Capricorn Highway between Jericho and Emerald. [154]

The 2021 EMP also referred to traffic impacts and indicated that there would be significant impacts on traffic volumes during the construction and operation of the mine. These appear to be most substantive along the Capricorn Highway, sections of which will see 1,160 vehicles per day (vpd) of mine generated traffic during construction, with 720 vpd of mine generated traffic during operations. [155] However the 2021 EMP reiterates that no road in the local area is expected to carry more than 3,000 vpd inclusive of background traffic and mine generated traffic, well below the 4,000 vpd threshold to maintain level of service A.[156]

Waratah has also outlined migration and control strategies and made a number of traffic management commitments in the 2021 EMP. These include:

- Road works identified in the control strategy to be implemented to migrate traffic impacts
- Upgrade of Saltbush Road and addressing potential problems at the Saltbush Road/Capricorn Highway intersection
- Working with the Department of Transport and Main Roads (DTMR) to address intersection upgrade solutions
- Revaluating road impact assessments at the design stage and working with local authorities and DTMR on works required and funding contributions

We note the findings of the CGR in respect of the maintenance of an "A" level of service during mine construction and operation, and the commitments by Waratah referred to in the CGR and the 2021 EMP. In addition, we also note

[152] See EIS, Chapter 12, SEIS, Vol. 1 Chapter 9
[153] SEIS Vol 2 Chapter 29 TTM Consulting (2012) Galilee Coal Project (Northern Export Facility) Supplementary EIS Traffic Engineering Report
[154] CGR, pp.94-96
[155] 2021 EMP, *op. cit.,* p.41
[156] *Ibid,* pp.41-42

the local contributions have already been internalised as part of the costings of the King report and assume that this includes costings for road maintenance, indicated by the CGR. Accordingly, we have not allowed for additional externality costs for traffic and transport and have assumed these costings have been internalised within the project expenditure, provided by the King report.[157]

4.13.2 Air traffic

As noted elsewhere there will also be an increase in air traffic associated with the mine, especially given the presence of fly in fly out workers (FIFO). Waratah has indicated in the Second Information Response that it intends to use the existing Alpha airstrip and pay on a per passenger basis .Discussions have commenced with the potential developer and operator on this. We note that the King report allowed for $1.478 billion in airport and camp operating expenses during the lifetime of the project. (Some of this is an allowance for accommodation costs given worker accommodation is now to be located in Alpha under the OMP and NMP).[158] This likely represents an allowance for the payments indicated by Waratah.

Accordingly air traffic costs are assumed to be internalised and no additional externality costs have been allowed for in this assessment.

4.14 GOVERNMENT SERVICES

4.14.1 Background

The EIS and SEIS and CRC refer to the social impacts of the project on the local area.[159] These also have impacts on government service provision. An economic impact study undertaken for the EIS defined the local area (or “mine catchment area”) as comprising of the BRC and the Central Highlands Regional Council.[160] However the CGR notes that a Significant Impact Assessment (SIA) established for the EIS focussed on the towns of Alpha and Jericho and surrounding regions within the BRC (although the SIA also examined a broader local region incorporating 5 LGAs).[161] The BRC is the region where most of the local impacts might be expected to be felt, given the location of the project 30km north of Alpha and the relatively small existing populations of Alpha and Jericho.

The EIS, SEIS and CGR detail a variety of social impacts of the project on the local area. More recently the *Statement of Evidence to the Land Court of Queensland on Social Impacts* (WAR 0441.0001) authored by Lars Holm,

[157] As indicted it is possible that further expenses will be incurred by Waratah when more detailed information on traffic conditions is available at the design stage. However given the commitments made in the 2021 EM Plan these would likewise be internalised as and when they arise.

[158] We understand that the split of accommodation to flight costs is estimated as 70% accommodation to 30% airport on a per head cost basis, based on information supplied from Waratah. Communication received through Hall & Wilcox, 24 February 2022. This communication is also included in Appendix 1.

[159] EIS, Volume 2, Chapter 16 and Appendix 23 : SEIS Volume 1, Chapter 12 and Appendix 30 (the Social Impact Management Plan)

[160] EIS, Appendix 24, p. vii

[161] CGR p.108. The SIA was revised for the SEIS.

dated 5 November 2021 has also examined the effects of the project on the local area.[162]

To the extent that these impact on government services, increase net costs to government and are not incorporated into exiting project costings, they represent an additional cost to society (or externality).

As indicated the frame of reference (or population of standing) for this CBA is the impacts on Queensland rather than of a given local area, regardless of definition. The provision of additional government services in a local area would mean higher levels of recurrent spending in the BRC for example. However from a State government perspective much of the recurrent expenditure involved will likely require more a shift in government resources and spending from one area to another rather than necessarily leading to an increase in overall government spending.

Nonetheless, new facilities may be required in some regional centres such as Alpha and Jericho and within the broader BRC. This will involve capital costs to government which would constitute a net additional cost given that it is "new" spending on fixed infrastructure and not simply a shift in recurrent resourcing..

The economic impact work prepared for the EIS suggests that the mine will employ some 2,000 workers when operational, of whom all but 300 would be fly-in-fly out (FIFO) workers.[163] In addition, the EIS notes that the impacts of the project on public infrastructure would be modest. Medical staff would be employed at the mine site and could provide an additional resource while serious injuries would be treated in Rockhampton or Mackay.[164] WAR 0441.001 likewise suggests medium level impacts on public infrastructure and services.[165]

However, the EIS also notes that the indirect workforce (i.e. contractors) and their families might increase demands on social infrastructure in Alpha or Jericho. In addition, since the time of the EIS, under both the OMP and NMP, it has been proposed that workers be accommodated in the township of Alpha rather than on-site.[166]

The small size of these communities means that the impacts could be quite notable. The issues associated with the location of the accommodation camp in or near Alpha were also noted in WAR 0441.001.[167]

In addition the effects would be magnified by the combined effects of other mines in the region. In particular, impacts might include:

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[162] *Statement of Evidence to the Land Court of Queensland on Social Impacts by* Lars Daniel Holm *5 November 2021* (WAR 0441.0001)

[163] EIS, Appendix 24, p.43. Information supplied to BISOE from Waratah as a part of the First Information Response based on the NMP indicates that the expectation is that the project will employ 2,000 operational workers although with a 4 year ramp up period as opposed to 2 years under the OMP. In addition 2,500 construction personnel would be employed in the early years of the project.

[164] EIS Vol. 2 Chap. 16, pp.396-397

[165] Holm, *op. cit,* p. 7

[166] *Affidavit of Nui Bruce Harris* 21 June 2021 (WAR 0291.0001), p. 21

[167] Holm, *op. cit,* p.9

- An increase in school children attending school in Alpha
- Increases in demands on health care and aged care facilities
- Increased demand for childcare services
- Increase in demand for welfare services (including accommodation support, domestic violence, child abuse and mental health support)
- Increase in demand on the rural fire brigade
- Increased demand for police and emergency services (largely resulting from increased traffic of large trucks in particular)[168]

There has also been commentary around issues such as impacts on the local housing market due to population surges and the social problems that come with such surges including drug abuse, family stress and social dislocation. Some of these impact on government services as indicated above. However as discussed previously ,many of these issues concern qualitative or distributional questions. This includes the impacts on the housing market (which as indicated is a secondary market from the point of view of the CBA).

The EIS, the Social Impact Management Plan (SIMP) in the EIS and Revised SIMP (in the SEIS) provided details of Waratah's commitments to manage social impacts.[169] The CGR also noted many of these social impacts and their effects, calling on Waratah to develop planning to manage and minimise their effects.[170]

Separately the CGR also noted the increase in air traffic movements the mine would bring and that Waratah was engaged in discussions about the use of the and upgrading of the aerodrome about that funding and access arrangements had yet to be concluded.[171]

Appendix 6 of the CGR also noted Waratah's social commitments including.[172]

- Financial support to address housing affordability and temporary housing needs in Alpha through Infrastructure and Community Development funds with contribution from a number of mining projects under the Galilee Basin CSIA Roundtable.

- As a member of the Galilee Basin CSIA Roundtable play a leading role in determining contributions of each proponent of mining projects in the area to an Infrastructure Fund (based on a development plan for Alpha) and a Community Development Fund (to improve service delivery maintain infrastructure and support local organisations).

- The Infrastructure and Community Development Funds will support a wide range of needs for Alpha including assistance for affordable housing and supporting local health and emergency service providers

[168] *Ibid*, p.397
[169] EIS, Volume 2, Chapter 16 and Appendix 23; SEIS Volume 1, Chapter 12 and Appendix 30.
[170] CGR pp.106-118
[171] CGR pp.98-99. The King report identified expenditure on the airport and camp (i.e. accommodation) costs of $1.478 billion (undiscounted).
[172] CGR pp.224-239

In addition the Revised SIMP notes the following:[173]

- Waratah is committed to base at least 50 staff in Alpha.
- All mine employees will also be given the opportunity to reside in the local area and will be given incentives to relocate to Alpha with their families.[174]
- Mine contractors would be encouraged to establish businesses and base their staff in Alpha.
- The placement of a relatively small number of mine workers in Alpha could therefore be the catalyst for substantial population growth. While estimates vary, if the town's population were to grow from the 349 recorded at the time of the SEIS to 2,000 (due to the impact of the project and others in the region), primary school students would rise to 200 (up from the 40 or so recorded at the time of the SEIS).
- The Coordinator General has requested that Waratah provide an equipped ambulance and funding to BRC for five years during construction and financial contributions to the provision of a police station in Alpha ,as well as staffing, accommodation, and vehicles.
- Galilee Basin proponents will contribute a total of around $2 million to a Community Development Fund once four or more mines are operational.

Waratah's Second Information Response also indicated that allowance has been made in associated projects to allow for any increase in Council services. (This appears to be a reference to the Infrastructure and Community Development Funds referred to above.) It further stated that coal royalty payments it will make during the project could be considered to be partially allocated to community funding.

While noting the passage of time since these commitments were made, WAR 0441.001 also sees the commitments made under the SIMP as appropriate to manage social impacts.[175]

4.14.2 Assessment

We note that the King report identifies a local and regional government contribution of $2.7 million (undiscounted). It also identified expenditure on the airport and camp (i.e. accommodation) of $1.478 billion (undiscounted).[176]Additional spending on accommodation and mine-related infrastructure services may also be included in general capital and operating costs.

[173] SEIS Appendix 30 Revised SIMP, pp.2910-2920

[174] We note the subsequent decision post the EIS/SEIS to place the workers accommodation camp in Alpha under both the OMP and NMP.

[175] Holm *op cit,* p.13

[176] As indicated above, some 70% of these costs can be allocated to accommodation costs (with accommodation now to be in Alpha).

However there may be additional costs which fall to state and local government outside of the amounts contributed by Waratah.

That said, it is difficult to fully assess the additional costs of the project in isolation on government (and thereby society) given:

- Some local contributions funding is already accounted for in the King Report's costings (i.e. $2.7 million in undiscounted terms).
- There is considerable uncertainty about local population growth, the level of additional service provision required and the accompanying costs.
- Other projects in the area may provide funding for local service provision. So given that the spending may be contingent on several mining projects attributing additional government spending solely to the Galilee Coal project may provide an upper level estimate of costs related to that project in particular.

Nonetheless, it is important to develop an estimate of the additional call on resources which such a large project may have on the community and to recognise that this will likely involve some level of additional government spending[177]. As indicated we have focussed our estimates on capital spending given that at a state-wide level recurrent spending may simply represent a shift in government resources.

In addition, although it is true that some of the royalties paid by Waratah might be allocated to funding local projects, these are already allocated to the benefits side of the CBA. The question here concerns the corresponding social costs.

Accordingly we have assumed the following, based on a sampling of primary research, recent Queensland government capital spending costs and past spending within the BRC.

- *New hospital, mental health service, aged care facilities* and *ambulance service*– Since the time of the CGR, a multipurpose health facility new hospital has opened in Alpha replacing the dated facilities noted in the report.[178] The new facility $17.5 million opened in 2016 and offers a range of primary, emergency allied and mental health services along with an ambulance service and five residential care beds.[179] It also operates an ambulance service in partnership with the Queensland Ambulance Service.

  We have assumed that a similar level of expenditure will be required again for further expansion or upgrade of these facilities and the

[177] In the past the Queensland government has recognised the need to reinvest mining royalties into regional areas through its Royalties for the Regions initiative. This has now been replaced by the Building Our Regions initiative. See https://www.statedevelopment.qld.gov.au/regions/economic-development/royalties-for-the-regions
[178] See https://www.queenslandcountrylife.com.au/story/4299447/new-alpha-hospital-making-history/
[179] See https://www.agedcare101.com.au/qld/alpha/alpha-jericho-multipurpose-health-service-2664

ambulance service in the event the project goes ahead. Updating the costings to 2021 figures implies a cost of $19.1 million

- *New primary school* - As indicated it is likely that the local primary school would require expansion to deal with the influx of workers. Analysis of the Queensland Government's *Capital Program 2020 Update* indicates that the cost of additional classrooms or other facilities in regional Queensland varies between $2 million and $10 million[180]. This obviously depends on the type of facility Accordingly we have assumed a figure in the centre of this range ($6 million).

- *Childcare centre* – Real estate reports suggests a range of $700,000-$800,000 for a new preschool. We have assumed $750,000. Note that not all of this may be funded by government, however private sector funding would likewise represent a call on social resources. [181]

- *New police station* – The Capital Program 2020 Update cites a cost of $3.5 million for a replacement police station in the small regional town of Biloela.[182] We have adopted this as an indicative cost for a new police station in Alpha.

- *New fire and emergency services centre* - The Capital Program 2020 Update cites costs of $1.5-$3.5 million for replacement auxiliary fire and rescue services facilities in small regional Queensland centres.[183] We have taken a figure in the centre of this range ($2.5 million) as indicative.

In all cases we have assumed that the facilities are initiated at the beginning of the project's construction (i.e. in 2023) although in likelihood they would only come onstream some years into project lifetime. Although no capital replacements are allowed for, this has the impact of higher costings then would be the case if the expenditure was assumed to take place in later years (due to discounting). Our approach is also summarised in the figure below.

Fig. 17. Assessed government and community services costs

Item	Assessed economic cost , undiscounted ($m)
New health care facilities	19.1
School	5.2
New childcare centre	0.75
Police station	3.5
Fire and emergency services	2.5
Total	**31.9**
Item	**Assessed economic cost , discounted (7% real) ($m)**
Total	**27.9**

Source: BIS Oxford Economics estimates

[180] Queensland Government (2020) *Capital Program 2020 Update*, p.32

[181] See https://www.realcommercial.com.au/news/how-much-does-it-cost-to-open-a-childcare-centre

[182] *Ibid* p. 40

[183] *Ibid* p. 40

4.15 GREENHOUSE GAS EMISSIONS (GHG)

4.15.1 Scope 1 and 2 emissions

The project will emit a variety of greenhouse gases (GHGs) during its construction and operation. These were detailed in ERM (2021) *Galilee Coal Project: Greenhouse Gas Assessment* ("the GHG Assessment") and were supplied to BISOE by Waratah. This assessment is consistent with the NMP.

The GHG Assessment covers Scope 1 and 2 emissions relating to the project. As defined in the GHG Assessment, Scope 1 emissions relate to direct GHG emissions from sources owned or controlled by the company. Scope 2 emissions in this context relate to electricity consumed by the company.[184]

The GHG Assessment estimates that the project will emit 105,705 t CO_2-e annually during the construction phase and 2,150,847 t CO2-e annually during the operational phase. Total emissions over the project lifetime will be 57,530,074 t CO_2-e.

The findings of the GHG Assessment for Scope 1 and 2 emissions were also noted by the Joint Statement of Evidence, *Final Report: Expert Advice – 4 February 2022: Questions for the Greenhouse Gas Emissions and Climate Change Experts*, authored by Professor John Church, Professor Will Steffen and Dr Bethany Warren, dated 4 February 2022 (COM 0067.0001).[185]

Given the total output of CO_2-e, there is a need to apply a carbon price to it to estimate the cost of the damage done

The assessment of an appropriate carbon price is, however, a problematic issue. A variety of potential valuations have been suggested in the past. These include

- *Australian carbon credit units (ACCUs)* – Managed by the Clean Energy regulator.[186] These are often used as offsets by commercial enterprises. This reflects pricing in a voluntary market. At the time of writing, (November 2021) spot price ACCUs had reached $39.00. This represents a more than doubling of the price over the course of 2021 after trading in the $15-$19 t/CO_2 range between November 2019 and February 2021.[187]

- *The US Environmental Protection Agency (EPA)s Social Cost of Carbon (SCC)* – This provides well-recognised SCC measures. A central estimate of the SCC is assessed at $US 51 t/$CO_2$ ($A 70.44),

[184] ERM (2021) Galilee Coal Project: Greenhouse Gas Assessment
[185] Final Report: *Expert Advice – 4 February 2022: Questions for the Greenhouse Gas Emissions and Climate Change Experts*, Professor John Church, Professor Will Steffen and Dr Bethany Warren, 4 February 2022 (COM 0067.0001)
[186] See Clean Energy Regulator "Australian Carbon Credit Units" http://www.cleanenergyregulator.gov.au/OSR/ANREU/types-of-emissions-units/australian-carbon-credit-units
[187] See Jarden https://accus.com.au/ ; ABC 6 November 2021,"Carbon price hits record high but Australia still a long way behind" https://www.abc.net.au/news/2021-11-06/carbon-price-record-but-why-is-australia-behind-/100595060

although this is assessed at a 3% discount rate[188]. A lower estimate ($US 14 t/$CO_2$ in 2020) is produced at a 5% discount rate.[189] The EPS also measures out a SCC cost pathway which recognises the growth in climate change costs over time.

- *The European Union Emissions Trading Scheme* – Prices under the ETS were some €69.17 t/CO_2 ($A 109.90) at the time of writing (November 23 2021).[190] This compares with a price of €32.96 t/CO_2 on 5 January 2021 – i.e. a more than doubling of prices within a year.

While the ACCUs may have appeal given that it provides an Australian yardstick we note that prices are considerably lower than the EU ETS prices (or indeed the EPA SCC) and that Australian companies are not legally obliged to offset emissions.[191]

The EU ETS measures may also reflect the impact of government policies and/or specific supply and demand issues in a given period (e.g. gas shortages currently affecting Europe or the German governments recent decision to place a price floor of €60/t CO_2).[192] We note for example that the EU ETS price has increased by 110% since the start of 2021. At the same time this may also be a reflection of growing awareness about the costs of climate change.

The EPS's SCC estimate of $70.44 t/$CO_2$ is near the midpoint of the ACCUs and EU ETS prices.

Given the uncertainties, we have adopted the following approach

- We have used the midpoint of current ACCUs and EU ETS prices as the starting point for our estimated carbon price. This equates to $74.42 t/$CO_2$. (It is interesting to note that is similar to the EPA SCC price of $70.44 t/$CO_2$.) We note this is substantially higher than the carbon price used in a number of past mining assessments.[193]

- Given uncertainties on the short term fluctuations in the carbon price which may be driven by current events, we have held this price of carbon constant to 2025 and calibrated to our estimate of the EPA SCC price in that year ($74.48/t CO_2). We then used the percentage growth path outlined by the US EPS to grow the cost of carbon over the lifetime of the project.

[188] Using the 1.33 fixed US$ to A$ exchange rate adopted for this study and allowing for inflation of 3.6% indexed to national CPI (ABS 2021 Consumer Price Index *op. cit.)* to adjust to 2021 prices.
[189] United States Government (2021) Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990 Interagency Working Group on Social Cost of Greenhouse Gases.
[190] See https://ember-climate.org/data/carbon-price-viewer/
[191] ABC 6 November 2021,"Carbon price hits record high but Australia still a long way behind" https://www.abc.net.au/news/2021-11-06/carbon-price-record-but-why-is-australia-behind-/100595060
[192] See https://www.reuters.com/world/europe/european-carbon-prices-hit-record-high-after-german-price-floor-pledge-2021-11-24/ ; https://www.ft.com/content/c1595f64-5a31-4e7b-bf98-9f5fcbb4e970
[193] In addition several past assessments do not appear to have allowed for the growth in the SCC over time.

- Project Scope 1 and Scope 2 emissions during each year of the construction and operational phases were derived by applying the GHG Assessment annual average emission figures to the relevant production years (and allowing for some mining ramp up).

- We apply this carbon price to these years (and grow it over time as described)

- This produces a total cost of project carbon emissions of $1.84 billion in PV terms over the period 2021-2051.

However climate change is a global phenomenon and this cost is reflective of the *global costs* of climate change. While the project *emissions* are located in Australia and more specifically Queensland, these *project climate change costs* will be spread across the world and not just confined to Queensland.

The *Technical Notes* to the NSW Guidelines also note that the economic impact of GHG emissions is to be limited to the effects of Scope 1 and 2 emissions and to be limited to the NSW community only, consistent with other costs and benefits measured in the CBA.[194]

Correspondingly, and as indicated above, the assessment of costs and benefits in this CBA is limited to the Queensland community.

There is therefore a need to apportion the costs of the project carbon emissions to Queensland. We have applied the ratio of the Queensland population to the global population (0.07%) in order to do this.

This produces a total GHG cost of $1.2 million in PV terms across the life of the project.

We note however the issue of climate change and the appropriate cost of carbon continue to be matters of ongoing controversy. We have therefore provided sensitivity tests exploring higher (and lower) carbon prices, as well as for externalities in general in the section of this report dealing with sensitivity tests.

4.15.2 Scope 3 emissions

Background

Scope 3 emissions relate to all other indirect emissions not covered by Scope 1 and 2 emissions. They occur as a consequence of the activities of Waratah Coal but occur in sources not owned or controlled by the company. In particular, in addition to the construction and operation of the project itself, CHGs will be emitted as a consequence of the transport and use (combustion) of the saleable coal.[195]

[194] NSW Department of Planning and Environment (2018) Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals, p.48
[195] For further discussion on the distinction between Scope 1,2 and 3 emissions see ERM Australia Pty Ltd (2021) *Galilee Coal Project Greenhouse Gas Assessment*

In considering Scope 3 emissions it is important to understand the context and national accounting background to their estimation.

Australia is a signatory to international climate agreements under the United Nations Framework Convention on Climate Change (UNFCCC). In addition Australia is a signatory to the Paris Agreement, which built upon the UNFCCC's objectives and which entered into force in 2016.

Australia's National Greenhouse Accounts (NGA) track national emissions from 1990 onwards. In particular, Australia's National Greenhouse and Energy Reporting Scheme (NGERS) records Scope 1 and 2 emissions.

Controlling corporations who exceed either a corporate group or a facility threshold must report their Scope 1 and Scope 2 emissions and energy production and consumption data to the Clean Energy Regulator under section 19 of the NGER Act.[196]

In short, current Australian legislation allows for the recoding of Scope 1 and 2 emissions but does not allow for the inclusion of Scope 3 emissions. This however has been the subject of challenge in recent years with efforts to incorporate Scope 3 emissions into the carbon accounting framework. In particular, the proposed *National Greenhouse and Energy Reporting Amendment (Transparency in Carbon Emissions Accounting)Bill* sought to include Scope 3 emissions in carbon accounting (although this bill is not proceeding).[197]

We also note the commentary in COM 0067.0057 on Australia's commitments under the Paris Agreement, namely[198]:

> *The Paris Agreement accounts for total GHG emissions through each country's Nationally Determined Contributions (NDCs). The boundaries for the NDC are physical and relate to the emissions released within the country. The concept of scope 1, 2 and 3 GHG emissions are not directly applicable to the Paris Agreement as over or incomplete accounting of emission could occur. As such, the scope of the emissions are not directly discussed in the treaty or in the NDCs.*
>
> *Using the GHG scope emissions framework, most simply, a country would want to only quantify scope 1 emission from all individual sources to be used for developing their NDCs. This would minimise any double or triple counting of a country's emissions.*

Parliamentary Committee

A House of Representatives Standing Committee considered the issue of the inclusion of Scope 3 emissions in a formal report on the Bill above. It is worth citing extracts from the key points noted in that report, namely:

[196] Parliament of the Commonwealth of Australia (2020) Advisory Report on the National Greenhouse and Energy Reporting Amendment (Transparency in Carbon Emissions Accounting) Bill 2020
[197] See https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6664
[198] COM 0067.0001, p. 53

2.42 In considering the evidence presented to the inquiry, the Committee views that there is insufficient evidence to support the inclusion of scope 3 emissions data in Australia's greenhouse gas reporting obligations….

2.44 The Committee believes that it is in Australia's interests to ensure that laws relating to the reporting of greenhouse gas emissions comply with its international obligations. At present, these obligations require the reporting of scope 1 and 2 emissions, consistent with the international requirement that Australia reports emissions from within its territorial boundaries. Importantly, Australia's current greenhouse gas reporting practice is also consistent with that of other comparable international jurisdictions.

2.45 The Committee received significant evidence about concerns relating to the calculation and reliability of scope 3 emissions data. In the first instance, the Committee agrees with DISER that the reporting of emissions data under NGERS is a matter of public confidence. Without this, the Australian Government would have difficulty in garnering support for its emissions reduction policies and strategies.

2.46 After careful consideration of the evidence, the Committee is of the view that the calculation of scope 3 data by Australian companies would be a significant undertaking both by Australian NGERS liable companies and the regulator. It would require a complete and complex understanding of each company's supply chain and product lifecycle - in many cases these processes are conducted overseas and readily available data is unlikely to be available or have the capacity to be audited.

2.47 Significantly, the Committee notes comments from DISER that a methodology to comprehensively calculate scope 3 emissions has yet to be developed. Estimating scope 3 emissions information would be costly and difficult to verify. In the Committee's view, the development of a methodology for the calculation of scope 3 emissions for use by Australian NGERS liable entities is likely to be a significant and complex undertaking that is unlikely to provide value beyond the scope 1 and 2 emissions data that is already internationally available.

2.48 The Committee acknowledges the concerns raised by some inquiry participants that the inclusion of scope 3 emissions in Australia's greenhouse gas reporting obligations would amount to scope 1 emissions being counted twice. Scope 3 emissions are indirect greenhouse gas emissions that are emitted either domestically or internationally as a result of a scope 1 emissions-producing activity in Australia but from sources not owned or controlled by the source of the scope 1 emissions.

2.49 As such, scope 3 emissions are likely to include emissions that have already been reported as scope 1 emissions by another country. The Committee is of the view that if Australia and other international parties continue to adhere to the international treaty principle that each jurisdiction is liable only for those emissions occurring directly within its territorial boundaries, there is reduced opportunity for scope 1 emissions to be counted twice and therefore the reporting provides a more accurate representation of each nation's progress against its international commitments.

2.50 The Committee accepts that there are a number of Australian companies that do voluntarily report on their scope 3 emissions, despite it not being a requirement under NGERS. The Committee notes comments by DISER stating that it had not assessed the quality of the estimates produced by companies, and thus, individual company assessments of scope 3 emissions are not of regulatory value.[199]

Australian practice

Likewise under approaches such as that taken by the NSW Guidelines only the impact of Scope 1 and 2 emissions on the NSW community is formally allowed for.[200]

Nonetheless there have been growing concerns about the impact of Scope 3 emissions by resource projects and the impact of downstream Scope 3 emissions and the role of Australian resource projects in such downstream or offshore emissions. Accordingly, while they have not entered into a formal CBA, mining projects in states such as the Hume Coal Project in NSW have been required by bodies such as that State's Independent Planning Commission to provide the quantum of Scope 3 emissions estimates.[201]

Our approach

That said in considering Scope 3 emissions in the context of the GCP, the following is relevant:

- There are considerable uncertainties in the calculation of Scope 3 emissions, along with the issue of double counting, as highlighted by the Federal Parliamentary Committee above.

- ERM's Greenhouse Gas Assessment for the GCP, which forms the basis of our analysis did not formally assess Scope 3 emissions (though a separate assessment of these was later carried out by COM 0067.0001 as discussed below).

- Scope 3 emissions involve damage costs to the "global commons" and not just Queensland.

- Scope 3 emissions involve significant environmental costs but the burning of coal also provides benefits to producers and consumers in the countries burning the coal (otherwise the activity would not be entered into in the first instance).

- This calculus of offshore costs (to the world) and benefits (to consumers) effectively represents a separate project to the mine itself. In order to assess the effects in full, both sides should be accounted for.

[199] Parliament of the Commonwealth of Australia (2020) *op. cit.,* pp. 20-23

[200] NSW Department of Planning and Environment (2018), Technical Notes *op. cit.* p.48 1979

[201] NSW Government, Independent Planning Commission (2019*), Independent Planning Assessment Report in relation to the Minister for Planning's request dated 4 December 2018 under Section 2.9(1)(d) of the Environmental Planning and Assessment Act*

While noting the last point in particular, we have nonetheless included an estimate of the impact and cost of Scope 3 emissions below. Such calculations however must be heavily caveated. In particular, they should be viewed as providing an indicative, ***order of magnitude calculation***, rather than being seen as a precise estimate. We also note the subsequent calculations of COM 00.67.0001.

Our approach is as follows;

- We have limited our estimation to Scope 3 emissions from the burning of GCP thermal coal. While there will be Scope 3 emissions from the transport of the coal domestically (i.e. by rail) we assume these are covered as Scope 1 emissions by the relevant rail provider and their inclusion would raise issues of double counting. A lack of data precludes us estimating the emissions from seaborne transport.

- The amount of total coal combustion was estimated to be equal to the project's output of saleable coal (761.828 million tonnes). This was streamed over the period of project production 2025-2051 to allow for the ramp up (and decline) of coal production and sales.

- The amount of CO_2-e released was estimated with reference to the approach outlined in The Department of Industry, Science, Energy and Resources (DISER), National Greenhouse Accounts factors for stationary energy emissions.[202]

- Allowance was made for CO_2 emissions along with CH4 and N2O emissions (though the latter two of these accounted for only very minor portions of the Co_2-e produced)

- This produced an estimated 1.86 billion tonnes of CO_2-e emitted from coal combustion over the production lifespan of the project

- The SCC detailed in the section above was applied to this carbon price over the project lifespan (i.e. $ 74.42 t/CO_2 in 2021 and following the percentage growth path outlined by the US EPS to grow the cost of carbon thereafter).

- This produced an undiscounted Scope 3 global cost of emissions of $175.9 billion or $59.0 billion in discounted terms over the entire project assessment period (2021-2054) using a 7% real discount rate).

As indicated, this represents a *global cost* of Scope 3 emissions and could be considered to relate to a separate project (i.e. the burning of coal as opposed to the mining of coal). Nonetheless, if this global cost is apportioned to the Queensland community (0.07% of total global population as described above) the PV of Scope 3 costs from project coal combustion is $39.1 million over the

[202] Commonwealth of Australia Department of Industry, Science, Energy and Resource (2020) *National Greenhouse Accounts Factors, Australian National Greenhouse Accounts*, pp.9-10 .

project lifetime. In itself, this amount does not exceed project benefits from a Queensland community perspective.[203]

We note that COM 0067.0057 has subsequently and separately calculated Scope 3 emissions using a variety of assumptions detailed on pp.47-48 of that document.[204] These include the transport of coal to Abbot Point and subsequently to Japan as an export market. The assessment of that report indicated that 2.21 billion tonnes of CO_2 would be emitted during the lifetime of the project. If this number is applied instead of the 1.86 billion tonnes estimated above, and calibrating the impacts to our existing model, the PV of Scope 3 costs rises to $70.1 billion.

An alternative approach is, as noted, to consider the Scope 3 emissions from global perspective as relating to a separate project (i.e. power generation in the recipient nations) with its own set of costs and benefits. On the cost side the most notable issue would be the climate change costs associated with the burning of GCP coal. As indicated the indicative cost of this is $59 billion in PV terms (or $70.1 billion if the approach adopted by COM 0067.0057 is taken). However if such an approach is taken then the benefits side must equally be accounted for on a global basis. As indicated above, this is because importing nations burn coal for a reason – to get the benefits of electricity generation. This would include the consumer benefit (or consumer surplus) associated with electricity generation .as well as any producer surplus (roughly speaking profits) associated with power generation itself.

Although the coal is intended to be exported to a variety of countries, past work by Gillespie Economics has illustrated consumer benefits from electricity generation, in South Korea (one of the proposed importing countries for GCP coal).[205] Adopting this approach also allows for an illustrative example of the potential consumer surplus from the GCP coal as follows:

- One tonne of coal can generate an estimated 1,951 kWh of electricity.[206]
- The base price of electricity for South Korean residential users was estimated as US$ 0.102 /kWh in March 2021.[207]

[203] It is worth noting the impacts of climate change in Australia and Queensland outlined in COM 0067.005 pp.24-27 as well as predicted sea level rises in the Torres Strait and Cairns region (p.3). However, as noted in that document, the project itself constitutes less than 0.2% of annual global emissions p.51. An additional issue is the impact of discounting (which reduces the PV of costs the further away they are in time) and the length of time over which these impacts play out. We also note that the *Statement of Evidence to the Land Court of Queensl*and by Mr Anthony Maxwell Coleman (YVL 0279.0001) dated 14th February 2022, has now been released and that this discusses climate change issues relevant to Queensland. However, we have not been able to review its findings for our analysis, given the time available to finalise our work.

[204] COM 0067.0057, pp. 47-48

[205] Gillespie Economics (2019) *Consideration of Scope 3 Emissions Economic Impact Assessment Prepared for KEPCO Bylong Australia Pty Ltd c/- Hansen Bailey*, March 2019. The approach here follows that laid out in that document with some minor changes and updates. As noted above there has also been discussion of the usage of the GCP coal for domestic power generation although this was not confirmed at the time of writing.

[206]Based on data from the US Energy Information Administration “How much coal, natural gas, or petroleum is used to generate a kilowatt hour of electricity?”
https://www.eia.gov/tools/faqs/faq.php?id=667&t=6

[207] See Global Petrol Prices https://www.globalpetrolprices.com/South-Korea/electricity_prices/

- This implies revenues of US$ 201 per tonne of coal burnt in South Korea (or A$267 per tonne at the US$ to A$ exchange rate of 1.33 used elsewhere in this study).
- Assuming for simplicity that all GCP coal is consumed in South Korea, this equates to $201 billion in revenue (or consumer spending) in undiscounted terms (or $71.8 billion in revenue discounted) over the period 2025-51.[208]
- The price elasticity of demand for South Korean residential electricity users has been estimated at -0.272.[209]
- Using a straightforward linear model to calculate consumer surplus (consumer surplus = 0.5*expenditure/elasticity) this implies a consumer surplus of $131.9 billion over the period 2025-2051.

Note this estimate excludes any producer surplus from power generation (which would be added to consumer surplus to estimate total social surplus).

We also note that a similar analysis could be applied to coal destined for Japan as assumed using the approach adopted by COM 0067.007.

These results are illustrative only. In practice coal exports will likely go to a variety of countries with different sets of consumer and producer costs and benefits. These could produce different results. Indeed, as indicated, COM 0067.0007 assumed the export of the coal to Japan. There would also be other costs and benefits in addition to the above. For example the cost of air pollution from coal emissions could be added to the cost side, while the positive externalities from providing and maintaining reliable power supplies to vital, non-residential, services such as schools and hospitals would form a benefit.

A broader point is that the consideration of global Scope 3 costs might also invoke consideration of global energy supply benefits. Indeed it is this trade-off which forms the backdrop to debates between Western countries and emerging markets over the pace and nature of the transition to renewable energy sources.

4.16 EXTERNALITIES SUMMARY

The table below summaries the assessed externality costs. In total these sum to $31.0 million in PV terms. However we note that there are a variety of externalities which are qualitative in nature and/or may require further analysis and which have not been assessed in the course of this analysis.

[208] South Korea indicated at the recent COP26 conference that it would eliminate coal for power generation by 2050. See https://thediplomat.com/2021/11/what-did-south-korea-promise-at-cop26/ However, this still implies some level of coal usage in the intervening years. In addition, the example here is intended to be illustrative using readily available data – regardless of which economy the coal is diverted to similar issues of consumer surplus would arise.

[209] See Tingwen Liu, 2015. "The Residential Demand for Electricity in South Korea," *International Journal of Economics and Empirical Research (IJEER), The Economics and Social Development Organization* (TESDO), Vol. 3(2).

Fig. 18. Externalities summary

Item	Value ($ PV, 7% discount rate)	Comment
1.Land acquisition and compensation costs	-	PV of $87.3 million incorporated into project costings
2.Make good costs	-	PV of $29.4 million incorporated into project costings
3.Rehabilitiaon costs	-	PV of $20.7 million incorporated into project costings
4. Terrestrial ecology and biodiversity	0.7	Incorporated into Waratah operating costs and/or items 1,2,3
5. Groundwater 6. Surface water	-	Incorporated into Waratah operating costs and/or items 1,2,3
7. Aquatic ecosystem	-	Incorporated into Waratah operating costs and/or items 1,2,3
8. Air quality	1.2	Allowance for additional costs made over mining operational lifetime
9. Noise	-	Negligible effects, incorporated into Waratah operating costs and/or items 1,2,3
10. Waste	-	Incorporated into Waratah operating costs and/or items 1,2,3
11. Visual amenity	-	Negligible effects, incorporated into Waratah operating costs and/or items 1,2,3
12. Indigenous heritage	-	Subject to qualitative assessment
13.Non-indigenous heritage	0.01	Value based on loss of Monklands heritage
14. Traffic and transport		Subject to qualitative assessment
15. Additional government and community investment	27.9	Allowance for additional capital works to support increased local population
16. Greenhouse Gas Emissions (Scope 1 and 2)	1.2	Allowance for impacts on Queensland made over mining operational lifetime
Total (excluding 1.2. 3. Internalised costs)	**31.0**	

Source: BIS Oxford Economics

*Indicates qualitative factor or no additional quantifiable cost.

5. COST BENEFIT RESULTS

5.1 RESULTS

The costs and benefits of the project as a whole (incorporating production results and externalities) have been reported below.

The following should be noted

- Net producer surplus (NPS) is a positive value, reflective of net benefits to the private sector.
- Royalties and payroll tax are added back to this. These are Queensland state revenues (and effectively a transfer of wealth generated from the private sector to the public one).They are part of the gross revenues generated by the project which are retained in Queensland and reflect benefits to government (and broader society) arising from project activity. Accordingly, these must be added back to the net producer surplus.
- A proportion of company tax is also added back. While company tax is a federal tax some of its proceeds will flow back into the Queensland community. Consistent with the fact that this is a State based assessment, and using the approach outlined in the NSW Guidelines, company tax attributable to Queensland has been assumed to be proportional to the State's share of the national population (20.22 per cent).[210]
- Externalities are costs to society in the case of the project. These have been deducted from the project benefits

The results indicate that the project provides a net benefit to Queensland of just under $4.1 billion. If the project plus transport links approach is taken the net benefit to Queensland is just over $ 2.5 billion.

We have provided a summary of the results in the table below. Negative values (i.e. costs) are shown in brackets.

Note that all these results are subject to the assumptions made in the analysis above. The following chapter on sensitivity tests explores the impact of a variety of alterations on key variables.

In particular, in assessing these findings, we note that there remain considerable uncertainties associated with the sale of coal due to recent international concerns about climate change and initiatives to curb the use of fossil fuels. These are separate again to "normal" project risk. With this and

[210] "National, state and territory population", Australian Bureau of Statistics (ABS), 17 June, 2021. https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/dec-2020#states-and-territories.

other typical risk in mind, we have incorporated a variety of sensitivity tests to examine how changes in a number of variables might affect the project economic case

Fig. 19. Queensland cost benefit analysis results for Galilee Coal Project

Item	Assessed economic value, (Present Value, 7% real) ($m)
Net producer surplus	1,752.5
Royalties	2,010.3
Company income tax (Qld proportion)	217.8
Payroll tax	139.3
Externalities	(31.0)
Net benefit to Queensland	**4,088.8**

Source: BIS Oxford Economics

Fig. 20. Queensland cost benefit analysis results for Galilee Coal Project (including transport links)

Item	Assessed economic value, (Present Value, 7% real) ($m)
Net producer surplus	211.6
Royalties	2,010.3
Company income tax (Qld proportion)	175.8
Payroll tax	150.0
Externalities	(31.0)
Net benefit to Queensland	**2,516.6**

Source: BIS Oxford Economics

6. SENSITIVITY TESTS

6.1 NET BENEFITS – SENSITIVITY TESTS

6.1.1 Net Benefits – Core Sensitivity Analysis

The CBA results presented in the previous sections have been undertaken in accordance with standard CBA practice. However, in assessing project upside and downside risk, it is also important to undertake a systematic sensitivity analysis.

As a first step, a lower bound discount rate of 4% and an upper bound of 10% have been applied. The figure below illustrates the variation in net benefits attributable to Queensland under different discount rates.

Fig. 21. Discount rate sensitivities

Discount rate	Excluding transport costs	Including transport costs
4%	6,564.51	4,307.29
7%	**4,088.81**	**2,516.55**
10%	2,627.57	1,474.02

Source: BIS Oxford Economics

Separate to this, a variety of sensitivity tests are applied at the standard 7% real discount rate. This part of the sensitivities analysis considers how the affected parameter impacts on net benefits to Queensland the overall net producer surplus on its own (i.e. **without** taking into consideration interaction effects with other parameters). This part of the sensitivity analysis comprises the following:

- *Export price (revenue) sensitivity*: Higher and lower price assumptions, where coal prices are modified by +/- 30 per cent range over the central case assumptions for the life of the project.
- *Royalties sensitivity*: Royalties are modified by +/- 30 per cent range over the central case assumptions for the life of the project.
- *Tax sensitivity*: Company income taxes are modified +/- 50 over the central case assumptions for the life of the project.
- *Operational and capital expenditure sensitivity*: Both operational expenses (OpEx) and capital expenses (CapEx) are modified +/- 30 per cent range over the central case assumptions for the life of the project.

Fig. 22. Sensitivity tests (excluding interactive effects)

Parameter	Variation in parameter	Excluding Transport Costs	Including Transport Costs
Central CBA	**N/A**	**4,088.81**	**2,516.55**
Export coal price forecast (revenue sensitivity)	30%	5,637.65	4,065.39
	20%	5,121.37	3,549.11
	10%	4,605.09	3,032.83
	-10%	3,572.53	2,000.27
	-20%	3,056.25	1,483.99
	-30%	2,539.97	967.71
Incremental royalties	30%	4,569.94	2,997.69
	20%	4,409.56	2,837.31
	10%	4,249.19	2,676.93
	-10%	3,928.43	2,356.17
	-20%	3,768.05	2,195.80
	-30%	3,607.67	2,035.42
Incremental company income tax	50%	4,144.37	2,576.38
	30%	4,122.14	2,552.45
	20%	4,111.03	2,540.48
	10%	4,099.92	2,528.52
	-10%	4,077.70	2,504.59
	-20%	4,066.58	2,492.62
	-30%	4,055.47	2,480.66
	-50%	4,033.25	2,456.72
OpEx	30%	3,483.40	1,506.34
	20%	3,685.20	1,843.07
	10%	3,887.01	2,179.81
	-10%	4,290.61	2,853.29
	-20%	4,492.41	3,190.03
	-30%	4,694.22	3,526.77
CapEx	30%	3,875.24	2,233.56
	20%	3,946.43	2,327.89
	10%	4,017.62	2,422.22
	-10%	4,160.00	2,610.88
	-20%	4,231.18	2,705.22
	-30%	4,302.37	2,799.55

Source: BIS Oxford Economics

In addition to this, we have also carried out sensitivities that model the interaction between the different parameters (“interactive effects”). For example, they take into account how a decline in price would affect the profits, tax, royalties and the overall net producer surplus. These sensitivity tests include :

- different increases and declines in price from our Central Scenario.
- price forecasts from our own proprietary databank (Oxford Economics forecasts).
- price assumptions based on price forecasts for FOB Newcastle thermal coal from Wood Mackenzie.[211]
- an interpretation of price and volume effects based on scenarios presented in the latest (2021) edition of the *World Energy Outlook* (WEO), published by the International Energy Agency (IEA). These include the Stated Policy Scenario (STEPS), Announced Pledges Scenario (APS) and Net Zero Emissions (NZE) scenario.[212]

These are presented below. A further discussion of these price and volume scenario estimates also follows below.

In interpreting these price and volume impacts (and the scenarios below), note these are broad (or "generic") interpretations of Coastal China prices and/or broad volume forecasts using data based on published IEA material. Detailed data on specific Australian price and volumes under these scenarios were not available for this report, though some commentary by the IEA on Australian exports in the years to 2030 was taken into account. Accordingly, they are intended as **illustrative order of magnitude** scenarios.

In practice some of these effects may be ameliorated for Australian coal exports. This is because volume changes (beyond 2030 in particular and for the NZE scenario) are based on our interpretation of broad changes in global demand as forecast by the IEA. In practice Asian demand for power generation (and for Australian thermal coal) may fall less steeply than is the case for global coal demand as a whole, given continuing reliance on coal as a power source and a potentially slower phase out in some Asian markets than the developed world in particular.

[211] Based on FOB Newcastle @ 6,000 kcal/kg content coal price forecasts as supplied by Wood McKenzie to BISOE on 17 December 2021 ("Wood McKenzie forecast prices"). Original price series in US$ has been converted to A$ at the constant exchange rate of 1.33 over the course of the project.
[212] International Energy Agency (IEA) (2021) *World Energy Outlook 2021*

Fig. 23. Sensitivity tests (including interactive effects)

Parameter	Variation in parameter	Excluding Transport Costs	Including Transport Costs
Central CBA	**N/A**	**4,088.81**	**2,516.55**
Price sensitivities	+30%	6,430.40	4,858.15
	+20%	5,640.47	4,068.22
	+10%	4,859.68	3,287.42
	-10%	3,334.80	1,762.55
	-20%	2,611.70	1,039.44
	-30%	1,920.85	348.59
Scenario price and volume sensitivities	BIS Oxford Economics (BISOE) forecast prices	3,567.26	1,995.01
	Wood Mackenzie (WM) forecast prices	4,894.02	3,321.76
	IEA STEPS (Variation only in prices)	4,491.38	2,919.12
	IEA STEPS (Variation in prices and volumes)	3,777.76	2,205.50
	IEA APS (Variation only in prices)	3,830.56	2,258.30
	IEA APS (Variation in prices and volumes)	1,857.75	285.49
	IEA NZE (Variation only in prices)	2,399.43	827.17
	IEA NZE (Variation in prices and volumes)	(631.15)	(2,203.40)

Source: King report, BISOE, WM, and IEA, WEO 2021.As an additional illustration, the breakdown of the net benefits to Queensland under these tests is provided below. Note there are certain scenarios where the economic outcome of the project is positive even when the NPS is negative (in cases where transport costs are included.

Fig. 24. Breakdown of net benefits to Queensland without transport costs

Scenario	Net producer surplus	Royalties	Company income tax	Payroll tax	Externalities	Total
Central Scenario	**1,752.51**	**2,010.26**	**217.76**	**139.28**	**31.00**	**4,088.81**
30% Price Increase	2,710.67	3,003.93	607.51	139.28	31.00	6,430.40
20% Price Increase	2,394.81	2,660.93	476.45	139.28	31.00	5,640.47
10% Price Increase	2,075.81	2,329.37	346.21	139.28	31.00	4,859.68
10% Price Decrease	1,415.48	1,712.28	98.76	139.28	31.00	3,334.80
20% Price Decrease	1,041.92	1,453.04	8.46	139.28	31.00	2,611.70
30% Price Decrease	578.35	1,234.22	-	139.28	31.00	1,920.85
BISOE forecast prices	1,539.36	1,791.65	127.97	139.28	31.00	3,567.26
WM forecast prices	2,028.64	2,429.35	327.74	139.28	31.00	4,894.02
IEA STEPS (Variation only in prices)	1,873.75	2,248.26	261.09	139.28	31.00	4,491.38
IEA STEPS (Variation in prices and volumes)	1,529.99	2,019.54	119.95	139.28	31.00	3,777.76
IEA APS (Variation only in prices)	1,602.81	1,967.59	151.87	139.28	31.00	3,830.56
IEA APS (Variation in prices and volumes)	382.79	1,366.67	-	139.28	31.00	1,857.75
IEA NZES (Variation only in prices)	883.48	1,407.66	-	139.28	31.00	2,399.43
IEA NZES (Variation in prices and volumes)	(1,301.99)	562.56	-	139.28	31.00	(631.15)

Source: BIS Oxford Economics

Fig. 25. Breakdown of net benefits to Queensland with transport costs

Scenario	Net producer surplus	Royalties	Company income tax	Payroll tax	Externalities	Total
Central Scenario	**211.55**	**2,010.26**	**175.76**	**149.98**	**31.00**	**2,516.55**
30% Price Increase	1,179.43	3,003.93	555.80	149.98	31.00	4,858.15
20% Price Increase	861.87	2,660.93	426.44	149.98	31.00	4,068.22
10% Price Increase	540.65	2,329.37	298.42	149.98	31.00	3,287.42
10% Price Decrease	(138.53)	1,712.28	69.82	149.98	31.00	1,762.55
20% Price Decrease	(532.58)	1,453.04	-	149.98	31.00	1,039.44
30% Price Decrease	(1,004.61)	1,234.22	-	149.98	31.00	348.59
BISOE forecast prices	(3.75)	1,791.65	88.13	149.98	31.00	1,995.01
WM forecast prices	491.95	2,429.35	281.48	149.98	31.00	3,321.76
IEA STEPS (Variation only in prices)	337.55	2,248.26	214.33	149.98	31.00	2,919.12
IEA STEPS (Variation in prices and volumes)	(11.00)	2,019.54	77.98	149.98	31.00	2,205.50
IEA APS (Variation only in prices)	61.25	1,967.59	110.48	149.98	31.00	2,258.30
IEA APS (Variation in prices and volumes)	(1,200.16)	1,366.67	-	149.98	31.00	285.49
IEA NZES (Variation only in prices)	(699.47)	1,407.66	-	149.98	31.00	827.17
IEA NZES (Variation in prices and volumes)	(2,884.95)	562.56	-	149.98	31.00	(2,203.40)

Source: BIS Oxford Economics

In addition we also present variations in project outcomes allowing for +/- 30% variations in externality costs, additional ecosystem costs and differing social costs of carbon discussed in the chapters above.

Fig. 26. Sensitivity tests: Externalities

Parameter	Variation in parameter	Excluding Transport Costs	Including Transport Costs
Central CBA	**N/A**	**4,089**	**2,517**
Externalities	+30%	4,080	2,507
	+20%	4,083	2,510
	+10%	4,086	2,513
	-10%	4,092	2,520
	-20%	4,095	2,523
	-30%	4,098	2,526
Higher ecosystem externalities (Sensitivity 1)	Loss of one threatened species, plus 1% decline in two non-threatened species plus loss of 1% of Desert Uplands vegetation due to subsidence	4,024	2,451
Higher ecosystem externalities (Sensitivity 2)	Loss of one threatened species, plus 1% decline in two non-threatened species plus loss of 3,926ha of the BNR (0.3% of Desert Uplands vegetation) due to subsidence	4,033	2,461
EU ETS social cost of carbon	EU ETS ($A110/t CO_2 in November 2021, adjusted for price increases thereafter)	4,088	2,516
ACCUS social cost of carbon	ACCUS ($39/t CO_2 in November 2021, adjusted for price increases thereafter)	4,089	2,517

Source: BIS Oxford Economics

6.1.2 Further discussion of the scenario price and volume assumptions

Below we provide a brief summary of the different price scenarios used in the sensitivity tests. Fig. 19 illustrates the different price series used for project coal prices, in real 2021 AUD.

The King Central Scenario price time series used in our analysis are presented below. As per the King report these represent the estimated price for GCP coal adjusted for caloric and ash content relative to 6,000 kcal/kg coal. In addition, for ease of comparison, we also present King's *unadjusted* 6,000 kcal/kg price series (i.e. prior to any caloric or ash content adjustment). This is compared to the other price series used in the sensitivity tests (prior to any caloric content adjustment which we undertook for those tests). This enables a clearer comparison of how the various price series differ prior to any GCP specific calorific or ash content adjustment.

Fig. 27. Comparison of different price scenarios (A$, 2021).

	2025	2030	2040	2050	Average
King (Central Scenario, adjusted for GCP caloric and ash content)	**98.97**	**94.39**	**96.51**	**96.51**	**95.77**
King (6000 kcal/kg)	113.33	113.33	113.33	113.33	113.33
BISOE databank forecast prices (6000 kcal/kg)	107.70	104.19	94.02	80.81	95.35
WM forecast prices (6000 kcal/kg)	107.40	112.79	118.48	107.76	115.27
IEA – STEPS (6000 kcal/kg)	117.46	113.38	107.23	101.08	108.57
IEA- APS (6000 kcal/kg)	113.37	105.18	96.99	88.79	99.08
IEA – NZE (6000 kcal/kg)	102.44	83.33	76.50	69.67	79.61

Source: King report, BISOE, WM, and IEA, WEO 2021.

As indicated, the price sensitivities presented above are based on price increases and reductions relative to the Central Scenario. In addition, the sensitivities include a price forecast from the BISOE databank (labelled as "BISOE forecast prices") a price forecast from Wood Mackenzie (labelled as "WM forecast prices") as well as the IEA's steam coal prices for the coastal China region, presented in their 2021 WEO report, for their STEPS, APS and NZE scenarios.[213]

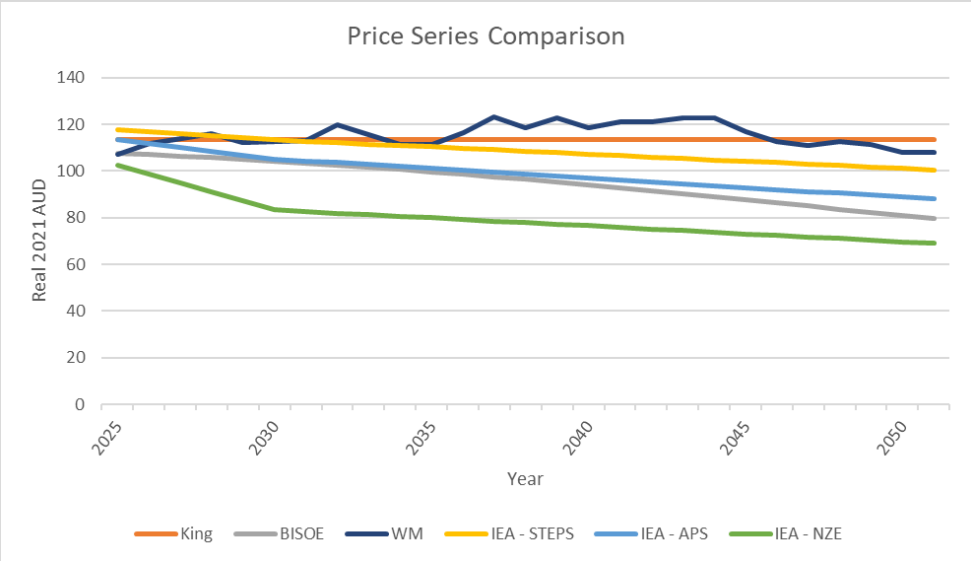
All of these price series were converted to real AUD 2021 terms (at a constant exchange rate of US$ 1 = A$ 1.33) across the project lifetime. In addition a base caloric content of coal of 6,000 kcal/kg was assumed for all these price series. (When modelling the actual sensitivity tests these prices were adjusted to allow for the caloric and ash content of GCP coal. This allowed the modelling to incorporate adjustments to these time series in a similar manner to the King report's adjustment for these factors .)

In the figure below we present a comparison of the 6,000 kcal/kg price series used (i.e. *unadjusted for caloric and ash content),* converted to 2021 real AUD.

[213] IEA (2021), WEO, p. 101. The original price series, as published originally by the IEA and in real 2020 USD terms, are:

	2020	2030	2050
STEPS	89	83	74
APS	89	77	65
NZE	89	61	51

Fig. 28. Comparison of different 6,000 kcal/kg price series (graph) (A$, 2021).



Source: King report, BISOE, IEA, *WEO 2021*, and WM.

In terms of volumes, we have used the original volumes from the King report for our Central Scenario, BISOE databank price forecast, and WM scenarios. As indicated, the IEA does provide some indication of changes in volumes (reflecting broad potential changes in coal demand). Accordingly, for each of the IEA's scenarios we have carried out two sensitivities: one assuming IEA prices but the same volumes sold as with the King report, and another where both prices and volumes are impacted by some of the global coal demand effects suggested by the IEA.

The IEA does not provide precise estimates for Australian export coal volume changes in all scenarios for all time periods, though it provides a limited discussion of broad Australian coal export volume changes for the STEPS and APS scenarios (to 2030). Accordingly, we have estimated project volume declines over time based on a linear trend model, guided by IEA comments of both Australian and generic international coal demand trends to and after 2030.[214]

As indicated, the lack of more specific export volume changes for Australian coal exports in particular under the volume scenarios means that caveats should be applied in interpreting these volume forecasts (and the price times

[214] When the mine production starts to decline in 2040, we assume a decline in volumes only if the post-2040 production volumes are higher than what the linear trend model would predict. In practice, this means that the post-2040 volumes for the STEP and AP scenarios do not veer too far away from the original volumes reported by Waratah, at least in the early years after 2040. Once the trend model gets below the post-2040 production volumes, the volumes are reduced accordingly. The STEP scenario is barely impacted, as the 2040 production reduction implemented by Waratah is already below the assumed 30% reduction for this scenario during the 2030-2050 period. The impact in the APS is slightly more pronounced, with additional reductions to the post-2040 volumes starting around 2045. Finally, in the NZE scenario, all the years after 2040 are affected by additional production cuts, as this scenario assumes a 90% decline which is more than the amount reduced voluntarily by Waratah in 2040.

volume sensitivities). They may be best seen as "what if" scenarios – i.e. what if demand for project coal decreased by a given percentage in line with international demand trends, along with a given price decrease. This may make some scenarios such as NZE appear extreme, as modelled here. In practice, as indicated there may be stronger residual demand for Australian coal than is the case for global coal as a whole.[215]

Our scenario volume assumptions are detailed in the figure below.

Fig. 29. Assumed GCP coal production declines

Scenario	2020-2030	2030-2050
STEPS	Down 5% by 2030[216]	30% less than 2020 in 2050[217]
APS	Down 25% by 2030[218]	50% less than 2020 in 2050[219]
NZE	Down 50% by 2030[220]	90% less than 2020 in 2050[221]

Source: IEA, BIS Oxford Economics

Fig. 30. Comparison of different project volume series (thousand tonnes)

	2025	2030	2040	2050	Average
King (Central scenario, BISOE and WM)	**408.00**	**37,900.48**	**24,300.48**	**24,300.48**	**28,215.84**
IEA - STEPS	387.60	36,005.46	21,941.14	20,194.61	24,969.40
IEA- APS	306.00	28,425.36	18,938.34	14,212.68	19,350.91
IEA - NZE	204.00	18,950.24	10,422.63	1,895.02	9,834.30

Source: King report, BISOE, and IEA, *WEO 2021*.

[215] By way of comparison, recent Australian government modelling suggested that the sector output value of the coal sector would decline by 50% by 2050 under its own Net Zero Emissions scenario. However, this forecast is likewise broad and we do not have access to the detailed modelling and assumptions behind this analysis. Accordingly we have used the IEA scenarios as a consistent, internationally recognised, analytical basis. See Australian Government (2021) *Australia's Long Term Emissions Reduction Plan: Modelling and Analysis*

[216] "In the STEPS, Australia remains the world's largest exporter of coal but exports fall by 5% to 340 Mtce in 2030 as demand falls in Japan and Korea, which have historically been important markets for Australian coal." IEA, *WEO 2021*, p. 242.

[217] "In the STEPS, there is a steady reduction in [global] coal demand between 2030 and 2050 to around 4 000 Mtce in 2050 (25% less than in 2020). This stems mostly from a 30% decline in the power sector over this period as wind and solar provide an increasing share of electricity generation." IEA, *WEO 2021*, p. 244.

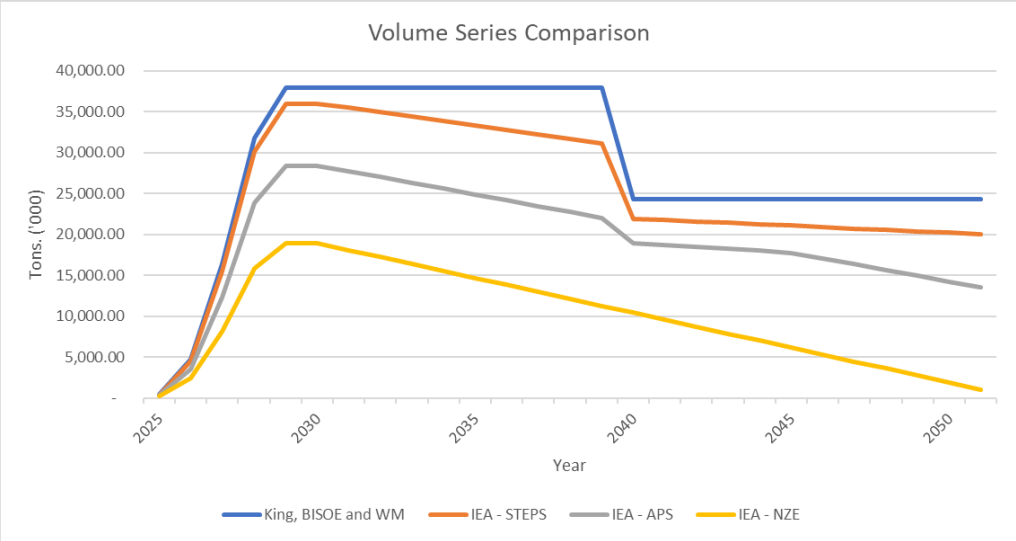
[218] "In the APS…Australian exports fall by 25% [to 2030]." IEA, *WEO 2021*, p. 243.

[219] "In the APS, coal demand declines much faster to 2,650 Mtce in 2050 (half of 2020 levels)…Coal use in China falls by close to 70% between 2030 and 2050 and its share of global coal demand drops to 30% in 2050 (from 55% in 2020). This decline comes about because China electrifies many industrial processes (e.g. by switching iron and steel production to electric arc furnaces) and significantly reduces coal use in the power sector. China has 800 GW of coal-fired power plants remaining in 2050 (down from more than 1 000 GW today), 20% of which are equipped with CCUS. The annual average utilisation of unabated coal-fired power plant capacity in China drops to less than 10% in 2050, down from more than 50% today." IEA, *WEO 2021*, p. 245.

[220] "In the NZE, global coal trade drops by more than 50% to 2030 and production in all exporting countries falls sharply." IEA, *WEO 2021*, p. 243.

[221] "In NZE, global coal use drops by 90% from 2020 to 2050, and around 80% of remaining coal use is in facilities equipped with CCUS by 2050. All new coal industrial facilities built after 2030 are near zero emissions and most facilities built before then are retrofitted to use CCUS or to enable co-firing with bioenergy or hydrogen-based fuels. The majority of remaining coal use in 2050 is in the chemical, iron and steel industries." IEA, *WEO 2021*, p. 245.

Fig. 31. Comparison of different project volumes series (thousand tonnes), graph



Source: King report, BISOE, and IEA, WEO 2021.

6.1.3 A note on interpretation of the scenarios

We have presented the sensitivity tests above for the information of the reader. Likewise it will be up to the informed reader to make judgements on their plausibility. We do note however there remain considerable uncertainties associated with the sale of coal due to recent international concerns about climate change and initiatives to curb the use of fossil fuels. These are separate again to "normal" project risk. The sensitivity tests above should be examined in this context.

Moreover, as indicated, specific price and volume forecasts under IEA scenarios were not available for this report and it was necessary to make interpretations based on global IEA price and demand forecasts for coal. Accordingly some effects (particularly in the case of volumes) may be ameliorated as in a number of cases they relate to global changes in demand as opposed to Asian demand for thermal coal (which may decline more slowly).

Nonetheless we also note recent pledges at the COP 26 Summit in Glasgow. These include the phasing out of coal for power generation by countries such as Vietnam, South Korea and (to some extent) Indonesia in the 2030s to 2040s.[222] Some of these countries were cited as recipients of the project's coal, as noted in the Introduction to this report. While this may simply result in a reallocation of project export coal to other markets and there may be differing views about the sincerity of these (and other) pledges at COP 26, such pledges could also be seen to add to project risk.

[222] See UN Climate Change Conference "Global Coal to Clean Power Transition Statement" https://ukcop26.org/global-coal-to-clean-power-transition-statement/

6.1.4 A note on financial vs economic impacts

In reviewing the above sensitivity tests, it should be noted that they reflect economic outcomes rather than financial ones. That is, it may be that the project becomes more (or less) financially viable due to certain changes, but these effects are distinct from economic analysis.

For example, the King report (which includes transport costs) notes that the project NPV of equity cash flows would fall to breakeven point at a decline in sale prices of roughly 13%. In contrast the economic case the project retains a positive NPV even with a 30% price decline (with no allowance for volume declines).

This reflects the fact that royalties, count as benefits in the economic case (and indeed are a significant part of benefits). Royalties are levied on revenues, but this is distinct from whether project operating revenues themselves cover costs.

6.1.5 A note on discounting

It must be noted that (with the exception of the discount rate sensitivities themselves) this CBA, as well as the sensitivity exercise presented above, are based on standard accounting practice of assuming a positive real discount rate (i.e., 7% real). While it is common practice to use a positive discount rate, there has been growing debate in the field of environmental economics regarding discounting. Most of these critiques are based on two main arguments:

1. There is no widely accepted consensus on what the correct discount rate should be, from a mathematical point of view. Simply stated, there is a lack of consensus on the mathematical theory that should be used to arrive at the correct discount rate, with several contending theories and even some economists arguing for the use of the lowest possible discount rate.[223]

2. There are moral arguments regarding how the future should be valued vis-à-vis the present. One argument is that if the future is heavily discounted, it could encourage reckless action on issues such as climate change which would lead to future generations being much poorer than the present one.[224] Given the enormous costs that could come with reckless action, some argue that the future should be only lightly discounted.

[223] See Weitzman, Martin L., "Why the Far-Distant Future Should Be Discounted at Its Lowest Possible Rate", *Journal of Environmental Economics and Management*, no. 36 (1998), pp.201-208. At its core, Weitzman argument is that when taking the mathematical limit of a time function, and taking it to infinity, the interest rate for discounting among events within the far distant future should be its lowest possible limiting value.

[224] See Stern, Nicholas, "A time for action on climate change and a time for change in economics", *Centre for Climate Change Economics and Policy* and *Grantham Research Institute on Climate Change and the Environment*, 26 October, 2021. https://www.lse.ac.uk/granthaminstitute/publication/a-time-for-action-on-climate-change-and-a-time-for-change-in-economics/.

Debates over climate change have given new vigour to debates over discounting (given climate change is a long term issue spanning generations and centuries).

This report cannot pass final judgement on these issues. We note however that if lower discount rates are used this could also be taken to apply to conventional project costs and benefits (e.g., operating costs, capital expenses and revenues).

7. CGE RESULTS

7.1 SUMMARY OF CGE RESULTS

7.1.1 Background

As indicated, in addition to the CBA Analysis, BIS Oxford Economics commissioned commissioned the Centre of Policy Studies (CoPS) at Victoria University Melbourne in order to undertake a CGE analysis of the project. this work.

Key material furnished to CoPS in order to undertake this work includes:

- James King (2021) *Analysis of Galilee Coal Project* ("the King report") and accompanying spreadsheet.
- BIS Oxford Economics draft Galilee Coal Project: Cost Benefit Analysis (December 2021) and the accompanying spreadsheet
- Waratah Coal (2021) *Draft Environmental Management Plan (EM Plan) Mine*
- Waratah Coal's responses to the first, second and third information requests

CoPS analysis uses its VU-TERM model. VU-TERM is a dynamic CGE model of the Australian economy covering 216 industries in 334 SA3 regions allowing for considerable detail.

The CGE analysis examined effects over the time period 2021-22 to 2051-52. The analysis used CoPS' covered two geographical areas, namely:

- The local area (defined in VU-TERM as SA3 region Outback South-Central Highlands) . This includes a wide area of southwest Queensland (see map in Appendix 2)
- The state of Queensland

In addition the modelling examined three scenarios:

1. The effects of the project excluding a dedicated rail link
2. The effects of the project including a dedicated rail link
3. As per 2. but with an assumption of falling nominal demand and prices of coal after 2030 (denominated in US$/tonne).

We provide a description of the first two of these scenarios below. Scenario 3 is detailed in CoPs' full analysis in Appendix 2.

CGE and CBA analysis share some interrelated features but differ in other aspects. In interpreting CGE results a number of key differences to CBA analysis should be noted, namely:

- CGE outputs are typically macroeconomic indicators such as employment and GDP. CBA may include non-market costs (such as externalities).

- The framework of a CBA focusses on comparison of costs to benefits. There is a defined decision tool (such as the NPV of a project given the

trade-off of costs and benefits, as discussed for the GCP above). Although CGE's also allow for displacement effects and crowding out of activity their focus is more typically on macroeconomic indicators of economic activity. There is no single outcome similar to a project NPV in CBA terms. Rather, results are presented in terms of a set of macroeconomic aggregates resulting from the given project or initiative.

- Connected to this, although CGE models produce welfare estimates (and these are detailed in Appendix 2) these differ from the economic welfare effects produced under a CBA. CBA estimates of welfare consist of the combination of producer surplus (roughly gross profits before taxes) consumer surplus (value above and beyond prices paid) and externalities (as discussed above). For example, in the analysis above the gross producer surplus for the GCP is calculated (inclusive of all taxes) and then that surplus is allocated to various parties (e.g. the producers, taxes). Externalities are also calculated though there is no Australian consumer surplus.

  CGE analysis typically uses macroeconomic indicators of welfare. For example in the analysis below welfare gains are calculated as the combination of household consumption and government spending less net foreign liabilities.

- Discount rates in the CGE may differ from CBA (rates are more prescriptive in the latter) . In this case the CGE analysis has uses a real 2.5% discount rate. However this is relevant mainly to the calculation of national welfare and the choice of rate has only modest impacts due to the offsetting effects of the legacy debt.

- Prices are endogenous in CGE models, meaning that they will be influenced by interactive effects within the models themselves. Accordingly, CGE modelled prices may diverge from CBA prices over time. Appendix 2 provides a discussion of this issue.

A full description of the modelling is provided in CoPs report in Appendix 2. However a summary of key outcomes is presented in this chapter.

7.1.2 Key results

7.1.2.1 Excluding rail link

In the project's investment (i.e. construction) phase from 2023-24 to 2027-28, there are substantial local economic impacts on the Outback South-Central Highlands region. These are particularly evident in employment outcomes.

Additional jobs in the region plateau at around 12% or 2,300 full-time equivalent jobs (FTEs) above a "business-as-usual "base (i.e. without the project occurring) . Real GDP in the region peaks at almost 30% above base.

However, additional local demands have a dramatic impact on prices for local commodities. Housing rentals in the region peak at 65% above base, but will be larger in regional communities close to the mine, although these will gradually decrease over time - see figure below.

Employment will gradually move back towards base due to rising real wages. However it will still be 1,000 jobs above base in 2035-36. With a partial scale down of operations from 2039-40, jobs in the regions will drop to around 380 to 450 above base.

Real GDP is boosted over virtually all of the project life. However it exhibits a step like pattern associated with the winding down of production in the late 2030s and project closure in the early 2050s, ending up slightly below base at the end of the project. .

Fig. 32. Labour market in Outback South-Central Highlands (% deviation from base)

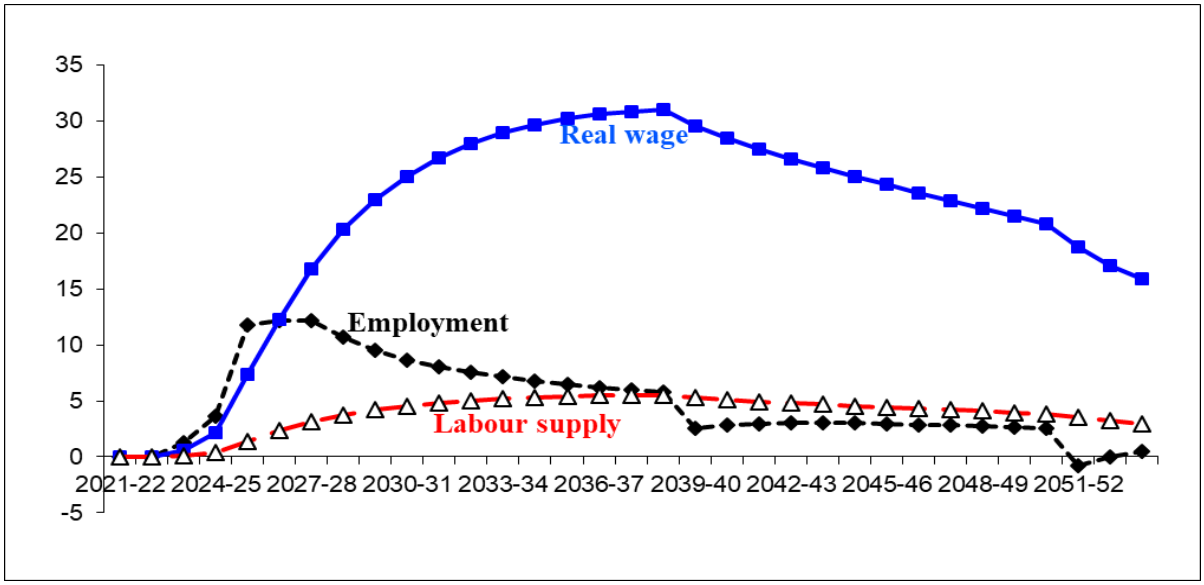


Fig. 33. Cost of living impacts in Outback South-Central Highlands (% deviation from base)

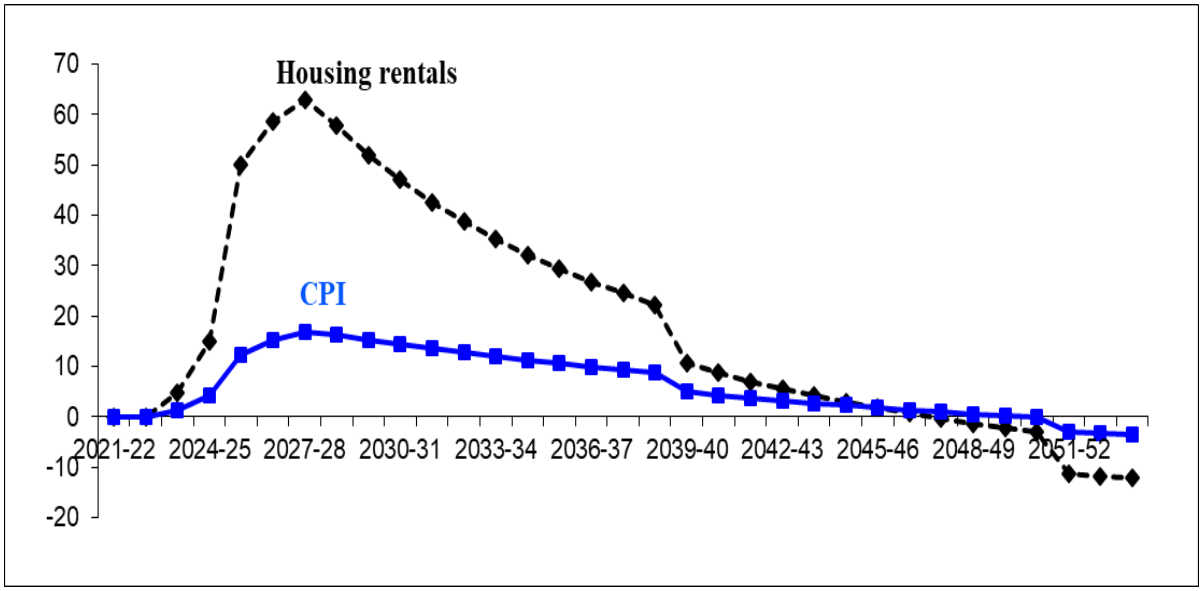
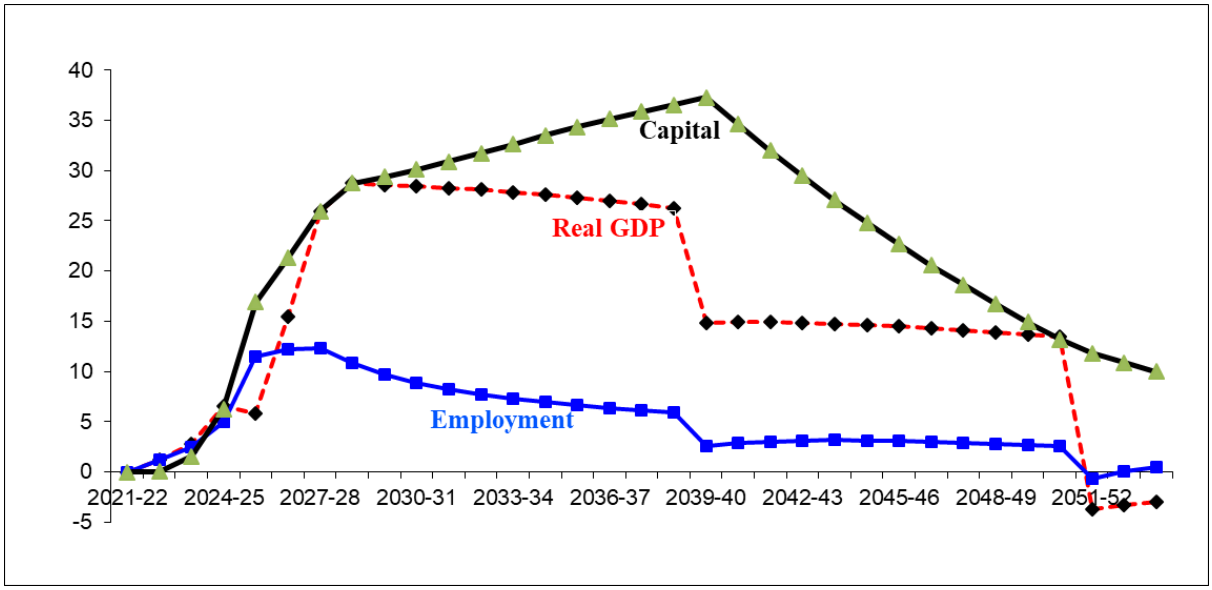


Fig. 34. : Outback South-Central Highlands real GDP income-side (% deviation from base)



At the Queensland, state-wide level, jobs will peak at 4,000 FTE's above the state's "business as usual" base in 2025-26. Real wages will rise to around 0.6% above base, which in turn slowly diminishes job impacts. Queensland jobs will remain over 1,000 above base until 2039-40. With the scaling down phase after 2050-51, statewide jobs will fall to more than 500 jobs below base, a consequence of real wages in the state persisting around 0.5% above base in the new phase.

Real GDP is likewise boosted but exhibits a similar step like pattern to that for the local area.

Fig. 35. Labour market in Queensland (% deviation from base)

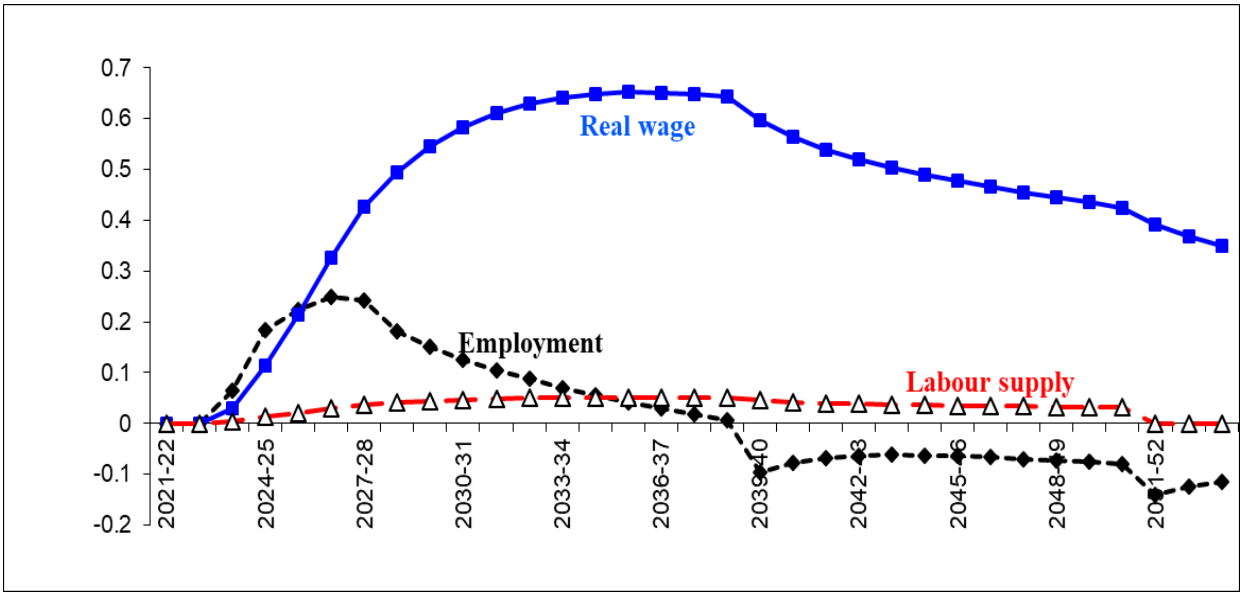
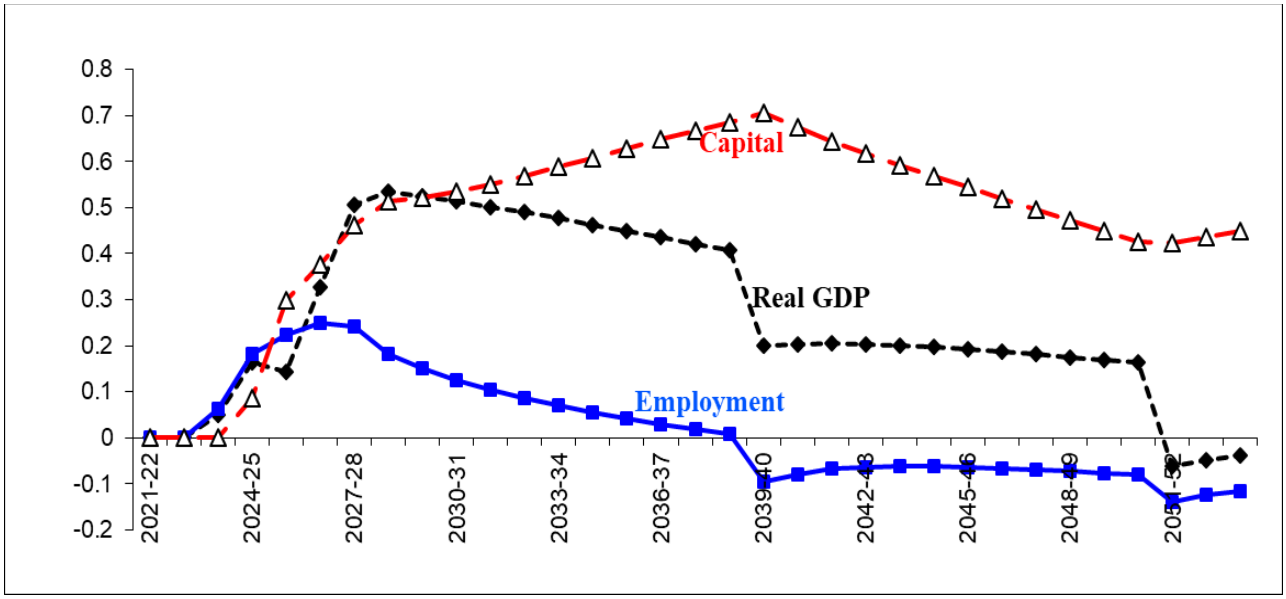


Fig. 36. Real GDP, income side, Queensland (% deviation from base)



7.1.2.2 Including rail link

A second scenario includes rail construction costs. These raise employment in Outback South-Central Highlands and Queensland between 2022-23 and 2024-25 above those of the first scenario. However jobs numbers peak at 2,300 in the local area in 2027-28 and at 3,600 in Queensland in that year (The higher peak jobs figures for Queensland exclusive of the link reflect the fact that real wage rises start earlier if the link is included, choking off jobs to some extent during peak investment.)

The project delivers a boost to real GDP with local GDP peaking at $542 million in 2033-34 and $765 million at the State level in 2027-28.

Broadly speaking, the jobs pattern and macroeconomic outcomes are similar to the first scenario,

Fig. 37. Labour market in Outback-South-Central Highlands (% deviation from base)

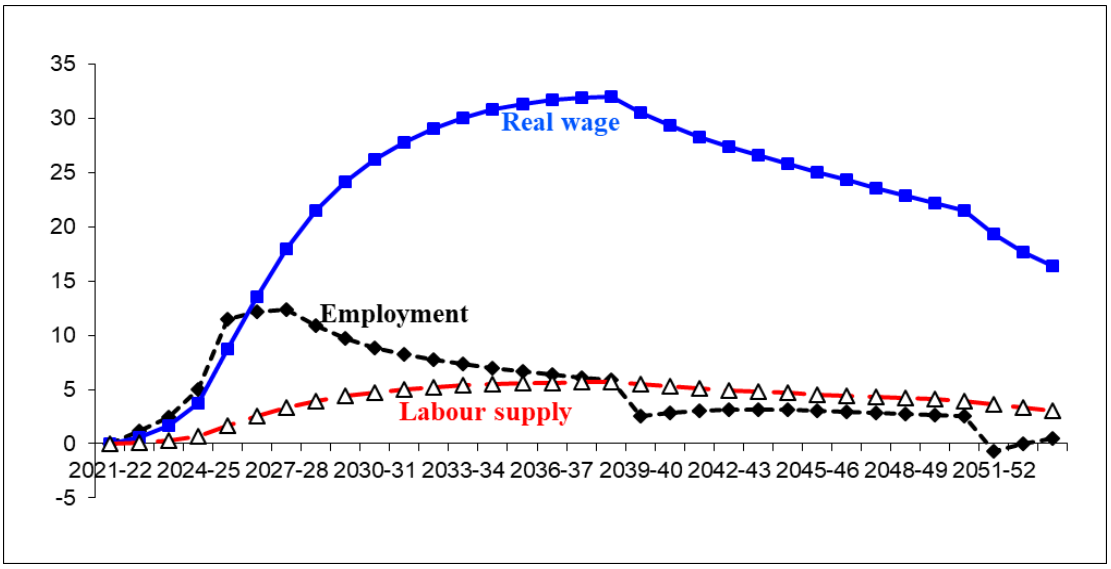


Figure 2.2.5: Labour market in Queensland (% deviation from base, rail costs included)

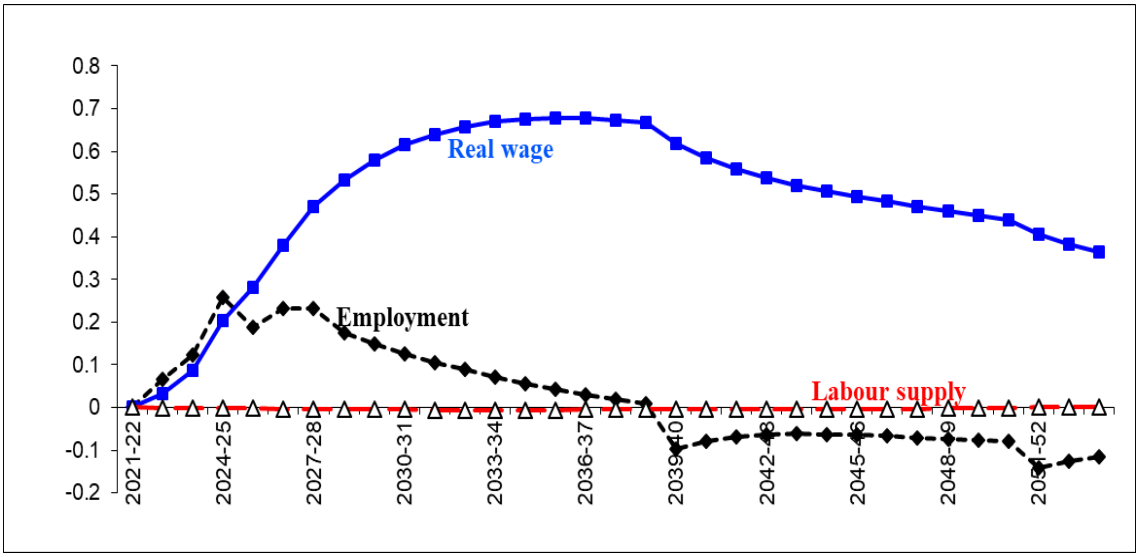


Fig. 38. Outback South-Central Highlands real GDP income-side (% deviation from base)

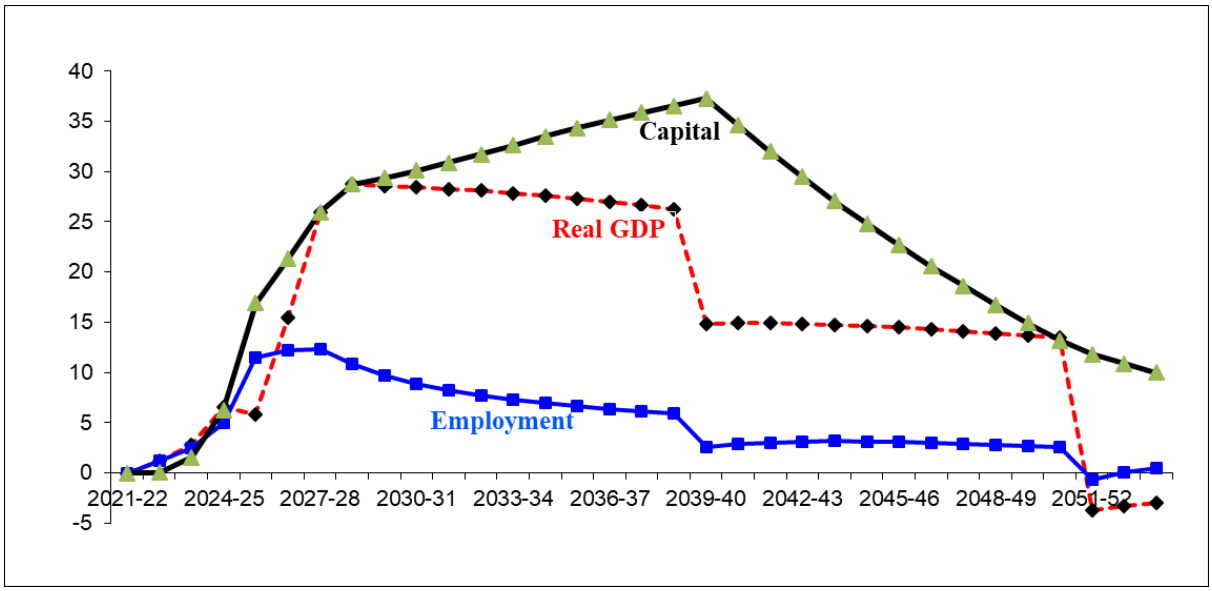
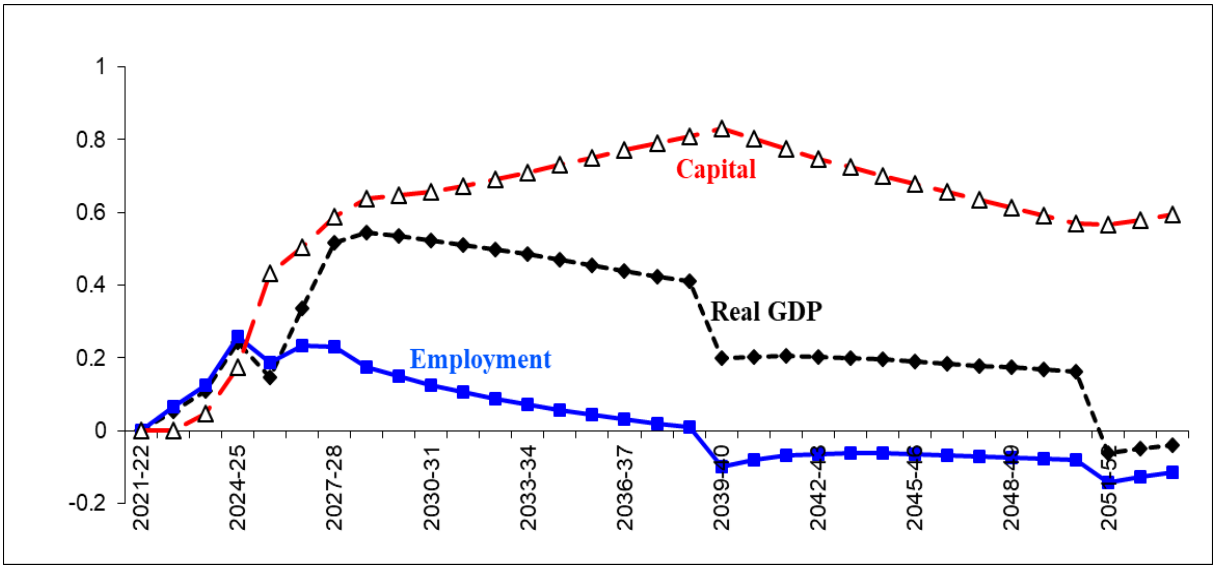


Fig. 39. Real GDP, income side, Queensland (% deviation from base)



7.1.3 Conclusions

Both scenarios provided above indicate that the project will produce a spike in employment in its early years. FTE's peak at 2,300 and 4,000 in Outback South and Queensland respectively (excluding the rail link). Inclusive of the link the figures are 2,300 and 3,600 respectively.

The project delivers a boost to real GDP peaking at $461 million at the local level in 2036-37 and $772 million at the Queensland level in 2027-28. Inclusive

of the rail link local GDP peaks at $542 million in 2033-34 and $765 million at the State level in 2027-28

As indicated in the analysis rising real wages along with the winding down of production have an effect on employment over time. This means that (regardless of whether the rail link is or is not excluded) employment is boosted during the project lifetime but effectively back to the “business as usual” base at the end of the project at the local level At the Queensland State level employment is likewise boosted until the late 2030s. However beyond that time it falls below the base by the late 2030,s under both scenarios.

In terms of real GDP the project records strong growth at both the local and Statewide levels, relative to base under all scenarios. As the project winds down, the GDP boost likewise falls off. By projects end GDP is slightly below base, which would reflect the cessation of such a substantial project.

In short the project will provide a substantial boost to local and Queensland FTE employment and GDP, particularly in its initial years. However these effects will wane over time, particularly as production slows down after the late 2030s.

APPENDIX 1: ADVICE ON NMP

BACKGROUND

On 6 May 2021 and 7 October 2021 BISOE received details of the New Mine Plan (NMP).

The advice received on 6 May 2021 was in the form of a letter dated 15 April 20121 to a number of parties engaged in the matter of Waratah Coal Pty Ltd v Youth Verdict Ltd & Ors (MRA 050-20; EPA 051-20) also denoted as WAR.0281.0001.

This letter has been separately attached to this report (Attachment 1).

The following should also be noted:

- Further advice on the NMP was provided in the Second Information Response. The Second Information Response has been reproduced below.

- Subsequent to this email correspondence on 3 March 2022 was received amending the description of the lease and workers camp descriptions contained in the Second Information Response. This email correspondence is also included after the copy of the Second Information Response, below under the title “Email of 3 Mach 2022”.

- Additional information on the arrangements for accommodation, airport and rail costs is provided below under the title “Email of 24 February 2022”.below.

I

SECOND INFORMATION RESPONSE

Second Information Request for Galilee Coal Project - Andrew Tessler

No.	Issue	Waratah Response
	Project Scope	
1	Please clarify again the scope of the proposed project and how the New Mine Plan (**NMP**) deviates from the Original Mining Plan (**OMP**) covered by the 2011 Environmental Impact Statement (**EIS**). The EIS refers to two open cut and four underground mines. We understand that the New Mine Plan (NMP) will also consist of two open cut and four underground mines. However, the original "Open Cut Two South" will be mined using underground methods (and is presumably an extension of existing underground mines) while Open Cut One South will now not be mined (but this in effect represents a truncation of Open Cut One North). We further understand that the NMP was the basis of James King's (June 2021) Analysis of Galilee Coal Project ("the King Report"), and therefore its numbers are the most reliable and up-to-date data to carry out the CBA.	The changes to the Project as proposed by the NMP are as follows: ■ delete open cut 1 south from Glen Innes ■ delete open cut 2 south from Glenn Innes ■ delete camp site ■ delete underground 3 surface facilities from Glenn Innes ■ include ramps within final void areas ■ amend MIA area to cover Underground 1, 2, 3 and 4 surface facilities, CHPP and Rail load-out ■ amend mining lease application 70454 boundary ■ Malcolm Creek Diversion Channel modified based on inpit/outpit waste facility area ■ show an enlarge view of mine industrial area The rate of 40Mtpa effectively stays the same for the first 19 years 37.9Mtpa – see King DCF Table 1 – Operations line 111 Saleable coal 761.8Mt which in total is a reduction from original MP. From year 19, ROM coal production reduces to 25 Mtpa.

No.	Issue	Waratah Response
	We also note that despite these changes, the quantity of saleable coal mined under the OM and the NMP will be the same (40 mtpa).	Total coal volumes are: TYPE OF COAL / OLD MINE PLAN / NEW MINE PLAN Total Coal (ROM) - MT / 1,400 / 1,120.335 (King Report line 86) Saleable Coal (Product) – MT / 1,003.4 / 761.828 (King Report line 111) Two open cut pits have been removed however the 2 draglines allocated for these pits will be reallocated to Open Cut 1 North and Open Cut 2 North such that an additional work face will be introduced in each of the existing two open cut pits so that four work faces in the open cuts will remain as originally planned – ie. double output for the four open cut pits that remain. Underground remains the same.

No.	Issue	Waratah Response
		There is no change in the extent of the underground mining as a result of the NMP. Underground mining was always proposed under Open Cut Two South and was assessed as part of the EIS. Yes, the King Report contains the most up-to-date economic information in relation to the Project, which incorporates the changes proposed by the NMP.
2	Please confirm that our understanding is correct (or otherwise).	As outlined above.
3	We also understand, in particular, that under the NMP mining will take place under the Bimblebox Nature Refuge (BNR). According there will be no surface disturbance to the BNR and no part of the BNR will now be removed in order to facilitate mining operations. Please confirm if this understanding is correct.	Correct. Some subsidence on the surface of the BNR will occur which will be rehabilitated.
4	In general, it would be useful to have a comparison of the key features of the Original Mine Plan (OMP) and New Mine Plan (NMP if such a document exists). The NMP may impact on some of the issues discussed below in respect of the original EIS.	See #1 and 2 Mine Layout Plans (20210413_GCP_Mine Layoput_2011_A1 and 20210413_GCP_Mine Layoput_2021_A1). See plans at Attachments A and B of [**WAR.0281.0001**].

	No.	Issue	Waratah Response
5		Note we have excluded the rail and port costs as per our contract, though these could be included (as costs only) in the sensitivities (expanded scope – also relevant to project financials).	Noted.
	Original Mining Plan and New Mining Plan		
6		We note the 2011 EIS findings but also the changes to operations in the NMP. Unless otherwise indicated (or different data are provided – e.g., as in the case of the BNR) we would need to refer to the EIS in estimating a variety of environmental valuations. However, we note that additional underground mining could have different effects. It's not entirely clear what these may be though we have pointed to some questions on this below. We will nonetheless refer to the 2011 EIS (unless there is updated info re the NMP). If there is, please supply this. It may be for example that there is less impact on the local environment under the NMP, however we cannot be certain of this	Use 2011 EIS and the SEIS and also have regard to the marked up version of the Revised Environmental Management Plan [**WAR.0359.000**] There is no additional underground mining proposed. Underground mining is the same in the OMP and assessed as part of the EIS and SEIS.

	No.	Issue	Waratah Response
	Market sales		
7		Who will purchase the coal (e.g., which other countries, markets, parties). Are all purchasers signatories to the Paris Agreement?	South Korea, Japan, Vietnam, Thailand, Indonesia & China.Yes all of the potential customers are parties to the Paris Agreement.
	Revenue flows and ownership structure		
8		Where are the project owners based and which parties will project revenues flow to? Are the owners based in a) Queensland b) Australia or c) Overseas? Likewise, what percentage of revenues will be retained in a) Queensland b) Australia or c) Overseas? What entity will they flow to?	The project owners are based in Queensland. All of the revune flows would be retained in Queensland other than the flows to contractors and employees the majority of which will be retained in Qld through local subcontractors.
	Taxation		
9		The King Report nominates corporate income taxes and royalties as taxes. Is the project anticipated to pay any other taxes to Federal, State or local authorities? If so, are there any estimates of their nature and size over the lifetime of the project? We note that the 2011 Economic Impact report indicates that payroll tax, land tax and tenure rents may also be payable to the Queensland government. GST, FBT personal	No additional taxes other than those listed in James King Report dated June 2021.

	No.	Issue	Waratah Response
		income tax and import duties are listed as Federal taxes payable by the project.	
	Government support - royalty holidays, tax deductions, contributions to infrastructure		
10		We note the arguments of some project opponents that the project will receive royalty holidays, tax concessions, fuel tax concessions etc. Is this the case and if so what amounts are relevant.	No subsidies.
11		Note however that in an economic assessment taxes are (in the first instance) a transfer and not directly relevant. The share of taxes paid to government however may be relevant depending on how the producer surplus (gross profits before tax) is distributed and what quantums end up accruing to government as opposed to the private sector in Australia or are remitted overseas.	Noted.
	Land acquisition, use and rental payments		
12		Please give an indication of the total size (e.g., in hectares) and breakdown (in ha) of land required to be taken up for the mining operations and the current uses/characteristics of this land. In addition, it would be	Open Cut*– 6,069 Ha MIA - 2,058 Ha U/G Subsidence – 27,265 Ha TOTAL 35,392 Ha

No.	Issue		Waratah Response
	useful to know if there is a broader area of land which while not directly taken up for mining might be otherwise affected by mining activities (or the mine footprint). We note the 2011 provides information regarding the characteristics of the land, but we would welcome any updated information, given the NMP.		* Open Cut comprises (In-Pit and Out-of-Pit waste dumps and final voids) The above figures are taken from 'Table A1: Mining Domains' of the Revised Environmental Management Plan [**WAR.0356.0284**], There is no updated information on land use from 2011 but the NMP does mean that the BNR will retain the characteristics it presently enjoys.
13	Data provided by Nui Harris dated 3 June 2021 refers to acquisition of 83,829 ha from eight properties and a total purchase price of $115.9 million for the mine. Will: (a) this comprise of the totality of the land directly required for the mine. (b) there be any additional payment of rents for properties not directly acquired by the mine but leased (or equivalent)? If so have these payments been quantified?	(a) yes; (b) no.	In respect to questions: In respect to the total acquisition cost figure you shoud assume total acquisition costs of A$100.00 million, being made up of acquisition and compensation being A$55.0 million and offsets being A$45.0 million. The original estimate of $115.9 included the property known as Corn Top ($12.1m) which is now not affected by mining and not required to be purchased reducing the land acquisition down to $103.8 rounded to $100m. With the revised mine plan some properties will not need to be purchased as only underground mining will be present in that area. Compensation will be paid to the landowner who will be able to stay on the land & continue with the current land use. Purchase properties (Kia Ora and 3 Monklands properties). Using Spring Creek as one price reference: in March 2017 was passed in at $3.6m,

No.	Issue	Waratah Response
		owners wanted $4m & for property size of 9,253.95Ha, average price is $432/Ha. Waratah has used $1,500/Ha as conservative premium to be paid. Compensation to Cavendish, Spring Creek & Glenn Innes has been calculated at $500/Ha which is effective the full Spring Creek value. This calculates for both purchase & compensation to $59.4m rounded to $55m. Offset land required has been estimated at $2,000/Ha essentially (4 times Spring Creek value) which calculates to $48.5m rounded to $45M allocated for offsets. This totals $100m ($55m + $45m)
14	The EIS notes that the land acquired is primarily grazing land although 15% is listed as reserves (presumably including the BNR).	Correct – some grazing is also carried out on BNR.
15	It is important to know the total amount of land required in which other uses are forgone (and if this exceeds the quantum of land purchased through acquisitions and if so what its current usage is).	There are no uses of land foregone outside the purchased land or compensated land (underground mining).
16	The EIS also refers to an open cut and clearance footprint of 14,600 ha. Presumably this is a subset of the 83,829 ha (or other) total required for operations. Presumably the 3,226 ha occupied by the BNR and listed as	Areas have been reduced in size. BNR does not need to be cleared & area is included in U/G subsidence area. The areas to be ceared are Open Cut* – 6,069 Ha MIA - 2,058 Ha

No.	Issue	Waratah Response
	being cleared in the EIS will now longer be cleared. However, an additional 4,594 ha of native vegetation is listed as being cleared in the EIS and presumably this will still be cleared. We presume the remainder of the cleared land will consist of grazing land. Please clarify if this interpretation is correct.	U/G Subsidence – 27,265 Ha TOTAL 35,392 Ha * Open Cut comprises (In-Pit and Out-of-Pit waste dumps and final voids) The above figures are taken from 'Table A1: Mining Domains' of the Revised Environmental Management Plan [**WAR.0356.0284**].
17	The EIS discussion of social impacts also indicates that the mine may cause disruption to the operations of 40 properties not directly acquired for the project. Is this estimate still correct and is compensation for such disruption separately allowed for in the project costings?	This is an extract from the original Appendix 23 Social Impact Table 1 which states 3 properties purchased and another 40 directly impacted by mine and rail. The vast majority of these (38) are affected by the railway.
18	We also note that some Objections refer to diminished property value during and post-operations (e.g. due to contamination) and/or the need for appropriate compensation. Has such compensation been costed?	Noise impacts included in compensation allowance - see King Report Table 1 – Operations line 182 Make good water and soil arrangements for a total of $81m. Noise compensation allowance is for double glazing of impacted properties, allow max of $50k per residence and max of 10 residences for allowance of $0.5M.
19	It is not clear if some of these claims refer to properties to be directly acquired by the mine or those in the area of the mine. However, it would be helpful to have a breakdown of the	Land directly affected included in compensation amounts.

No.	Issue	Waratah Response
	land directly affected by the mine and that indirectly affected by the broader mine footprint. We have conducted analysis in the past by examining impacts on both of these areas.	
20	In essence, then our current assumption is:	
	▪ The $115.9m represents land acquisition costs	Assume A$100.0 million, rather than $115.9m(Corn Top not affected) – see Response to Item #13.
	▪ There will be clearing of land in order to facilitate mine construction and operation	Yes. Assume no clearing of BNR is required. An area of 796.7ha of remnant Least Concern will be cleared in total (see Table 21 of EM Plan).
	▪ The clearing of this land will affect the uses of the land (currently comprised of a mix of grazing properties, the BNR and some other reserves)	Yes. No clearing of BNR is required. An area of 796.7ha of remnant Least Concern will be cleared in total (see Table 21 of EM Plan).
	▪ The acquisition price reflects the market price of the land (and is in economic terms opportunity cost of the land, meaning other uses are forgone for the duration of the project)	Price is market price & includes premium for mining.
	▪ It is not clear if properties in the vicinity of the mine which are not taken up but may nonetheless have operations impacted have been (or will be) paid compensation for any potential disruption to their operations and/or if the value of their properties will be diminished during or after operations. It is important to clarify if this has been considered in the project costings (and if so what the cost allocation is).	Properties not affected have not been considered – allowance made for water make good.

No.	Issue	Waratah Response
	▪ Likewise, the extent (in hectares) of the broader mine footprint above and beyond the properties directly acquired is currently somewhat unclear. It would be important to clarify this.	Footprint is described in Item 16.
21	Please confirm these assumptions (or otherwise and offer clarifications).	See answers above.
	Land clearing and BNR	
22	As per the above we note the NMP may have different land clearing effects to the OMP. Your previous response indicated that the BNR would now not be impacted as mining would take place underground. To clarify under the NMP are we saying that none of the BNR will be affected? Or would a portion still be affected? (If so, please provide details of the affected area in hectares and if any flora and fauna species would be impacted).	BNR not affected other than by subsidence which is not expected to affect vegetation. In worst case some parts of BNR in northwest area, may subside up to 3m but will have a land slope of 1:60 at the steepest, which should not result in any loss of vegetation. Even if some damage to vegetation occurs, the amount of compensation allowed will more than cover and compensate for the impact. Further information can be provided once updated Subsidence and Flora and Fauna Assessments have been completed.
23	If the BNR would not now be forgone to enable mining operations, it would not seem logical to quantify the loss of the original portion (50%) of the BNR under the NMP. The whole of the BNR will continue to exist. However, this loss could be quantified through a sensitivity test. Alternatively, if a portion of the BNR	No part of the BNR will be forgone.

No.	Issue	Waratah Response
	will still be taken up that would need to be assessed in the main project costings.	
24	Apart from the BNR how much land would now be cleared under then NMP? An additional 4,594 ha of native vegetation is listed as being cleared in the EIS and presumably this will still be cleared. We presume the remainder of the cleared land will consist of grazing land. Please clarify if this interpretation is correct.	Remnant (Least concern) vegetation now being cleared is 796.7 ha (See Table 21 of updated EM Plan). Correct remainder is already cleared grazing land.
	Details of the Nui Harris land acquisition estimates and offset purchases	
25	The estimates provided by Nui Harris are very helpful. We have a few questions on their interpretation and request clarifications on the meaning and terminology and context for the land acquisition and offset data provided. Namely:	
	▪ Were the “rates per hectare” for the eight listed properties determined by some market assessment or other means? Presumably the properties have not yet been purchased. Have the purchase prices been accepted by landowners?	Market assessment – not negotiated with landowners.
	▪ Presumably ML refers to mining lease. If we interpret this correctly the whole of the properties will be purchased	Correct. The properties have not yet been purchased. All the property will be purchased – not just that portion covered by the ML area.

No.	Issue	Waratah Response
	thoough the mining lease covers only part of the properties.	
	▪ What do the “compensation rates” and “compensation amounts” refer to? Why do the compensation rates and amounts differ from rates per hectare? Why does the total of the compensation amount ($61m) differ from the purchase amount ($115.9m)?	Where underground mining only is carried out, compensation for disturbance may be made & allow the grazier to continue rather than purchase the property. Use $100.0 million, $55.0 million for land acquisition and compensation and $45.0 million for offsets.
	▪ What do the shaded aqua and grey areas signify? They appear to identify areas where the purchase price and compensation amount are equivalent and differ respectively.	There are 2 sets of figures. Purchase for $115.9m, but use $100m as per King as Corn Top will not be purchased). Second set is combination of purchase (aqua) and Compensation for a total of $55.0m which is combination of selection from purchase (aqua) and compensation for disturbance (grey) and potentially water and $45.0 million for offsets.
	▪ Presumably the $115.9m purchase price supersedes the $100m land acquisition estimate provided in the King Report and should be used in preference to it. Is this the case?	There are 2 sets of figures. Purchase for $115.9m, but use $100m as per King Report as Corn Top will not be purchased and Compensation for $55.0m which is combination of purchase (aqua) and compensation for disturbance and $45.0 million for offsets. Use $100m as Corn Top not affected with NMP – see item #13
	▪ How was the post mining residual rate ($1000) determined and why does it apply to only a sub-set of properties? Presumably this reflects an end of project life use value (lower than original value). We would assume it does not apply to all properties as some will be	No. Lower post-mining residual value is conservative value of land that Waratah owns. It is for information only for completeness. It’s an asset worth $27m at the zeend of the project.

No.	Issue	Waratah Response
	unusable for the original purposes (e.g., ex open cut areas) but please confirm.	
	▪ We note that some Objections have expressed concern about whether affected lands can be returned to their former condition. Does the lower post-mining residual value reflect this?	Residual rate is market rate and will not apply to the properties which have compensation paid as the original owner will retain & residual for project is zero.
26	In respect of the offsets:	
	▪ Presumably the compensation rates for the purchase of the offsets are value of the purchase of the offset properties. Please confirm.	These values are inflated to reflect the commercial pressure of 'offset land'. Refer to Waratah offsets report [**WAR.280.001**].
	▪ Presumably these offset costs are not incorporated into the King Report. Please confirm.	Not specified as single line item but compensation estimate is more like $45.0m (no Corn Top) and with offsets is 107.9 which as offsets will be progressive some funds from Table 1 Operations line 189 'Make good water and soil arrangements' totalling $81m can be provided. Offsets costa are included but not specified. Meaning $45m has been specifically allocated in the budget & if this is insufficient (in potentially unusual market conditions) then some funds from the $81m operational budget can be provided for over-runs. $81m is for progressive make good & offsets will be a progress offset purchase.
	▪ Please clarify the references to habitat for Koala and connectivity above and beyond the offset for the BNR. Is the former implying that Koala species outside the BNR may be affected and would require an offset (or are these	Koala habitat is for total area affected includes BNR and other properties. Connectivity is one of the inputs into offsets. Waratah does not intend to change offsets even with reduced clearing.

No.	Issue	Waratah Response
	within the BNR?). Likewise, please clarify the connectivity reference.	
	▪ In addition, we note that there is an offset for wetlands. Does this imply that wetlands within the mine area will be permanently lost and require an offset?	Yes The wetlands will be mined so will be permanently lost as a wetland so a replacement will be required to offset this loss, it is accounted for.
	▪ Have the offsets already been purchased or is this reflecting an intention to purchase? Is there a guarantee (or some other legal or statutory arrangement) that the offsets would be maintained in perpetuity?	Offsets not yet purchased. Offsets need to be managed (Offset management plan is encumbrance on Property Title) until achieves Remnant status then it's protected by the EPA.
27	These estimates also seem to form a sub-set of a larger document. If this larger document also provides additional details on the breakdowns of project costs that would be quite valuable. If this is the case can this be provided?	There is no further document.
	Externalities – general	
28	Several environmental externalities (i.e., potential costs) are noted below along with references to the Environmental Management Plan (EMP) and mitigation measures. A common theme is that: (a) it is important to determine if these (or mitigation measures to address them) have been separately identified and costed in the estimation of project costs;	Typically those externalities will be covered in the King Report - Table 1 Operations line 182 'Make good water and soil arrangements' totalling $81m if not covered in the Capital acquisition costs.

No.	Issue	Waratah Response
	(b) related to a) if mitigation measures referred to in the EIS have been adopted it would be useful to know their separated-out (or individual) cost if this is available; and (c) is there any indication that the costings/mitigation would fully allow for identified potential costs (this is known as internalizing the externalities (costs) – i.e., whether potential costs have been fully accounted for in the project finances or there are outstanding costs which have not been (and what they might be).	
	Surface and ground water	
29	Surface and ground water are the subject of contention of many projects, and it would be good to get as many details as possible on issues such as the price paid for water allocations and mitigation costs/efforts.	We are not expecting significant effect from the drawdown which means little or no 'make good' arrangements. Waratah has excess water in the water balance which can be provided as make good or drilling of new bores.
	▪ What is the size of the project's water requirements? Have water allocations been purchased and secured in respect of this project? If so what allocations and at what cost? If not have these been factored into operating costs? (We note that past projects we have analyzed have indicated their purchase of water allocations over the lifetime of the given project at market rates.)	No need to purchase water
	▪ The EIS indicates that there will be surface water impacts from construction including sediment flows, the potential for flooding and tailings and other chemical contamination, subsidence and erosion. There are also indication of mitigation works. To what extent have these mitigation works been costed within the existing (King	No need to purchase water as project has excess

No.	Issue	Waratah Response
	report) project costings? If such costings have been undertaken would they entirely mitigate such concerns?	
	▪ The EIS indicates that there will be surface water impacts from construction including sediment flows, the potential for flooding and tailings and other chemical contamination, and erosion. There are also an indication of mitigation works. To what extent have these mitigation works been costed within the existing King report? If such costings have been undertaken would they entirely mitigate such concerns?	Mitigation include the diversion drains, environmental dams and waste facilities which are included in the capital and operating costs. No residual impacts are expected
	▪ Likewise, the potential for groundwater issues such as contamination, subsidence and the draw down of local bores was also identified in the EIS and that impacts could range 30km. Mitigation measures are noted in the EIS but have mitigation costs for these been specified? Have they been incorporated into the King estimates? We note that the King report refers to $3m per annum in make good, water and soil arrangements. Was there a process by which this figure was identified – e.g., identification of draw down compensation costs or other potential loss-based grounding for the estimates? What aspects of project environmental costs do the make good costs cover?	As above.
	▪ We note that some of the Objections have expressed concerns about the cost and uncertainty of surface and groundwater changes and the adequacy of make good conditions so it would be good to clarify these issues through clarifying how costs have been taken into account and make good arrangements determined.	In this Mining Objection Hearing the volume of water to be taken under the Mining Lease is not a consideration as that is a considerastion under the requirement for an Associated Water Licence. However, impacts on water quality are a relenat to the proceedings.

	No.	Issue	Waratah Response
			See previous comments. Drawdown effect is expected in one direction only and excess water balance can be used here. $3m pa is a generous allowance based on experience. It covers all potential impacts as most (other than water) are considered to be minor – see earlier comments on groundwater Excess water is available from the mine which can be piped to the affected landowner. Alternatively new water bores can be installed on the affected properties at a max cost of $3m Max no of new bores per property: 4 Max cost per bore (external rates: $50k Max no of affected properties: 15.
	Aquatic impacts		
30		Based on the EIS, there would appear to be only a limited aquatic environment in the region of the mine. As in the discussion of surface water above, the EIS identified the potential for some impact on sediments, contamination, fish stocks, wetlands and weed assemblage/flooding. As above, it would be useful to understand whether mitigation measures have been built into project costings and what these costs are.	These mitigation costs are considered minimal and would be included in the $3m pa allowance (per King Report) if any costs eventuate at all. Essentially good management practices will mitigate all the potential impacts – sediment (designed for 1:1000 & if escape would be caught by Burdekin dam and discharge to GBR); fish stocks (no offsets, culverts inserted in waterway for connection through normal design); weeds (operational practices).

	No.	Issue	Waratah Response
31		We do note in the case of wetlands that offsets refer to wetlands. Is it the case that some wetlands will be permanently forgone due to the mine but that the offsets have been purchased in compensation for this?	Offsets will be purchased for wetlands. There is a very small amount of wetlands (insignificant in size and costs – 24.40 ha) under the strict definitions which will be affected.
	Subsidence		
32		The issue of the potential for subsidence has been noted above and is discussed at various points in the EIS. Has the impact of subsidence been costed explicitly in the project costings? If mitigation measures to deal with subsidence are proposed have the costings for these been identified and will they fully compensate for any subsidence?	Mitigation includes occasional minor attention to drainage lines and disruption costs to the landowner. Costs are covered in earthworks and compensation allowances.
33		Likewise, we note that some Objections refer to subsidence of up to 1.9 meters and suggest land cannot be resorted to its former use value. As above, has a cost allowance ben made for this (if this is the case)? Is there a defined area over which subsidence might take place (presumably within the broader mine footprint) ?	Mitigation includes occasional minor attention to drainage lines and disruption costs to the landowner. Costs are covered in earthworks and compensation allowances.
34		It's been indicated that there may be less subsidence under the NMP.	NMP may include bord and pillar options where there would be nil to minimal subsidence, for example

	No.	Issue	Waratah Response
		Could more clarity be given under this point (and any difference in projected subsidence costs)?	under houses. The total subsidence area has been increased (27,265 ha) as open cut in the BNR will not occur and subsidence mitigation will be required on the BNR land. Allowance has been made to mitigate the entire subsidence area and should bord and pillar be used there would be a very small saving to this allowance (which should be ignored at this stage).
	Noise and air quality		
35		We note the noise and air quality issues surrounding the operations as identified in the EIS. We are working through these with a view to arriving at some external costings. However as above it has been indicated that some mitigation measures may be put in place. As above have these been costed and would they ameliorate the noise and air quality impacts completely (or to some extent)?	These costs would form part of the acquisition and compensation costs of $55.0 million. and $45 million respectively for directly affected property otherwisw are included in the general allowance of $81 for compensation – see items #18 and 20.
36		On a separate note, as indicated the NMP may have different effects on noise and air quality to the OMP. We will need to abide by the EIS (unless new work has been carried out consistent with the NMP). One might speculate increased underground activity would reduce such costs. However, this is an engineering/environment issue so it	Rely on OMP figures for costings. Assumption that costs should be decreased is correct.

	No.	Issue	Waratah Response
		would be useful to know if this is correct or otherwise.	
	Visual amenity and non-indigenous heritage		
37		We note that there may be some issues associated with visual amenity through these would appear to be low from a distance, apart from some night time light effects. Some properties closer to the mine site may experience higher degrees of visual impacts.	Accounted for within $55.0 million and $45 million land acquisition and compensation costs.
38		We would anticipate that visual amenity impacts would now be lessened under the NMP as it will involve additional underground mining under the BNR. Is there any data to support this?	There will be no open cut operations on BNR, and there will be the same amount of underground longwall mining under BNR in the NMP, exactly the same as the OMP.
39		The EIS suggests only minor impacts to non-indigenous heritage but if any additional data has emerged post-EIS this would be welcome.	No additional data available.
	Indigenous heritage		
40		We understand there were no impacts on any listed indigenous sites. Indigenous heritage is typically handled in a qualitative manner rather	No additional data here.

	No.	Issue	Waratah Response
		than subject to CBA quantification. Nonetheless any additional data post-EIS is welcome.	
	Effects of climate change on the project		
41		The EIS lists a variety of climate change impacts on the project including the potential for higher winds to cause erosion and the impacts of more bushfires and heatwaves. As above it lists a variety of mitigation measures including managerial monitoring. It also suggests that project design parameters will include the impact of climate change adaptation. Presumably these will be factored into costings but if this could be confirmed (or such additional adaptation/mitigation costs separately identified) that would be useful.	These costs would be part of the design and operational costs and are considered to be minor See s7.2.2 of the CoG report 4th para which refers to the climate change assessment in EIS vol 2 Chapter 2. 'The assessment concluded that impacts can be managed through proper infrastructure design and a sound workplace health and safety system.'
	Greenhouse Gas Emissions adaptation and sustainability measures		
42		We note that the EIS provided estimates of Scope 1 and 2 emissions and that these have recently been updated in the Galilee Coal Project Greenhouse Gas Assessment (2021). We will utilize these Scope 1 and 2 findings in our costings. We understand that Scope 3 emissions	GHG expert to advise on Scope 3 as relevant.

	No.	Issue	Waratah Response
		have not been estimated for the project (although other recent projects have undertaken such work). If this is the case we will seek data on the estimation of such emissions.	
43		Some reference is made to energy efficiency measures, GHG mitigation measures, GHG offsets and similar measures in the original EIS and above document. It would be helpful if some additional clarity could be given as to whether there is a commitment to have adopted these measures, their cost and if these have been included in the project costings.	Adoption of industry improvements regarding energy efficiency and GHG mitigation. No costing available.
	Waste		
44		The EIS provides details of the project's waste management plan and mitigation strategies. Presumably some of this will be factored into operating and rehabilitation/decommissioning costs. However, as above it would be of assistance if separate costings of the plan are available.	Waste management is assumed within operational costs.
45		We note that some Objections refer to the potential for arsenic contamination and others refer to	Not directly, however would be considered to be included in operational costs. Bill Thompson will be

	No.	Issue	Waratah Response
		topsoil stability and contamination in general. Has such contamination been dealt with in the project costings? We note that there is some provision for make good water and soil costs in the King report, through it is unclear how these wee arrived at or if they address he totality of potential costs.	preparing a report dealing with this issue but that he should make assumptions in the meantime. Arsenic contamination and topsoil stability and contamination in general are part of the progressive rehab and waste management strategies where savings can be generated through good practices and are recognised as opportunities.
	Traffic and transport		
46		The EIS notes the potential for increased local traffic increased travel times and potential for increased accidents associated with the operations of the mine. These costs could be considered an additional cost associated with the mine. We note increased vehicle movements associated with the mine are quantified in the Appendices. Has any more recent work been carried out quantifying the increase in such traffic volumes, travel times and accidents?	No more recent work available.
	Workforce location and wage costs		
47		We note the discussion of the workforce in the 2011 Economic Impact Assessment.	

No.	Issue	Waratah Response
48	We note you have provided an update of the workforce numbers during construction and operations. However apart from thus has the nature of the workforce changed? In particular are there any new data on	Nothing further to add at this stage. Refer to social impacts assessment in CG report and in EIS/SEIS.
	▪ Where the workforce will be drawn from (e.g., towns, LGAs, other localities, % of "locals" vs FIFO or permanent/temporary migrants)	
	▪ Industry of occupation	
	▪ Wages bill	
	Public infrastructure costs and social impacts	
49	The EIS notes increased potential costs on the public sector due to population movements. These include changes on costs for public school education, training, welfare, fire and emergency services, childcare, health care, power, water and garbage and potentially some public housing costs (given pressures from the changes in private sector purchase and rental prices). Reference is also made to an airstrip. There is a discussion of planning measures in the EIS but has any costing of these additional public	An airstrip already exists at Alpha and it is intended to use this upgraded facility and pay on a per passenger head basis – discussions have commenced with potential developer & operator. Some budget allowance has been made in associated projects for the increase in Council services. Waratah considers payment of coal royalties is meant to be partially allocated for local community funding.

No.	Issue	Waratah Response
	sector costs been carried out either during or since the EIS?	
50	We also note references the EIS to positive and negative social impacts in regional towns such as a greater sense of community vs negatives such as resentment of higher paid workers, drug and alcohol abuse and the direct effects of higher living costs. In terms of the private sector effects of issues such as higher living costs, these would constitute secondary market effects which normally wouldn't be considered in a CBA which focuses on the "primary market "– i.e., the mining initiative itself (and noting there are winners as well as losers from market price adjustments). However, some might be considered positive or negative externalities (non-market third party costs). Such potential costs to government are noted above. In the main, broad social issues and questions of equity are usually handled via separate qualitative analysis. We assume that no further work has been done post-EIS on some of the social issues above but obviously if there has been some done, we would be happy to receive any additional data.	Nothing further to add at this stage. Refer to social impacts assessment in CG report and in EIS/SEIS.

EMAIL OF 3 MARCH 2022

From: Brendan Tobin <Brendan.Tobin@hallandwilcox.com.au>
Sent: Thursday, March 3, 2022 10:54
To: Andrew Tessler <atessler@oxfordeconomics.com>
Cc: Alison Thorp <Alison.Thorp@hallandwilcox.com.au>; Gus Haseler <Gus.Haseler@hallandwilcox.com.au>; Ryan Thomson <Ryan.Thomson@hallandwilcox.com.au>
Subject: Waratah Coal - assumptions re Galilee Coal Project

EXTERNAL EMAIL >> PLEASE TAKE CARE

Dear Andrew

We refer to the economic information that was provided to you on 7 October 2021, which included a document called "Second information request for Galilee Project – Final" [**WAR.0508.0001**].

In the Applicant's response to question number 1, it stated that:

"

The changes to the Project as proposed by the NMP are as follows:

….

- *Delete camp site*
  …
- *Amend mining lease application 70454 boundary*

…"

The statement relating to the amendment of the MLA boundary was an error. We have now been advised that there will be no amendment to the mining lease boundary as a result of the changes to the Project as proposed by the new mine plan.

The statement relating to the deletion of the 'camp site' was an error. The deletion of the workers accommodation camp, or 'camp site' is not specifically linked to the changes proposed to the Project as a result of the new mine plan. Regardless of whether the old mine plan or the new mine plan is adopted by the Applicant, the workers accommodation camp will no longer be located within the mine site. Accommodation for workers will be provided at a purpose built 2500 person workers village in Alpha, away from the mine site, by a third party. In this respect, we refer to paragraphs [56] and [271] of the First Affidavit of Nui Harris dated 21.06.2021 [**WAR.0291.0001**], which confirms this change.

Kind regards

Brendan Tobin | Partner

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If our bank account details change, we will notify you by letter, phone call or face-to-face, but never by email.

Hall & Wilcox acknowledges the Traditional Custodians of the land, sea and waters on which we work, live and engage. We pay our respects to Elders past, present and future.

EMAIL OF 24 FEBRUARY 2022

From: Brendan Tobin <Brendan.Tobin@hallandwilcox.com.au>
Sent: Thursday, February 24, 2022 12:48
To: Andrew Tessler <atessler@oxfordeconomics.com>
Cc: Raul Arias <rarias@bisoxfordeconomics.com.au>; Kristian Kolding <kkolding@bisoxfordeconomics.com.au>; Gus Haseler <Gus.Haseler@hallandwilcox.com.au>; Alison Thorp <Alison.Thorp@hallandwilcox.com.au>
Subject: RE: Next steps [HW-Active.FID2957636]

Hi Andrew

Thanks for the update.

In relation to your additional queries, we advise as follows:

- In relation to the costing entered into the King Report spreadsheet for the rail link:
  - this rail link specifically relates to costs associated with the Abbott Point option; and
  - capital costs in the spreadsheet include $10mil for acquisition costs and labour is 40% of the balance.

- The workers camp in Alpha village will be built and owned by a private company. Waratah will pay on a per head basis. Accordingly, there are no capital costs for accommodation, but there will be operational costs commencing in 2025 (relating to the airport and camp costs).

- The airport/flights will be provided by Waratah on same per head basis as the accommodation. The split is 70% accommodation & 30% flights.

We note your anticipated release date of 28 February 2022. Counsel are quite concerned that this won't give us enough time to finalise the report and provide it to the relevant parties ahead of the commencement of the conclave. I know there is a lot of work to review and update the documents, however is there any way you would be able to provide us with a revised draft by the end of the week, or over the weekend?

Thanks for noting your availability for a conference on the 6th – I'll send through a calendar invite for this shortly.

If there is anything else you need to assist with the revised draft, please let me know.

Kind regards

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APPENDIX 2: CGE MODELLING

Using dynamic VU-TERM to analyse the Galilee coal project in a CGE framework

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Contents

Executive summary

This study uses a dynamic CGE model to estimate the impacts of the proposed Galilee coal mine over the lifetime of the project. Three main scenarios are modelled. The first excludes rail construction costs.

In the investment phase from 2023-24 to 2027-28, there are substantial local economic impacts on the Outback South-Central Highlands region. Additional jobs in the region plateau at around 2300 full-time equivalent above a business-as-usual base. Real GDP in the region peaks at almost 30% above base. However, additional local demands have a dramatic impact on prices for local commodities. Housing rentals in the region peak at 65% above base, but will be larger in regional communities close to the mine.

In Queensland, state-wide jobs will peak at 4000 above base in 2025-26. Real wages will rise to around 0.6% above base, which in turn will slowly diminishes job impacts.

Over much of the lifetime of the mine, from around 2025 to 2051, local demands in Outback South-Central Highlands will persist above base. Employment will gradually move back towards base due to rising real wages, but will still be 1000 jobs above base in 2035-36. With a part scaling down of operations from 2039-40, jobs in the regions will drop to around 380 to 450 above base.

At the statewide level, Queensland jobs will remain over 1000 above base until 2039-40. With the scaling down phase, statewide jobs will fall to more than 500 jobs below base, a consequence of real wages in the state persisting around 0.5% above base in the new phase.

The national welfare calculation in this study is based on the net present value of deviations in private and public consumption from base at the national level, net of any increase in foreign debt in the final year of the scenario. It does not include externalities such as an estimate of the negative impact of additional greenhouse gas emissions or other environmental damage. In the initial baseline of the study, real export prices of coal remain relatively constant over time. With this assumption, the net present value of the project discounted at 2.5% (a rate which reflects real interest rates over the past quarter of a century) is $10.45 billion, equal to an annuity of around $260 million. Since a higher discount rate would deflate the national legacy debt of the project, the outcome is not particularly sensitive to the discount rate.

A second scenario uses the same future coal prices as the first, but includes rail construction costs. These raise employment in Outback

South-Central Highlands and Queensland between 2022-23 and 2024-25 above those of the first scenario. Otherwise, the jobs pattern and macroeconomic outcomes are similar to the first scenario. The welfare outcome of the second scenario is $9.66 billion, equivalent to an annuity of $240 million.

The modelling is more sensitive to the assumed timeline of coal export prices than the discount rate. In a third scenario, the same assumed fixed costs are modelled against a baseline in which global demand for coal declines from around 2030. The coal mine remains highly profitable in the first few years of its lifetime, less so thereafter. Variable costs and output decline relative to the first scenario in response to lower prices. Against this baseline, the national welfare gain is only $2.23 billion. CGE modelling is not going to reproduce the same prices as CBA in a scenario, as prices are endogenous. In the first two scenarios, baseline prices modelled here are higher than those in the CBA. In the third scenario, they are lower.

1. Introduction

This study uses the same input costs and project mine outputs year-on-year as the cost-benefit analysis (CBA) of the project reported elsewhere in modelling the Galilee project. This study uses a dynamic computable general equilibrium (CGE) model. The aggregation of VU-TERM used in this study includes 24 sectors[225] and three regions (Outback South-Central Highlands, Rest of Queensland, Rest of Australia). Appendix A describes VU-TERM.

1.1 Differences between cost-benefit analysis and CGE modelling

There are several key differences between CBA and CGE modelling. A CGE model solves for both prices and quantities. An appendix contains further details on the dynamic CGE approach.

This approach is particularly relevant when it comes to examining price squeezes on local regions during resource booms. In the mining boom decade starting around 2005, numerous mining towns in Western Australia and Queensland experienced prolonged price hikes for housing and local services. These resulted in cost-of-living hardship for some inhabitants alongside those benefiting from the boom.

Since prices are endogenous in a CGE model, a project that boosts output of a commodity, in this case, coal, reduces its market price. Even with relatively elastic export-oriented commodities such as coal, modelled prices decrease as output increases.

The dynamic CGE model allows investors to borrow during a construction phase, thereby running up debt. By the end of the simulation period, we can account for increased debt by subtracting its discounted real value in the national welfare calculation.

CGE models account for real activity. A nominal interest rate of 5% is assigned to the scenario, within bounds of interest rates that have prevailed over the past 15 years or so. Since baseline inflation is 2.5% per annum, an appropriate real interest for discounting is 2.5%. Using a higher discount instead of 2.5% reduces both the net present value of

[225] These sectors are (1) Agriculture, forestry & fishing; (2) Black coal; (3) Oil & gas; (4) Other mining; (5) Food products; (6) Petroleum & coal products; (7) Other manufactures; (8) Electricity generation – coal; (9) Electricity generation – other; (10) Electricity distribution; (11) Other utilities; (12) Construction; (13) Trade; (14) Hotels & cafes; (15) Transport; (16) Rail freight; (17) Other services; (18) Communication; (19) Finance & insurance; (20) Ownership of dwellings; (21) Public administration, defence & public order; (22) Education; (23) Health; (24) Community care.

future earnings (positive) and future debt (negative), that is, with opposite contributions to the welfare calculation.

2. Summary of scenarios

The Galilee mine is located west of the Central Highlands SA3 region in the Outback South SA3 region. The projected is modelled without and with inclusion of a rail link that may be constructed as part of the project. Such a link would pass through Central Highlands to Abbot Point port terminal. The two regions (Central Highlands and Outback South) are combined in this study. Although the combined region is large in area, covering around 680,000 km^2, the GDP of the combined region is only $6.5 billion, or 1.7% of Queensland's GDP.

This section details the modelled economics of the Galilee project with different sets of assumptions. Two key variants are the projected time series of coal prices in the simulation period and the coverage of project costs.

The scenarios are:

1. Project excluding rail construction costs, using assuming coal base 1 prices (figure A2);
2. Project including rail construction costs, using assuming coal base 1 prices (figure A2); and
3. Project including rail construction costs, using assuming coal base 2 prices (figure A2)

2.1 Project without rail construction costs (coal price base 1)

The costings in the scenario include neither the costs of rail construction costs nor year-on-year transport infrastructure upgrades that may be required as part of the project.

The Galilee project is large in both the investment and operational phases relative to the economy of Outback South-Central Highlands. In the VU-TERM database, existing coal mining accounts for more 40% of the region's GDP in 2021.

The main investment phase of the project proceeds from 2023-24 to 2027-28 for mine developments.

Figure 2.1.1: Labour market in Outback South-Central Highlands
(% deviation from base 1, no rail construction costs)

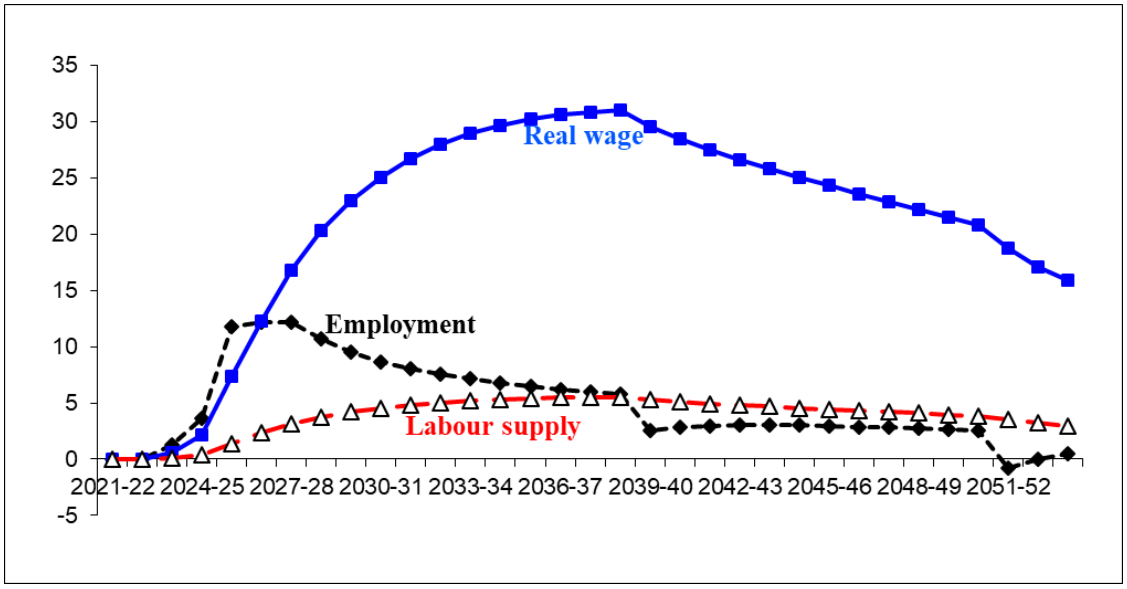


Figure 2.1.1 shows the impact on the labour market in Outback South-Central Highlands. Construction activity peaks in 2024-25, hence the peak in aggregate investment in figure 2.1.2. However, the local labour market strengthens further in the following year as the project operations ramp up. Employment in the region peaks around 12% above base, or around 2,300 jobs full-time equivalent (FTE) above base, from 2025-26 to 2027-28.

Much of the increase in employment is driven by the jump in local aggregate consumption (figure 2.1.2), which rises to 26% above base by 2026-27. Aggregate consumption remains more than 30% above base while the project proceeds at maximum capacity, then moves back partly towards base as operations scale down in 2039-40. In 2027-28, aggregate consumption in the region is more than $300 million (2022 dollars) above base, peaking later in the 2030s around $460 million above base (table 2.1.2).

Rising real wages in the region choke off additional employment from 2028-29 onwards, but jobs remain more than 1000 above base in 2035-36. When the project scales down in 2039-40, employment drops to around 2.5% to 3.0% above base (380 to 450 jobs) for the remainder of the lifetime of the project. In 2051-52 when operations cease, employments falls a little below base as a consequence of persistent above base wages. The model uses a theory of sluggish wages

adjustment which explains the below base employment at this time (see appendix B).

Figure 2.1.2: Outback South-Central Highlands aggregate consumption and investment

(% deviation from base 1, no rail construction costs)

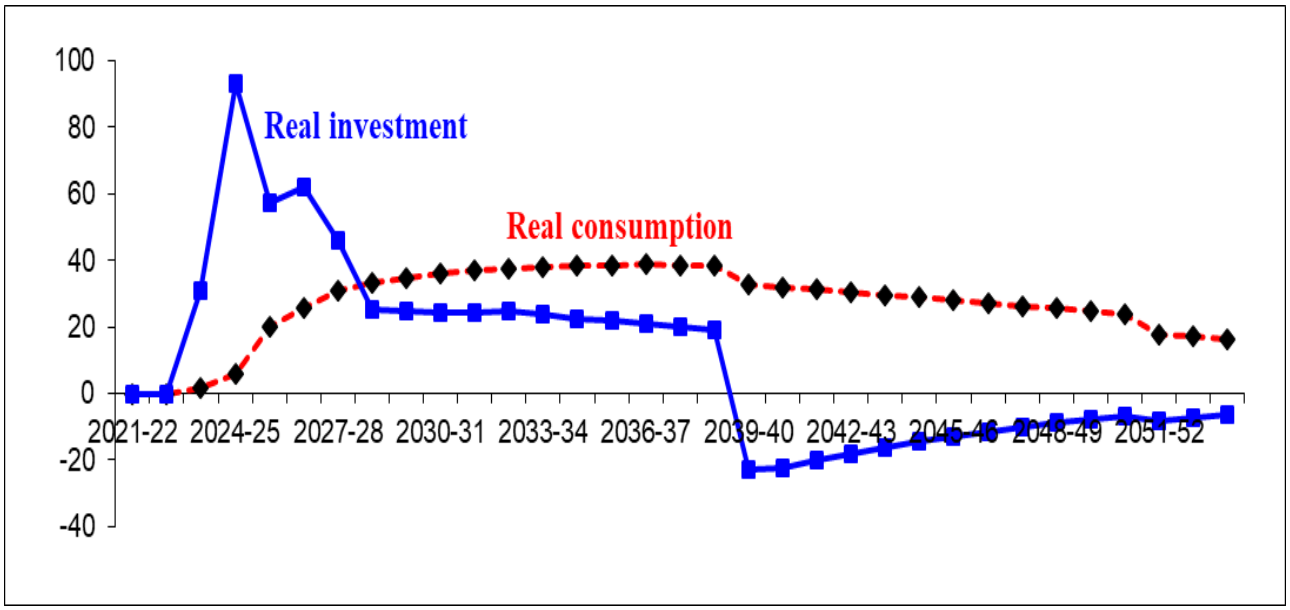


Figure 2.1.3: Outback South-Central Highlands real GDP income-side

(% deviation from base 1, no rail construction costs)

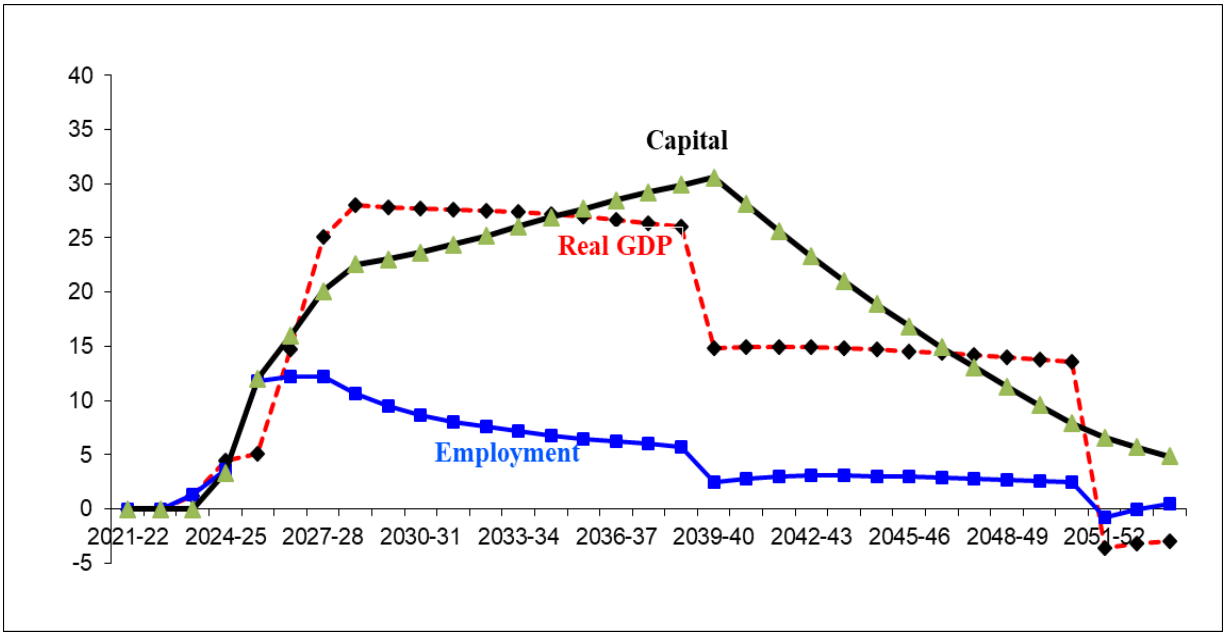
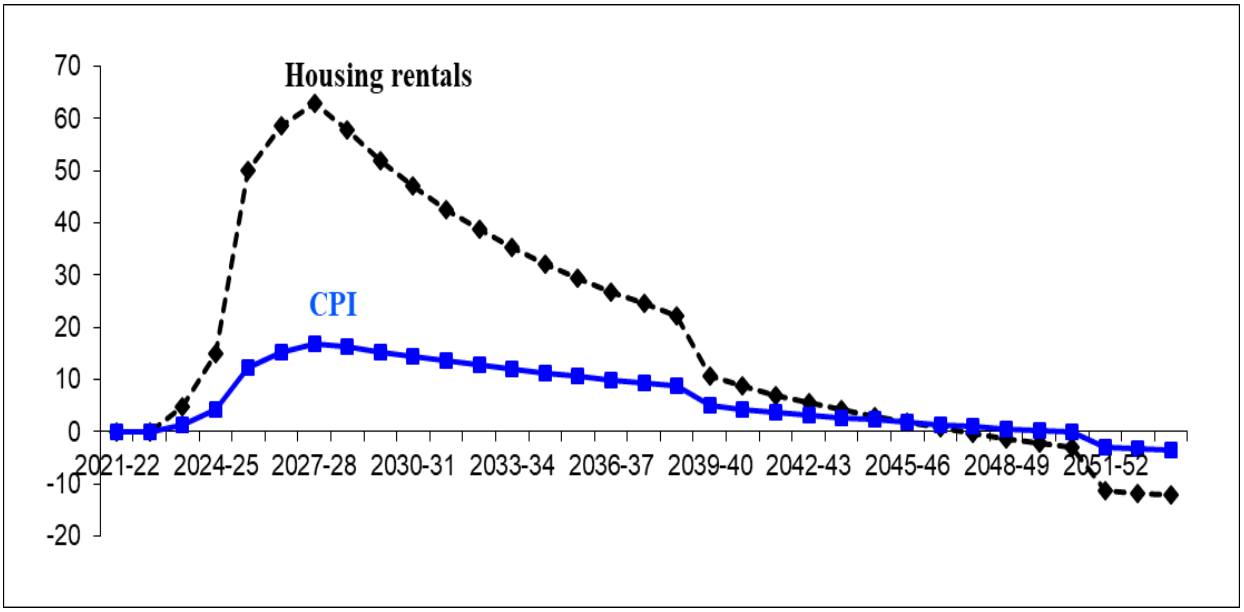


Figure 2.1.3 shows the impact of the project on the region's real GDP on the income side. When the mine is operational, real GDP rises by a

larger percentage than both employment and capital. This reflects income gains from exploitation of the coal resource. Sharp drops in real GDP in both 2039-40 and 2051-52 reflect scaling down of mining operations.

Figure 2.1.4: Cost of living impacts, Outback South-Central Highlands

(% deviation from base 1)



Relatively non-traded demands, such as housing, rise in price steeply due to the large increase in demand associated with the project. The impacts of local price squeezes arising from the Galilee project are shown in figure 2.1.4. By 2026-27, housing rentals on average across the region are 65% above base, but could be much higher in settlements close to the mine. For local property owners, the impacts will not be as onerous as for those who are renting. Employees in education, health care and other local services, for example, who are renters will require substantial additional wages to compensate for working in the region rather than elsewhere. To the extent that project-specific accommodation is built, squeezes on local accommodation will lessen. However, the costings of the project modelled here do not include accommodation costs.

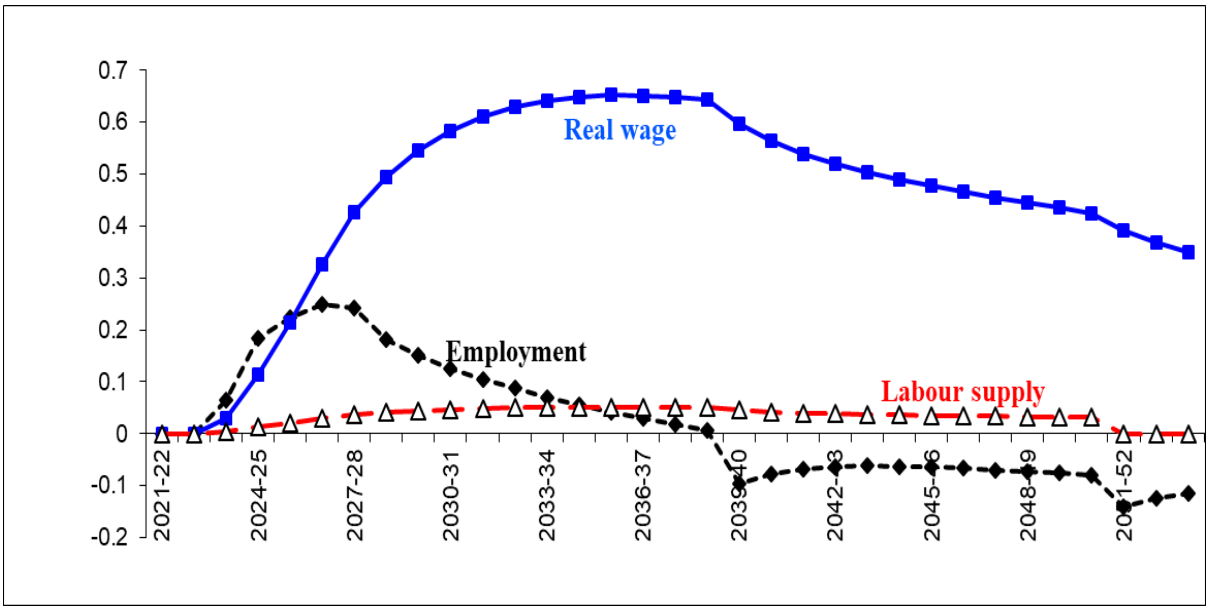
Price hikes of this magnitude are a reality of local mining booms. Housing price booms and busts have been experienced across the mining regions of Queensland and Western Australia since around 2005.[226]

[226] See https://www.abc.net.au/news/2019-08-22/mining-town-house-prices-booming-again-in-wa-queensland/11438774

2.1.2 Queensland-wide impacts of the project (excluding rail costs)

Since Outback South-Central Highlands' economy is small relative to that at the state level, the macro impacts as the state level are demagnified. At the statewide level, in 2024-25, jobs rise to almost 3100 full-time equivalent above base and peak in 2027-28 at 4000 jobs (0.25%) above base. Statewide real wages plateau at little more than 0.6% above base during the operational phase of the project (figure 2.1.5). When operations scale down in 2039-40, statewide employment falls to more than 0.1% or around 470 jobs below base. Thereafter, there is a slight recovery as real wages move a little towards base.

Figure 2.1.5: Labour market in Queensland
(% deviation from base 1, no rail construction costs)



Aggregate investment at the statewide level remains above base until the year of scaling down. This reflects persistent above base investments in various sectors in Outback South-Central Highlands.

Table 2.1.1: Employment

(full-time equivalent, relative to base 1, rail costs excluded)

	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33
OutSCntHi	0	241	688	2210	2293	2306	1982	1731	1545	1400	1288
RoQld	0	852	2444	1275	1671	1518	902	758	617	495	412
QLD	1	1093	3132	3485	3964	3823	2883	2490	2162	1895	1700

	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44
OutSCntHi	1187	1101	1030	968	916	872	378	419	444	454	454
RoQld	309	226	170	122	90	63	-899	-584	-361	-220	-131
QLD	1497	1328	1199	1090	1006	935	-521	-165	83	234	323

	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54
OutSCntHi	447	437	424	410	395	380	365	-110	-3	68
RoQld	-75	-40	-18	-4	4	11	16	-461	-288	-171
QLD	373	397	406	406	400	391	381	-571	-291	-103

Figure 2.1.6: Aggregate consumption and investment in Queensland

(% deviation from base 1, no rail construction costs)

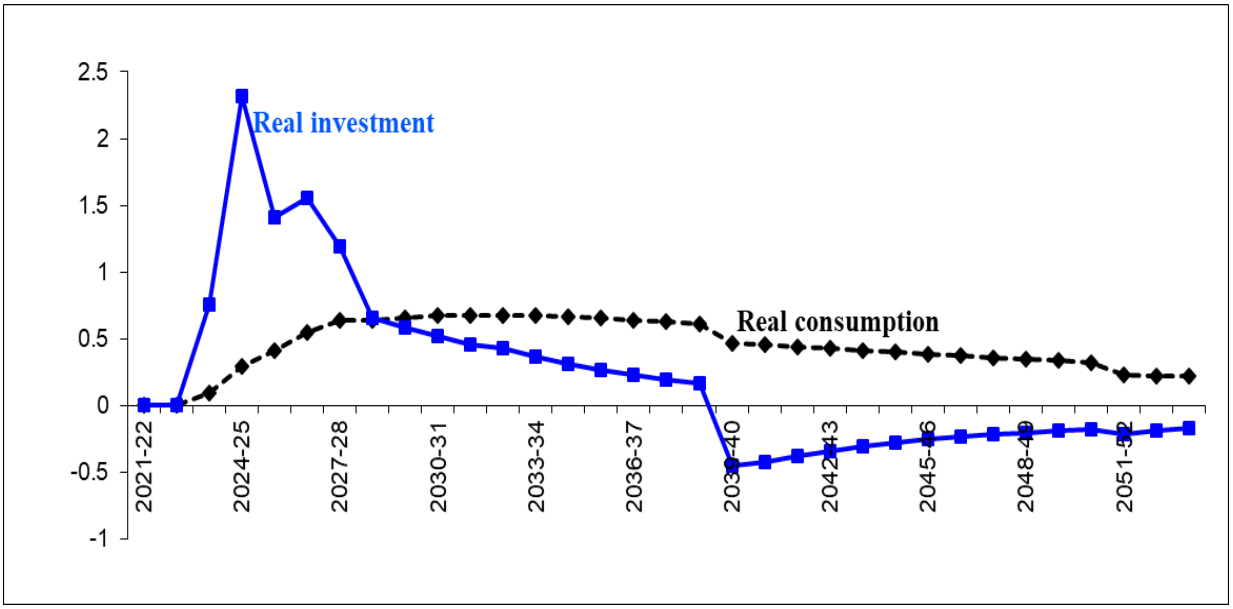


Figure 2.1.7 shows the statewide income-side components of real GDP relative to base.

Figure 2.1.7: Real GDP, income side, Queensland

(% deviation from base 1, no rail construction costs)

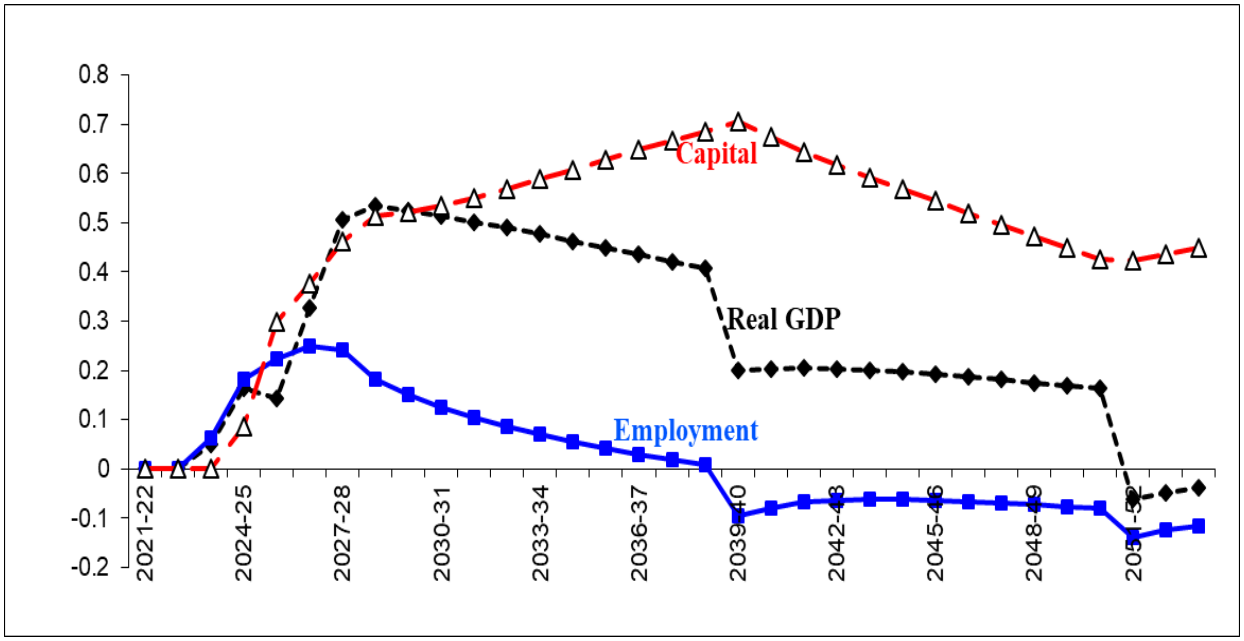


Table 2.1.2 shows dollar deviations in expenditure-side macro accounts.

Table 2.1.2: Regional and state expenditure-side
(real $m deviation from base 1, no rail construction costs)

	2022-23	2023-24	2024-25	2026-27	2027-28	2030-31	2033-34	2036-37	2039-40	2042-43	2045-46	2048-49
OutbackS-CntHighlands												
Aggregate consumption	0	17	56	254	311	382	430	461	411	400	385	366
Aggregate investment	0	124	383	268	204	115	118	110	-126	-106	-79	-56
Real GDP	0	20	72	251	436	511	533	547	320	337	344	345
All Queensland												
Aggregate consumption	0	186	601	888	1025	1105	1168	1176	840	823	797	763
Aggregate investment	0	186	573	415	360	180	131	88	-251	-184	-141	-111
Real GDP	0	145	456	588	772	696	651	625	184	309	364	396

2.2 Project with rail construction costs (coal price base 1)

There are two key differences in modelling results when rail construction costs are included. First, the local employment peak is higher than in the scenario that does not include such costs. Rail construction, not included in the first scenario, proceeds from 2022-23 to 2024-2025 for railway construction. Figure 2.2.1 shows the labour market impacts over time relative to a business-as-usual base. At the local level, the local jobs impact in each year from 2022-23 to 2024-25 is around 200 more than in the scenario without rail construction.

Table 2.2.1 shows that statewide employment is more than 1100 jobs above base in 2022-23 and more than 2000 jobs above base in the following year. These are temporary impacts that are larger than in the scenario that excludes rail construction.

Figure 2.2.1: Labour market in Outback South-Central Highlands
(% deviation from base 1, rail costs included)

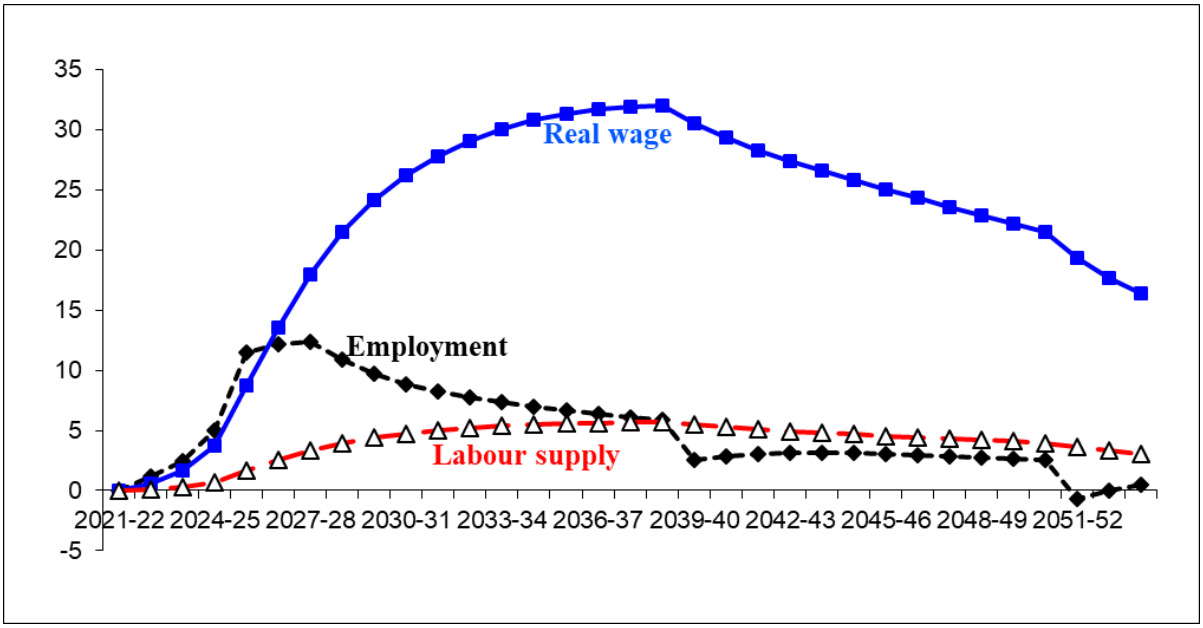


Table 2.2.1: Employment
(full-time equivalent, relative to base 1, rail costs included)

	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33
OutSCntHi	228	460	943	2163	2293	2330	2013	1764	1577	1431	1316
RoQld	911	1654	3469	664	1333	1270	715	643	548	454	391
QLD	1541	2114	4412	2827	3626	3600	2727	2408	2125	1885	1707

	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44
OutSCntHi	1213	1125	1051	988	935	890	381	425	452	463	465
RoQld	298	221	168	123	92	67	-929	-602	-369	-222	-129
QLD	1511	1345	1219	1111	1027	956	-548	-177	82	242	336

	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	
OutSCntHi	459	449	436	422	407	392	377	-105	3	76	
RoQld	-70	-34	-11	3	12	18	23	-454	-280	-163	
QLD	389	415	425	425	419	410	400	-559	-277	-87	

In the operational phase, impacts are similar to those of the first scenario. The remaining figures and tables in this section are very similar to those of the first scenario shown in section 2.1.

Figure 2.2.2: Outback South-Central Highlands aggregate consumption and investment

(% deviation from base 1, rail costs included)

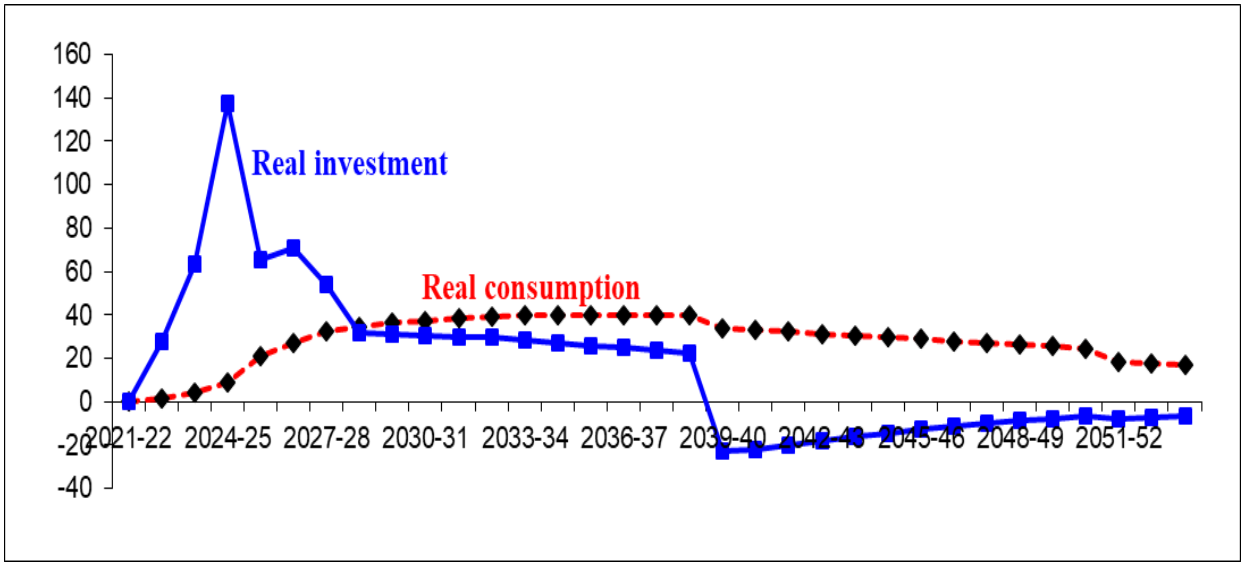


Figure 2.2.3: Outback South-Central Highlands real GDP income-side

(% deviation from base 1, rail costs included)

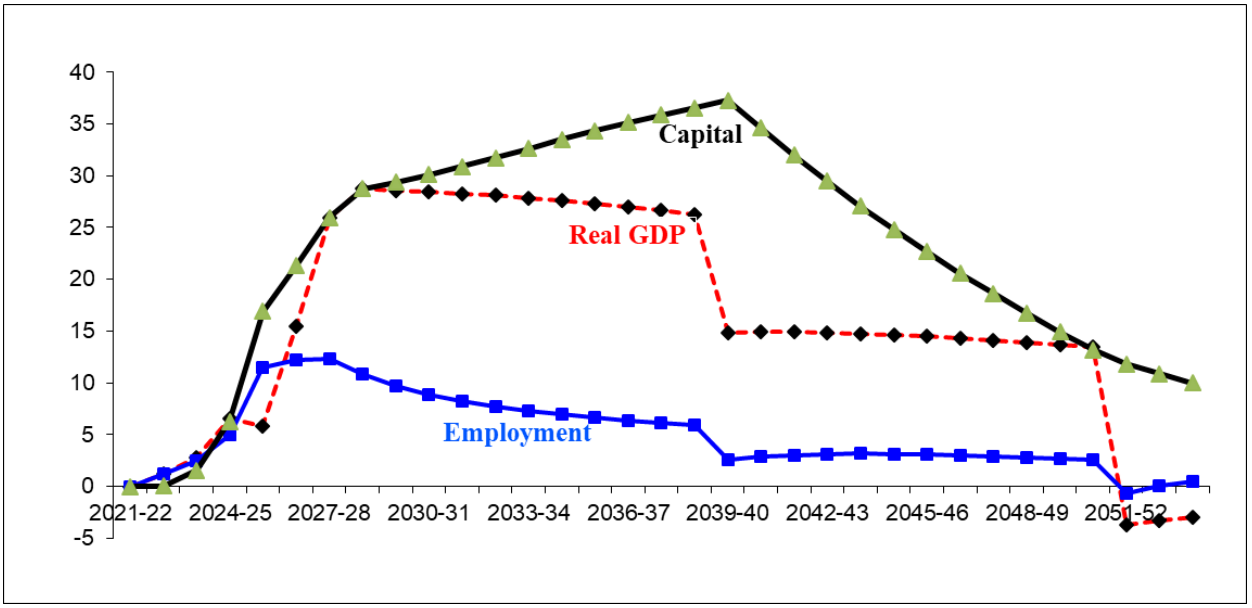


Figure 2.2.4: Cost of living impacts, Outback South-Central Highlands

(% deviation from base 1, rail costs included)

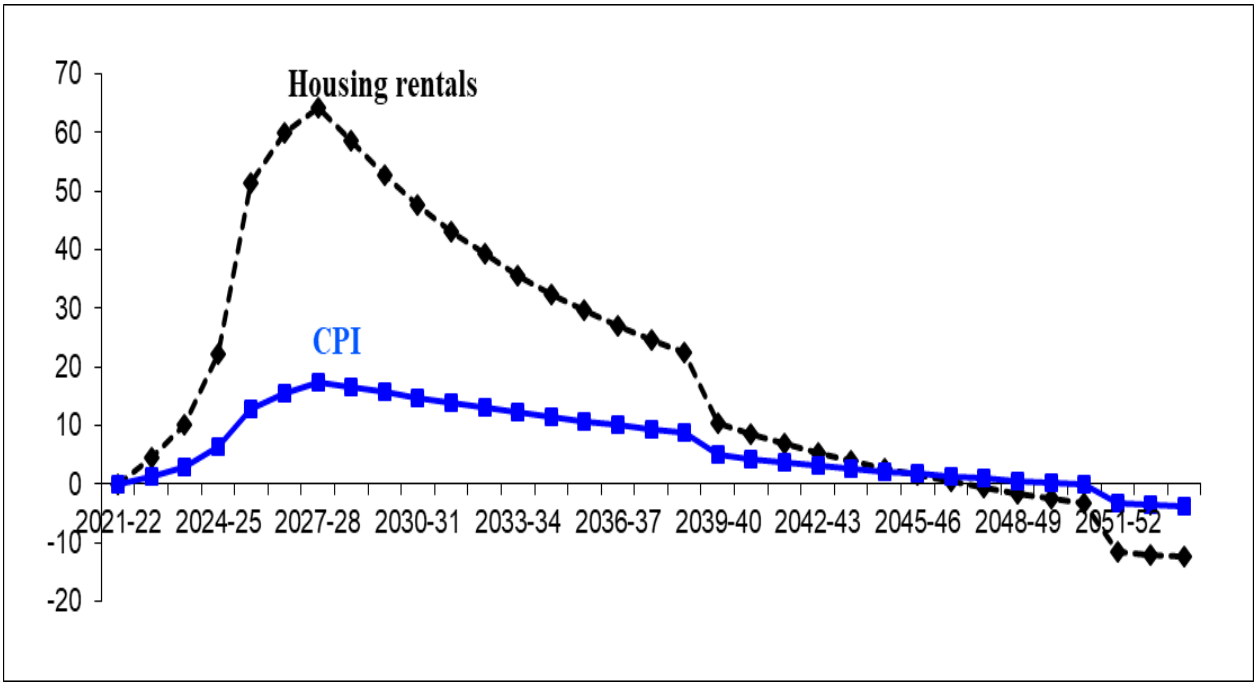


Figure 2.2.5: Labour market in Queensland
(% deviation from base 1, rail costs included)

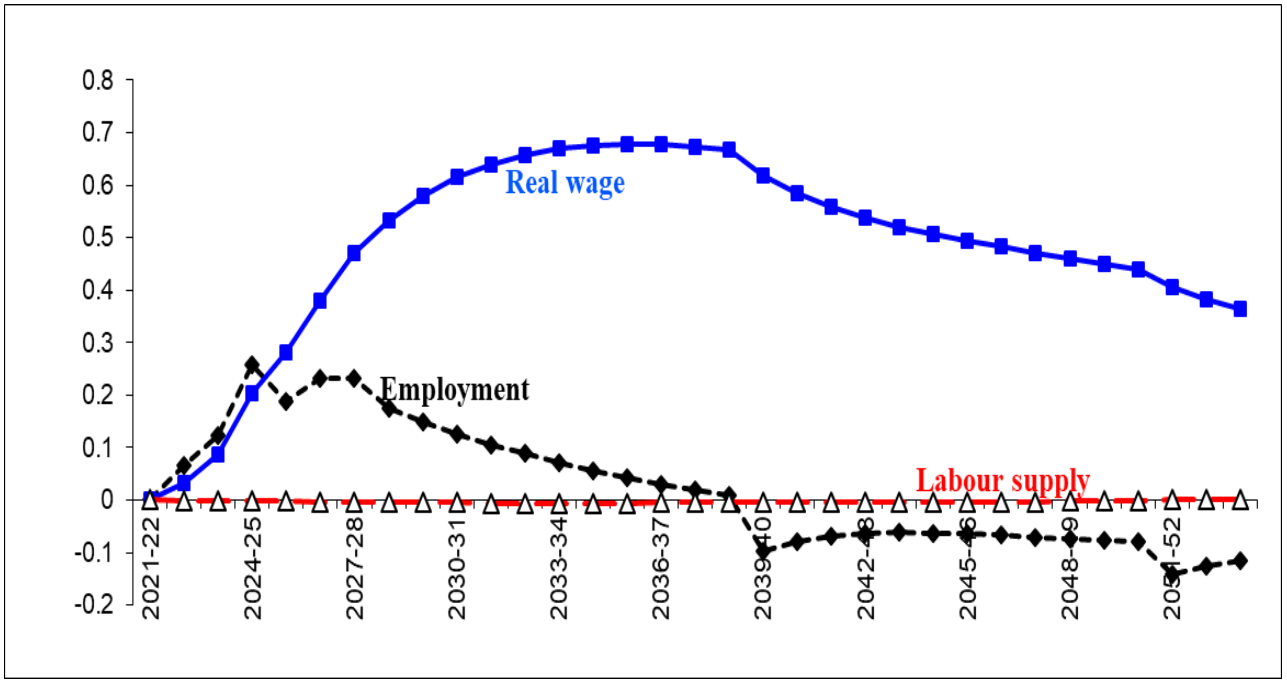


Figure 2.2.6: Aggregate consumption and investment in Queensland
(% deviation from base 1, rail costs included)

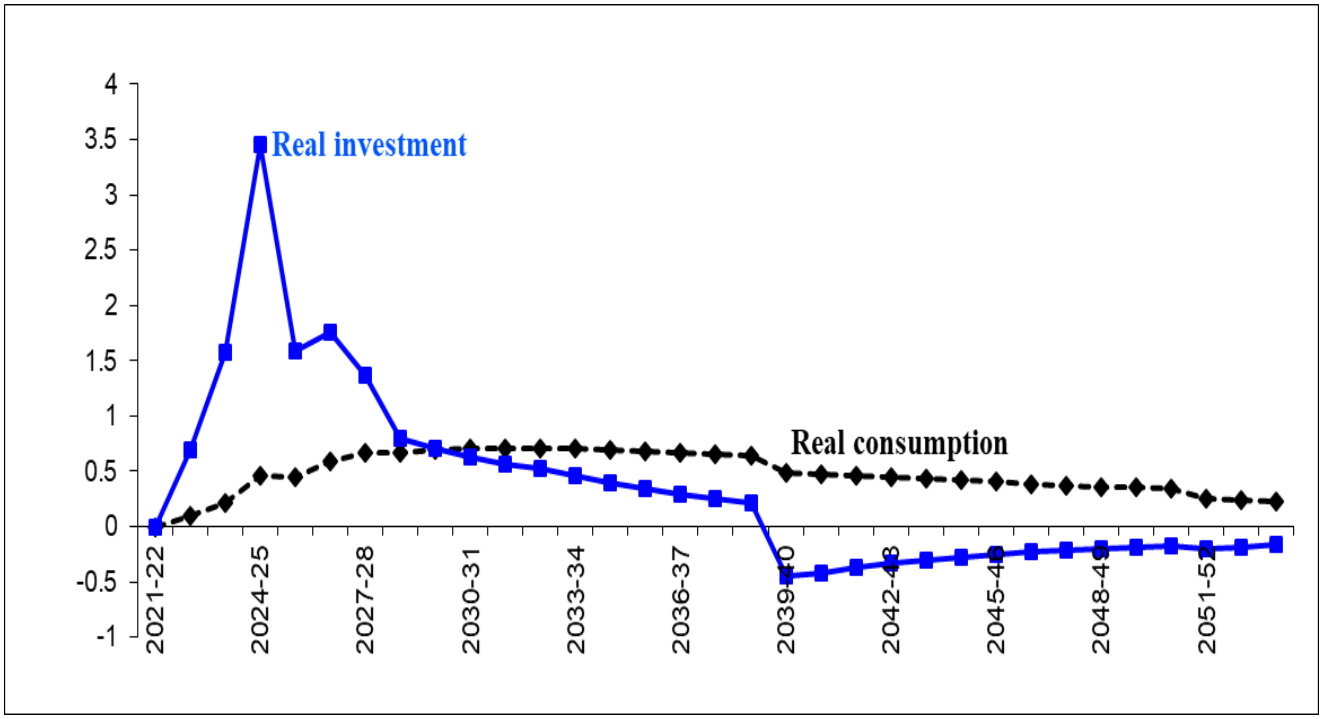


Figure 2.2.7: Real GDP, income side, Queensland
(% deviation from base 1, rail costs included)

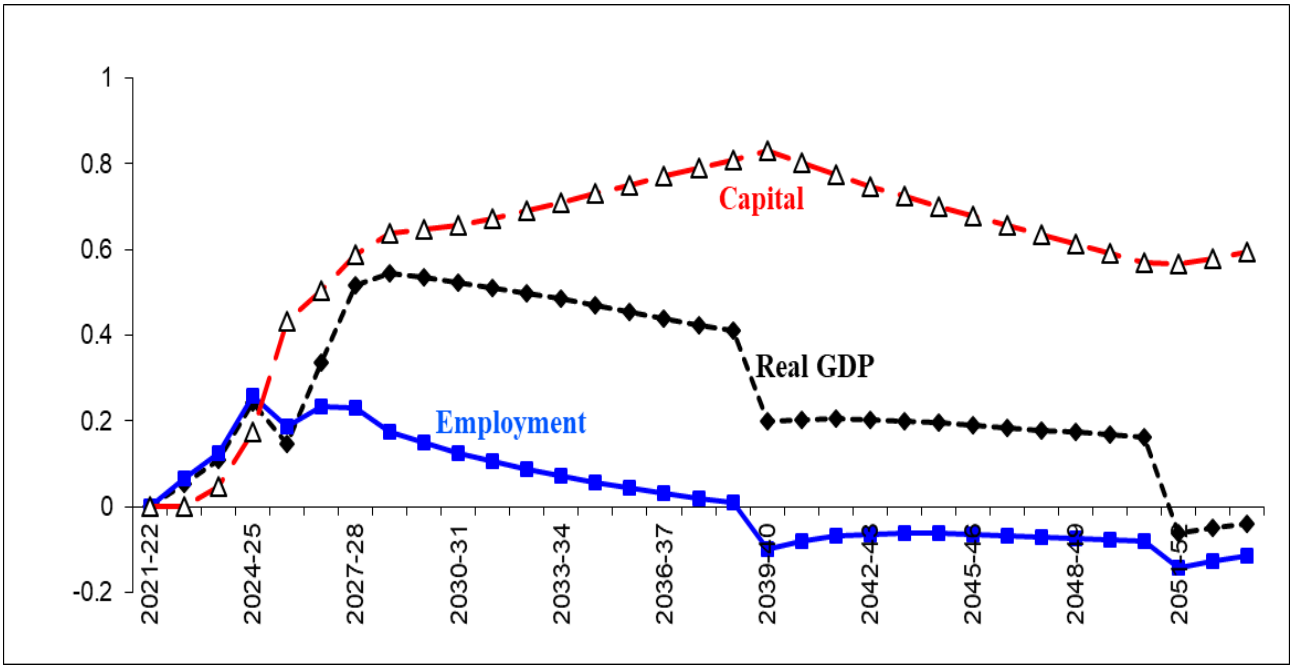


Table 2.2.2: Regional and state expenditure-side
(real $m deviation from base 1, rail costs included)

	2022-23	2023-24	2024-25	2026-27	2027-28	2030-31	2033-34	2036-37	2039-40	2042-43	2045-46	2048-49	2051-52
OutbackS-CntHighlands													
Aggregate consumption	16	38	84	267	326	397	446	476	424	412	397	377	276
Aggregate investment	109	256	566	307	239	142	143	131	-125	-106	-78	-56	-55
Real GDP	19	45	108	264	451	524	542	553	320	336	342	342	-94
All Queensland													
Aggregate consumption	193	420	938	948	1078	1153	1217	1223	874	856	831	795	518
Aggregate investment	174	385	850	431	370	192	149	106	-253	-185	-141	-111	-148
Real GDP	150	305	678	579	765	694	649	620	166	294	349	380	-152

2.3 Project with rail construction costs (coal price base 2)

How will the modelled outcomes of the project differ if there is a marked reduction in global demand for coal, starting around 2030? Figure A.2 shows the time path of Australian coal prices in base 1, base 2 and in the CBA. This time, we revisit the scenario that includes rail construction costs, but with base 2 coal prices in the future.

Figure 2.3.1: Labour market in Outback South-Central Highlands, 2nd scenario

(% deviation from base 2)

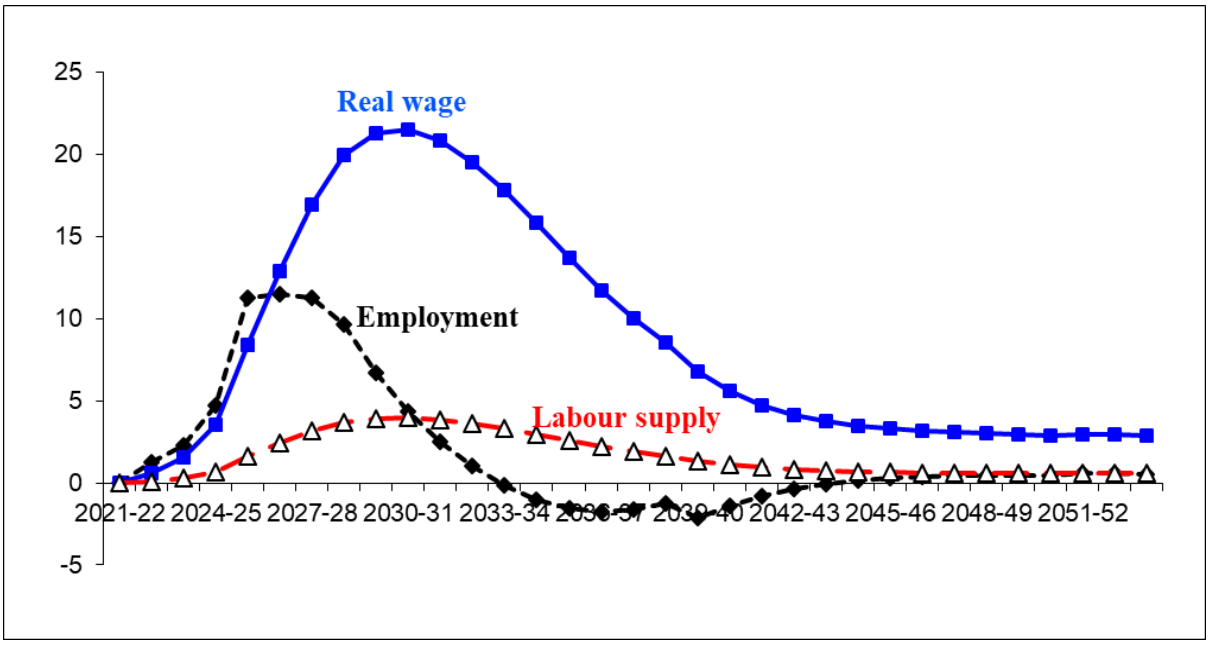
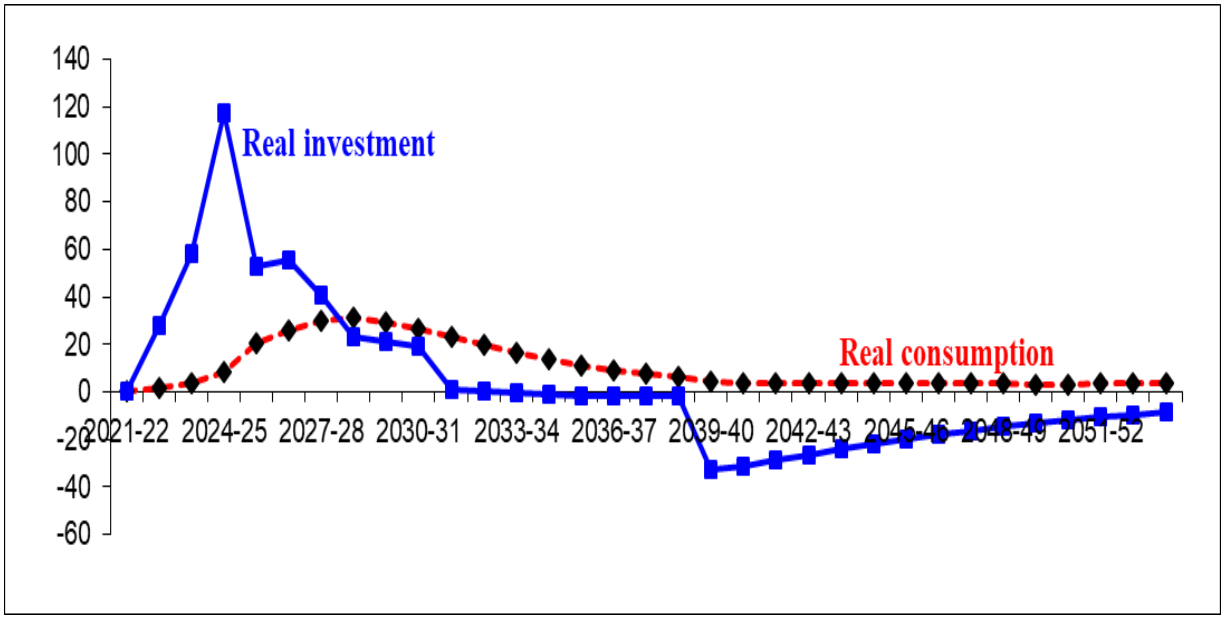


Figure 2.3.2: Outback South-Central Highlands aggregate consumption and investment, 2nd scenario (% deviation from base 2)



From early in the 2030s, the differences in Outback South-Central Highlands relative to the base 1 coal price scenario are apparent. Although real wages still persist above base for many years, they are more subdued in the second scenario. Regional employment falls below base in 2033-34 (figure 9). The global fall in the price of coal impacts on local demands. Housing rentals fall earlier and more rapidly with a lower coal price base, as does CPI (figure 2.3.4).

Figure 2.3.3: Outback South-Central Highlands real GDP income-side, 2nd scenario

(% deviation from base 2)

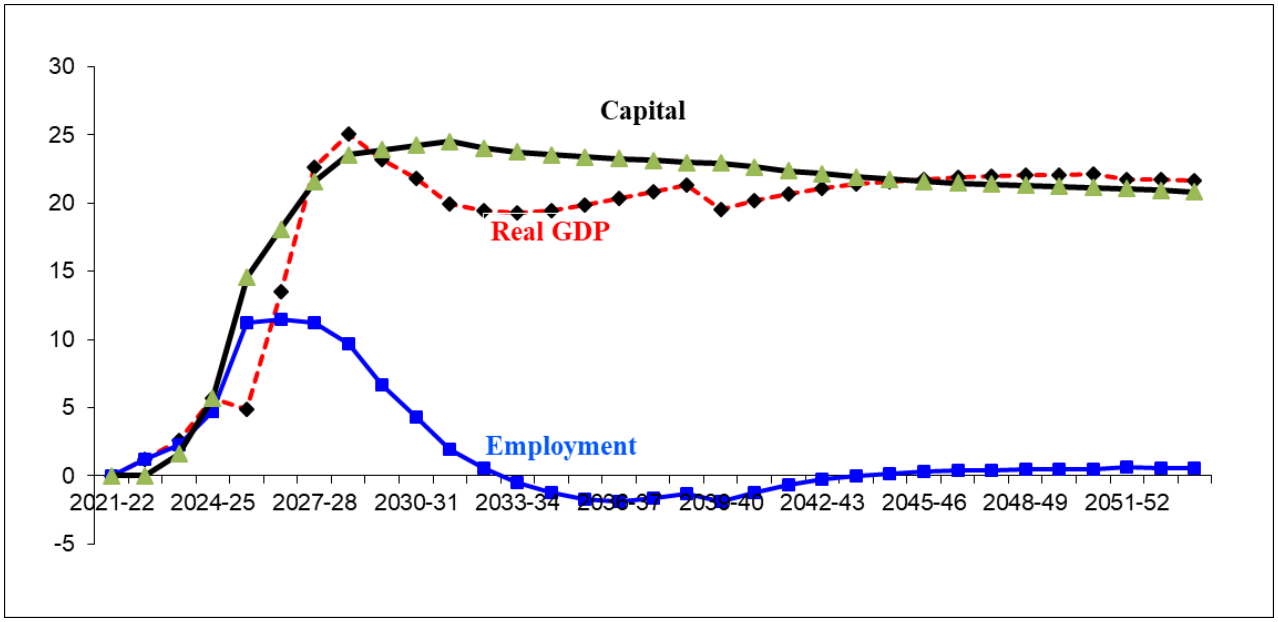
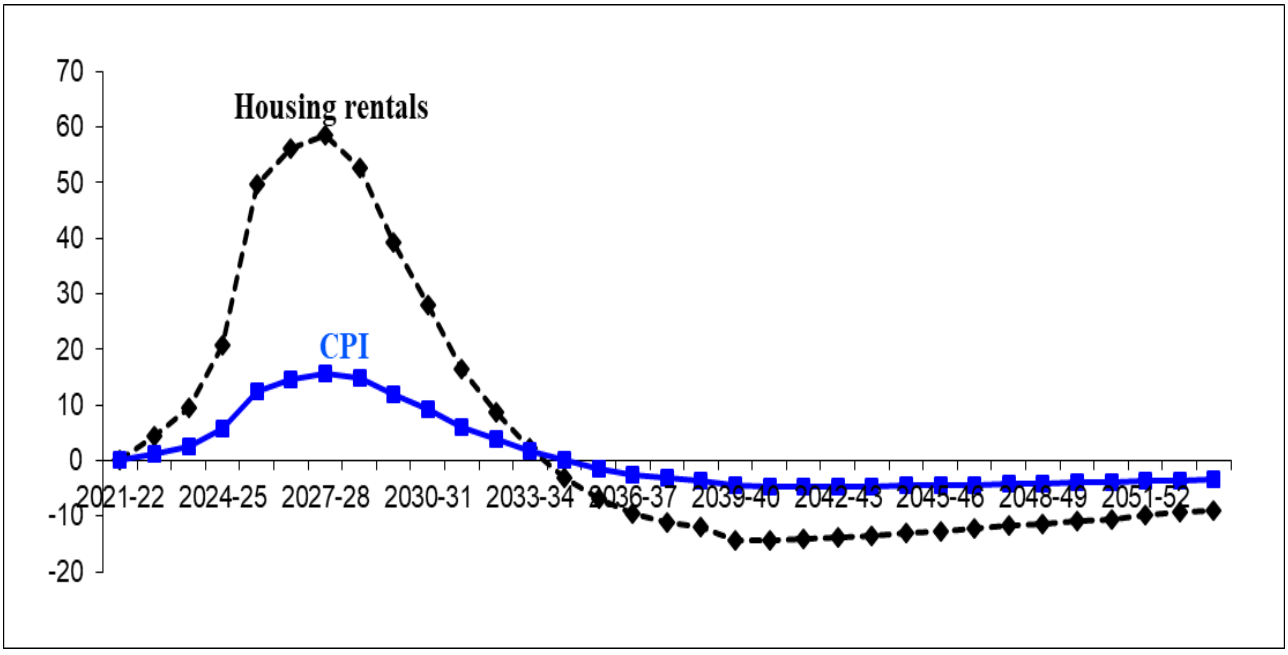


Figure 2.3.4: Cost of living impacts, Outback South-Central Highlands, 2nd scenario

(% deviation from base 2)



3. Welfare analysis in this study

There are two dimensions to demand for coal that are critical in determining whether the Galilee project will have positive welfare benefits, based on CGE modelling without any consideration of externalities. The first is well understood: global demand for coal into the future is vulnerable to a downturn driven by a transition from fossil fuels to renewables in the global energy mix. The justification for this project appears to be that demand for coal in some nations may grow for a number of years. Coal prices at present are at high levels, although for most of the decade up to April 2021, prices were well below US$100 per tonne (figure A1).[227] Given global efforts at greenhouse gas mitigation, there must be some doubts concerning demand conditions in the 2030s and beyond. Coal prices have been highly variable over the past decade or so. Given this, modelling in this report is undertaken using two different coal price baselines.

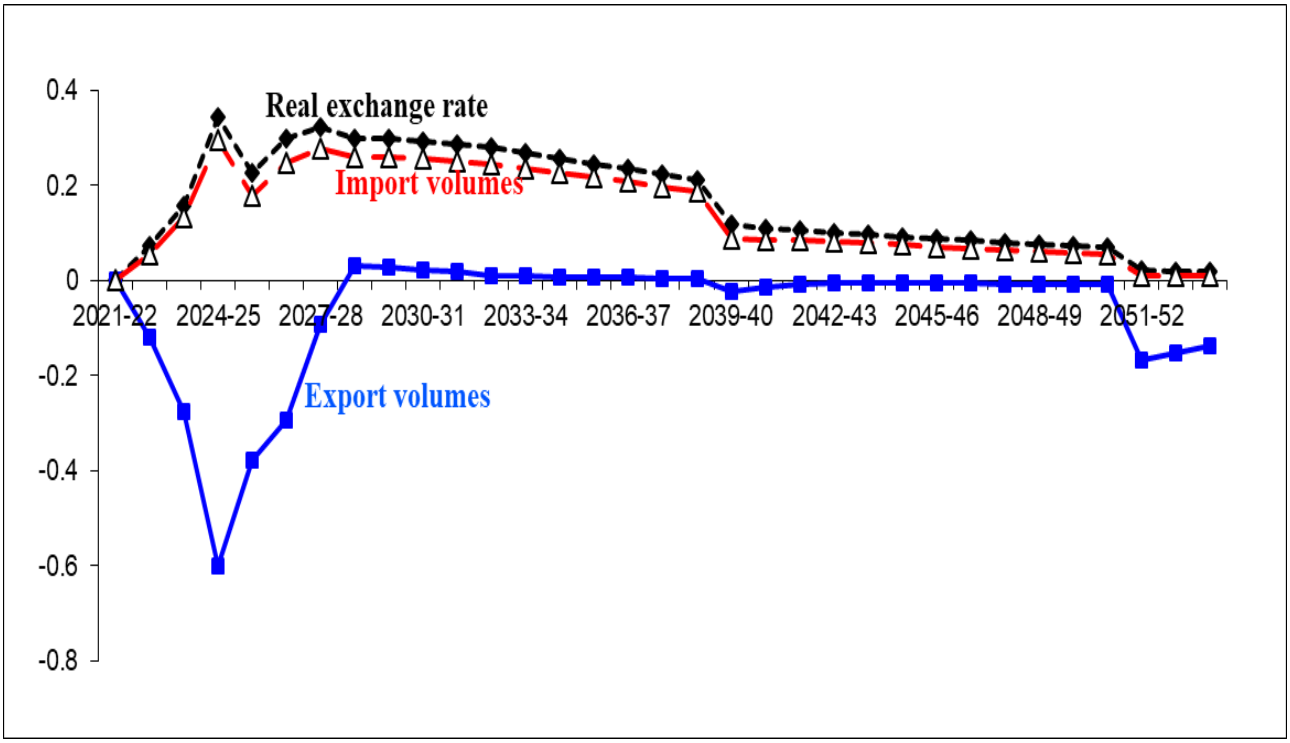
The less understood component of demand concerns the impact of a significant new development on prices. The default export demand elasticity for coal in VU-TERM is -4. This implies that each 4% increase in Australian export supply decreases the coal export price by 1%. If we use the default demand conditions of the model, terms-of-trade losses will erode welfare gains to some extent. In the base, coal exports total $63 billion. When Galilee is fully operational, default assumptions within the model push coal prices down by 1.7% relative to base. The negative contribution of this price fall to welfare prior to discounting is therefore around $1.1 billion (=$63bn x -2.7%) per annum. One argument might be that Galilee will displace coal from other Australian sources. If this so, then displacement will result in income losses from other mines. This would weaken the negative terms-of-trade impact, but at the same time income losses elsewhere would make a negative contribution to national welfare.

Another impact captured in CGE but not alternative partial frameworks concerns real exchange rate impacts. The investment and operation phases of the Galilee mines raise domestic demand for goods and services above base, thereby inducing a real appreciation of the Australian dollar. This is reflected in real wages rising above forecast both locally and at the national level. This reduces the competitiveness of Australian exports other than coal in global markets. Consequently, in

[227] See https://tradingeconomics.com/commodity/coal.

each scenario, the volume of Australian exports falls relative to base during the investment phase, due to cost squeezes arising from Galilee (figure 3.1). Thereafter, increased coal exports are virtually offset by decreased exports of other commodities. Real exchange rate impacts are captured in each of the modelled scenarios.

Figure 3.1: Real exchange rate and trade volumes
(% deviation from base, scenario 2: including rail costs and base 1 coal prices)



3.1 What the welfare estimates reported in this study exclude

Two further qualifications concern presentation of welfare estimates in this study. First, given how sensitive the welfare outcomes are to the future price of coal, any ostensible net benefits of the project must be weighed against the potential costs of environmental damage from further mining of coal.

Second, externalities are not included in CGE modelling. However, in presenting welfare numbers, we can add out-of-model externality welfare impacts to the within model welfare calculation if required.

3.2 Computation of national welfare impacts

The deviation in welfare (*dWELF*) at the national level is computed as:

$$dWELF = \sum_d \sum_t \frac{dCON(d,t)+dGOV(d,t)}{(1+r)^t} - \frac{dNFL(z)}{(1+r)^z} \quad (1)$$

where *dCON* and *dGOV* are the deviations in real household consumption and government spending in region *d* and year *t*; *dNFL* is the deviation in real net foreign liabilities in the final year (*z*) of the simulation; and *r* is the discount rate. The latter is set at 2.5%. The welfare calculation accounts for legacy debt.

In the first scenario, the net present value of the welfare gain is $10.46 billion, equivalent to an annuity of $260 million.

In the second scenario, the net present value of the welfare gain is $9.66 billion, equivalent to an annuity of $240 million.

In the third scenario, in which returns from the mining development suffer ongoing diminution from around 2030, the welfare gain is $2.23 billion, equivalent to an annuity of $56 million.

Table 3.1: Modelled welfare components in each scenario

	Base 1, no rail	Base 1 + rail	Base 2 + rail
Consumption	35166	36322	16461
Legacy debt	-24711	-26666	-14227
Total within model welfare	10455	9656	2234

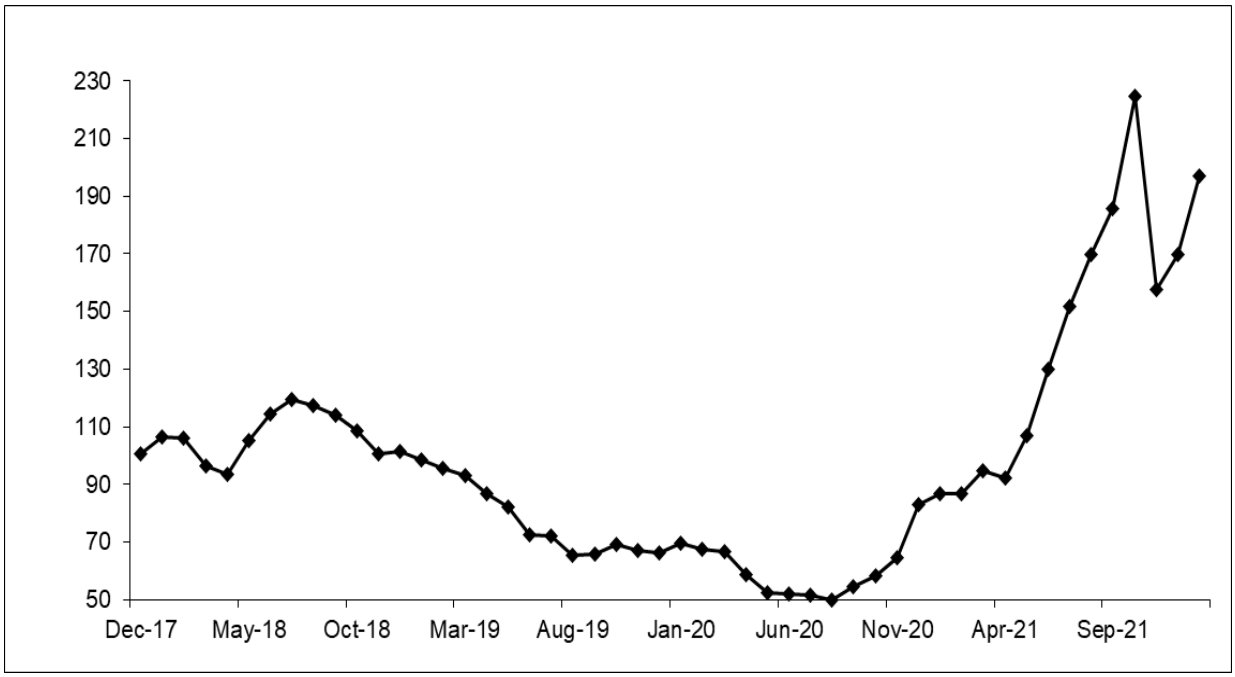
7.2 APPENDIX A: THE TWO BASELINES USED IN MODELLING THE MARGINAL IMPACTS OF THE PROJECT

The main source of the national data used in preparing the VU-TERM CGE database is the 2017-18 input-output tables produced by the ABS. These tables present data in values, without detailing volumes. Figure A1 shows a time series of Australian coal prices between December 2017 and January 2022. The monthly price has varied between US$50/tonne and US225/tonne in this time.

The underlying variation in coal prices in the past four years shows that no future coal prices can be forecast with reasonable certainty. Future coal prices are important in estimating the returns from a new coal mine.

Coal price may be driven by significant seasonal events, such as a cold winter in coal importing nations, plus other influences on supply and demand.

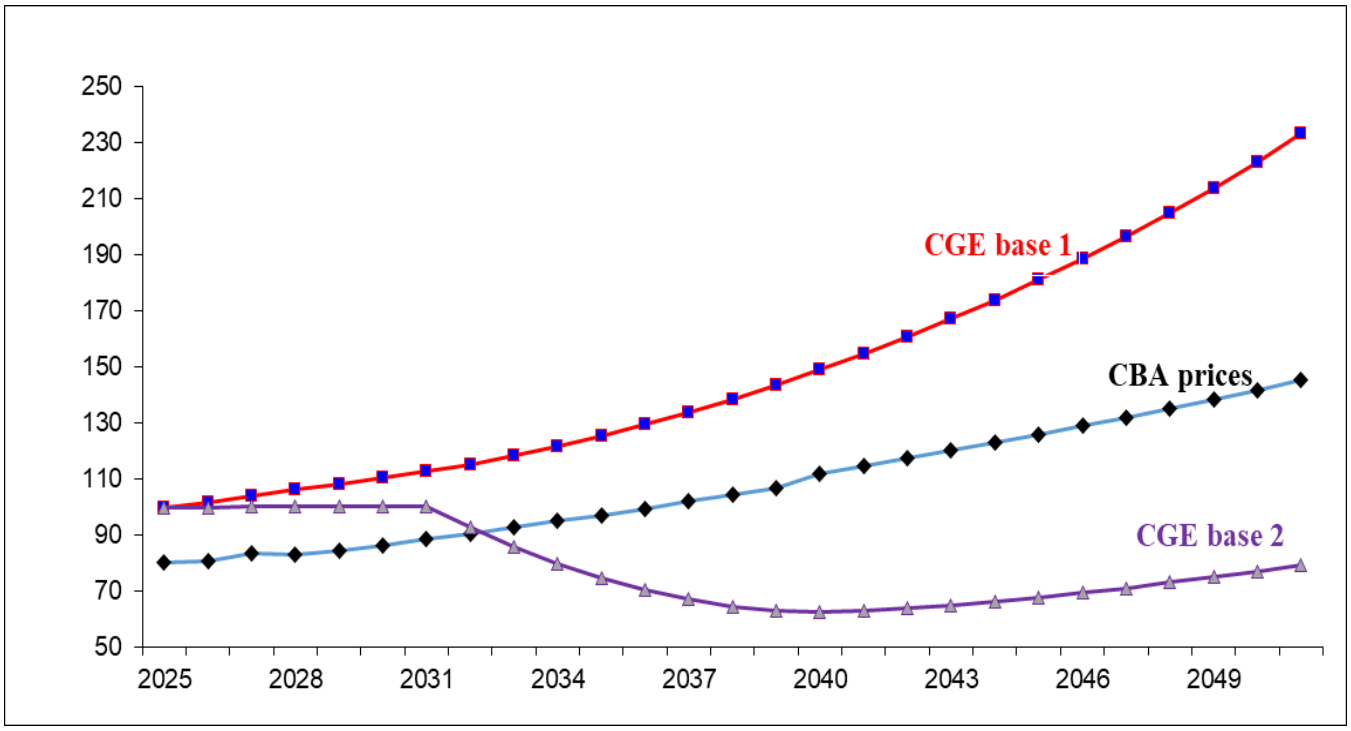
Figure A1: Coal price, December 2017 to January 2022
(US$/tonne)



Source: https://ycharts.com/indicators/australia_coal_price

Figure A2 shows baseline nominal price series assumed for the CGE scenarios (base 1 and base 2) and cost-benefit analysis. The figure shows that the CBA baseline lies between base 1 and base 2 beyond 2033. One of the key differences between CGE and CBA is that prices are endogenous in CGE. That is, an increase in supply relative to base of any commodity will drive down its price relative to base. In the case of export-oriented commodities including coal, demand is relatively elastic. In VU-TERM, the export demand elasticity of coal is -4, so that for each one percent increase in supply, the price of coal will fall by 0.25%.

Figure A2: Coal price
(US$/tonne, nominal)



The US/AUD exchange rate is assumed to be unchanged over time. If global demand for resources were to strengthen over time, the Australian dollar could appreciate. Conversely, a weakening of global demand may result in a depreciation. The impact on the coal sector would depend on whether it is driving changes in resources demand. If, for example, resources demand strengthens while demand for coal weakens, this could strengthen the Australian dollar and thereby worsen the returns to coal producers in Australia, relative to a constant exchange rate. Though it appears unlikely, if demand for coal were to strengthen relative to other resources, the Australian dollar could weaken, improving returns to coal producers relative to a constant exchange rate.

VU-TERM is a model of real activity: it does not include a financial module. Therefore, different nominal exchange rate scenarios cannot be modelled within VU-TERM. However, VU-TERM does model real exchange rate impacts. These are most evident in the construction phase of the project, as additional demands arising from the project induce a real appreciation.

Fixed and variable mine costs over lifetime of the project

The fixed costs of the mine concern the investment phase from 2022-23 to 2028-29. The net present value of these investment costs is $16.4 billion. Some costs, including mine and rail development, are sunk. These will not change if coal prices weaken substantially over time.

The expectation is that if real prices fall over time, variable inputs will decline. The low baseline price scenario has been adjusted to reflect lower variable costs from 2031-32 on.

7.3 APPENDIX B: BACKGROUND NOTES ON VU-TERM (THE ENORMOUS REGIONAL MODEL)

VU-TERM is a multi-regional CGE model of the Australian economy. The master database includes 216 industries in 334 SA3 level regions. This provides considerable sectoral detail at a small region level. In practice, sectors and regions of little direct in a particular project are aggregated in VU-TERM. We retain detail in sectors and regions of interest in a particular scenario.[228]

TERM models have been used for scenario analysis in Australia since the first application to the drought of 2002. Since then, TERM models have been applied to numerous studies in Australia and in other countries, including USA, Brazil, Indonesia and China.

7.4 WHAT IS A COMPUTABLE GENERAL EQUILIBRIUM (CGE) MODEL?

A CGE model can be an economy-wide model. In the context of the current proposed project, it is an economy-wide model that also includes small-region representation. Another sort of model is an input-output model. The difference is that an input-output (IO) solves either for quantities or for prices, but not both at once. A CGE model solves for both prices and quantities together.

7.5 DYNAMIC CGE MODELLING

Dynamic models trace the effects of ascribed direct impacts across time periods. The theoretical basis of dynamics is in linkages between investment and capital across time, and the balance of trade and net foreign liabilities. Investment and balance of trade outcomes are flows represented in a comparative static model. Capital and net foreign liabilities are stocks that require a dynamic model for representation.

State treasuries are unlikely to accept the results generated by input-output analysis. This is because such analysis assume that supplies are infinitely elastic, implying that there are no opportunity costs arising from resource use. In addition to including price mechanisms which impose a squeeze on resources when demand increases, dynamic CGE models also account for costs over time. For example, construction phase that generates jobs in the short time will add to net foreign liabilities and thereby impose a squeeze on spending in the future.

[228] See https://www.copsmodels.com/archivep.htm TPGW0172 for notes on database preparation and compilation.

7.6 REGIONAL DETAIL IN VU-TERM FOR THIS PROJECT

The present divides Queensland in to two regions, namely Outback South-Central Highlands and Rest of Queensland (figure B1).

474 **Figure B1: Regions of this study**

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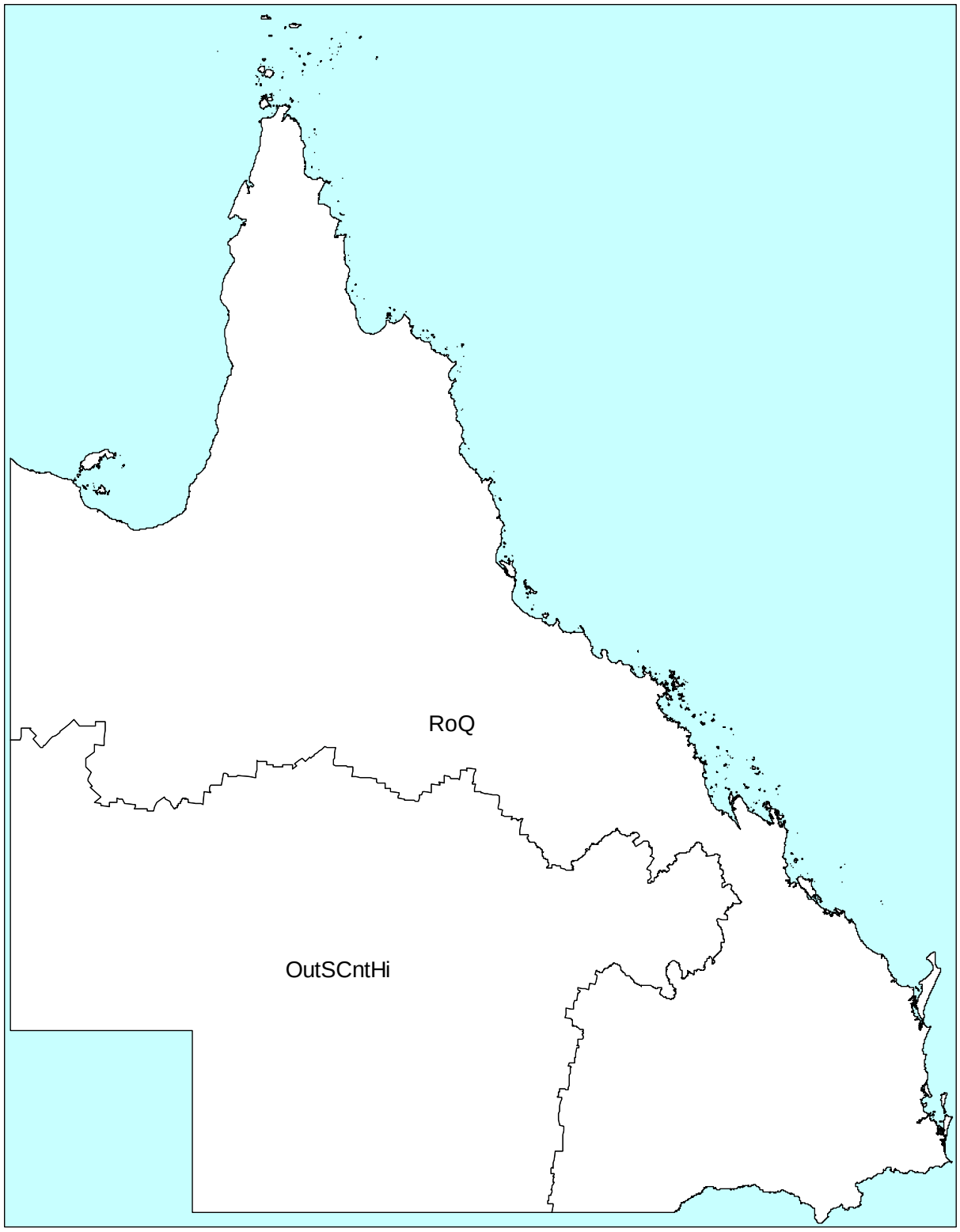

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Industries

VU-TERM contains 216 sectors, with detail beyond the published input-output table in various agricultural, mining, mineral processing, health, education and tourism sectors. This study aggregated to the following 24 sectors:

Agriculture, forestry & fishing; Black coal; Oil & gas; Other mining; Food products; Petroleum & coal products; Other manufactures; Coal-generated electricity; Other electricity generation; Electricity distribution; Other utilities; Construction; Trade; Hotels & cafes; Other transport; Rail freight; Other services; Communication; Finance & insurance; Ownership of dwellings; Public administration, defence & public order; Education; Health; Community care.

7.7 DYNAMIC TERM

Dynamic models allow us to depict the year-by-year impact of changes relative to base (i.e., underlying forecast) over time.

In dynamic TERM (VU-TERM), we use an underlying forecast. This may be based on the macro forecasts of other agencies. The underlying forecast or baseline gives us a year-by-year "business as usual" case. In the current project, coal export prices are one of the most critical of the underlying forecast variables.

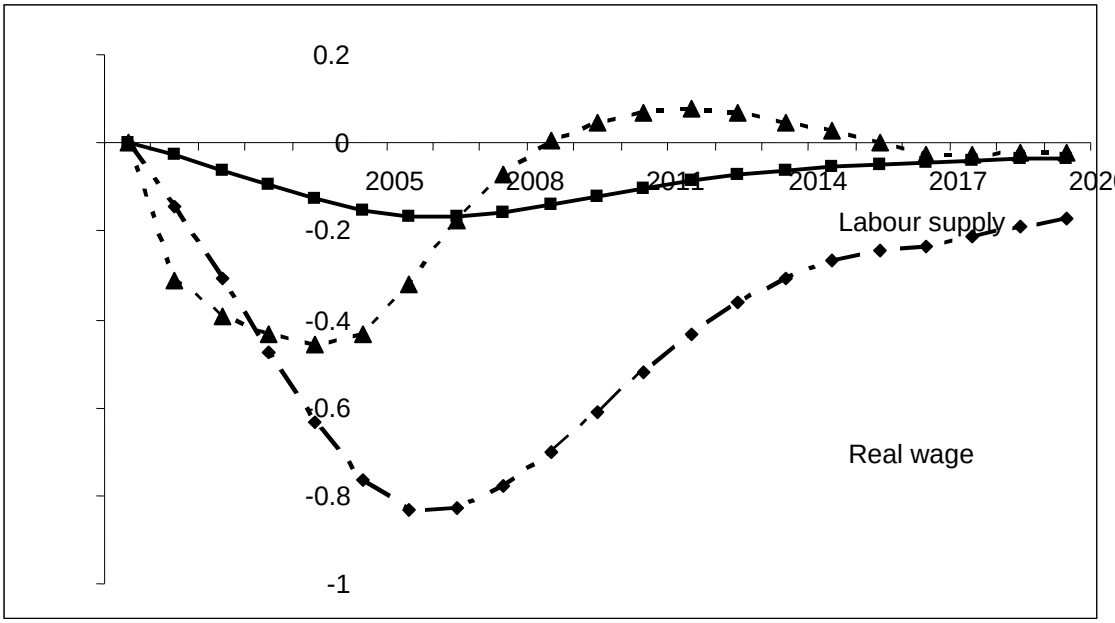
Typical variables to be reported in the policy scenario relative to a baseline forecast are regional real GDP, employment and aggregate consumption. Industry level results are also available. Report may also include statewide and national macro outcomes. Usually, reports also include a national welfare measure.

Labour market – forecast v. policy scenario

In the theory of regional labour market adjustment, if regional labour market conditions improve or deteriorate relative to forecast, adjustment occurs in the short term mainly via changes in employment. Regional wages adjust sluggishly, with gradual adjustment in regional labour market supply (i.e., through migration between regions). Real wages will fall or rise to close the gap between employment and slowly adjusting labour supply. Once the deviation in employment is equal to the deviation in labour supply, real wages reach a turning point (either they bottom out, in the case of a weakening labour market, or peak, in the case of strengthened labour market conditions). Within this theory, adjustment in the longer term occurs via a combination of altered regional labour supply and real wages that deviate relative to those in other regions. Figure 1

shows an example, in which weakened labour market conditions in a region lead to unemployment in the short run and a lower real wage in the region in the long run.

Figure B2: An example of a weakened regional labour market with eventual recovery (% change from forecast)



Production technologies

VU-TERM contains variables describing: primary-factor and intermediate-input-saving technical change in current production; input-saving technical change in capital creation; and input-saving technical change in the provision of margin services (e.g. transport and retail trade).

VU-TERM's unique treatment of transport to assess the regional benefits of the project

The supply of margins originating in one region can lower the costs of moving goods between regions further afield. Previous multi-regional models (for example, Naqvi and Peter, 1996) assign the margins supply of a sale either to the origin or destination of the sale.

Selected publications

Wittwer, G. and Waschik, R. (2021), "Estimating the economic impacts of the 2017–2019 drought and 2019–2020 bushfires on regional NSW and the rest of Australia", *Australian Journal of Agricultural and Resource Economics* 65(4):918-936, doi.org/10.1111/1467-8489.12441

Wittwer, G. and Anderson, K. (2021), "COVID-19 and Global Beverage Markets: Implications for Wine", *Journal of Wine Economics* 16(2): 117-130, https://doi.org/10.1017/jwe.2021.13

Wittwer, G and Banerjee, O. (2015), "Investing in irrigation development in North West Queensland, Australia", *Australian Journal of Agricultural and Resource Economics,* 59(2):189-207**.**

Wittwer, G. and Dixon, J. (2013), "Effective use of public funding in the Murray-Darling Basin: a comparison of buybacks and infrastructure upgrades**",** *Australian Journal of Agricultural and Resource Economics* 57(3):399-421**.**

Wittwer, G. and Griffith, M. (2011), "Modelling drought and recovery in the southern Murray-Darling basin", *Australian Journal of Agricultural and Resource Economics*, 55(3): 342-359, October.

Dixon, P., Rimmer, M. and Wittwer, G. (2011), *"*Saving the Southern Murray-Darling Basin: the Economic Effects of a Buyback of Irrigation Water", *Economic Record,* 87(276): 153-168.

Horridge, M, Madden, J. and Wittwer, G. (2005), "Using a highly disaggregated multi-regional single-country model to analyse the impacts of the 2002-03 drought on Australia", *Journal of Policy Modelling* 27(3):285-308, April.

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