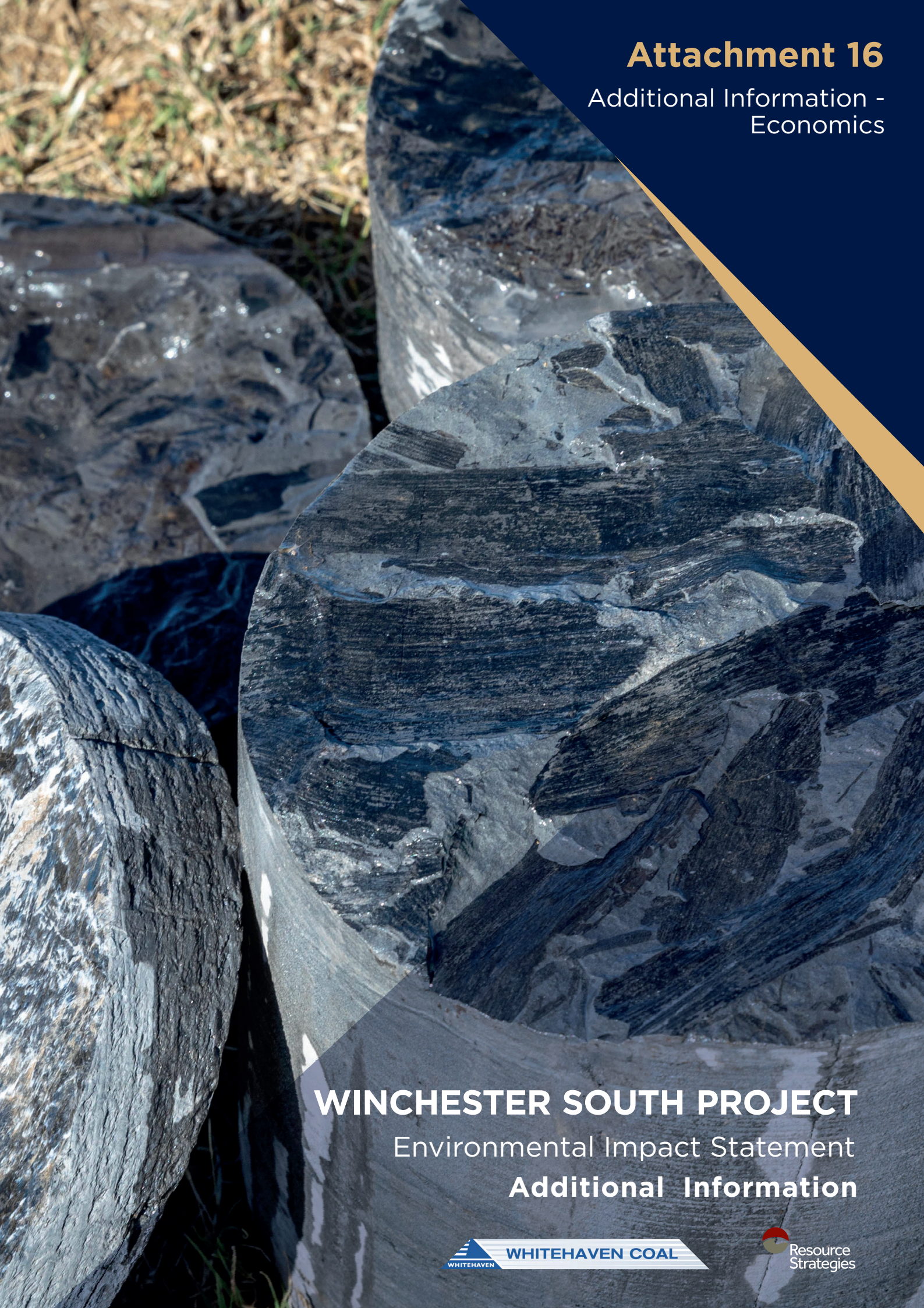

Attachment 16

Additional Information - Economics

WINCHESTER SOUTH PROJECT

Environmental Impact Statement

Additional Information

WHITEHAVEN COAL

Resource Strategies

Deloitte.

Winchester South Project - Economic Assessment

Whitehaven WS Pty Ltd

July 2022

Deloitte Access Economics

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Abbreviations

Acronym	Full name
ABS	Australian Bureau of Statistics
ADAWE	Australian Department of Agriculture, Water and the Environment
CBA	cost benefit analysis
CGE	Computable General Equilibrium
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant
CO	carbon monoxide
CO_2	carbon dioxide
$Co_{2\text{-}e}$	carbon dioxide equivalent
DAE-RGEM	Deloitte Access Economics Regional General Equilibrium Model
DSD	Department of State Development
EIS	Environmental Impact Statement
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GRP	Gross Regional Product
GSP	Gross State Product
GST	goods and services tax
GVA	Gross Value Added
IO	Input-Output
km	kilometres
LGA	Local Government Area
MIA	mine infrastructure area
MLA	mining lease application
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
Mt	million tonnes
Mtpa	million tonnes per annum
NPV	Net Present Value
NO_x	oxides of nitrogen
NSW	New South Wales
NSW Guideline	NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals*
PCI	pulverised coal for injection
$PM_{2.5}$	fine particles smaller than 2.5 micrometres
PM_{10}	coarse particles smaller than 10 micrometres
QLD	Queensland
RIA	Regional Impact Analysis

ROM	run-of-mine
SA3	Statistical Area Level 3
SIMP	Social Impact Management Plan
SO_2	sulphur dioxide
the Guideline	Department of State Development (2017) *Economic Impact Assessment Guideline*
the Project	Winchester South Project
TSP	total suspended particulate matter
ToR	Department of State Development, Manufacturing, Infrastructure and Planning (2019) *Terms of reference for an environmental impact statement – Winchester South Project*
US EPA	US Environmental Protection Agency
Whitehaven	Whitehaven Coal Limited
Whitehaven WS	Whitehaven WS Pty Ltd

Definitions

Term	Definition
Local area	For the regional impact analysis, the Local area is defined as the Isaac Local Government Area. The Local area includes the towns of Moranbah, Dysart and Coppabella, which are defined as the local study area for the purpose of assessing social impacts for the Winchester South Project.
Local Government Area	Local Government Areas are boundaries defined by the Australian Bureau of Statistics as part of the Australian Statistical Geography Standard. Local Government Areas are constructed to represent administrative divisions that a local governing body is responsible for.
Net Present Value	The Net Present Value, or NPV, is the difference between cash inflows and outflows in present terms. The conversion to present terms is done by applying a discount rate to future cash flows, a rate which recognises that money in the present is worth more than the same amount in the future due to inflation and to earnings from alternative investments.
Net producer surplus	The net producer surplus of a project is the economic rent attributable to owners of the project (i.e., the shareholders). This is equivalent to the owner's share of the producer gain, as a return for their investment, excluding all opportunity costs of inputs and the economic benefits to all other parties. The net producer surplus is equal to revenue less costs, taxes, and royalties.
Region	For the regional impact analysis, the Region the Winchester South Project is located in is defined as the Isaac and Mackay Local Government Areas.

Executive summary

Deloitte Access Economics has been commissioned by Whitehaven WS Pty Ltd (Whitehaven WS) to undertake an updated economic impact assessment of the Winchester South Project (referred to as the Project Case, or the Project) to reflect the optimised mine plan and mine schedule, and current market conditions. This report provides an update to the Economic Assessment included in the Draft Environmental Impact Statement (the Draft EIS) that the Office of the Coordinator-General placed on public notification from 4 August 2021 until 15 September 2021.

This report is prepared for Whitehaven WS solely for its use pursuant to our contract. The economic assessment comprises a cost benefit analysis (CBA) and a Regional Impact Analysis (RIA) based on the Department of State Development's (2017) *Economic Impact Assessment Guideline* (the Guideline) and the Queensland Treasury's (2015) *Project Assessment Framework – Cost-benefit analysis*. The CBA and RIA are different and complementary approaches whose results are not directly comparable. This assessment has been prepared for use by Whitehaven WS to provide an assessment of the optimised mine plan and mine schedule, current market conditions, and responses to issues raised in submissions, as well as satisfying the requirements of the *Terms of reference for an Environmental Impact Statement – Winchester South Project* issued by the Coordinator-General- on 4 September 2019.

The Region is defined as the Isaac and Mackay Local Government Areas (LGAs), which includes the Local area (the Isaac LGA).

Key findings

- The Project is estimated to increase Gross Regional Product (GRP) in the Region by $7.8 billion and increase Gross State Product (GSP) in Queensland (QLD) by $11.0 billion, both in net present value (NPV) terms.
- Incremental employment, including direct Project employment and flow-on employment effects (including any crowding out that might occur in other sectors), is estimated to average 858 full time equivalents (FTE) a year and peak at approximately 2,200 FTE in the Region in FY27.
- An assessment of costs and benefits indicates that the Project is expected to generate a net benefit of $882 million to QLD over its life, assuming a 7% discount rate.
- The Project is estimated to employ up to 500 personnel at the mine site (measured in FTE) incremental to the Base Case during the construction phase and ongoing operations, with the majority of workers employed from within QLD.
- In all sensitivity analyses, the incremental net benefits of the Project to QLD exceed the costs.
- Economic benefits to suppliers in QLD are predicted to be $5.7 billion as a result of additional producer surplus (excluding wages) accrued in the Project Case.

About the Project

The Project involves the development of a predominantly metallurgical open cut coal mine and associated infrastructure within the Bowen Basin, located approximately 30 kilometres south east of Moranbah, within the Isaac Regional Council LGA.

The Project would include construction and operation of a mine infrastructure area, including a Coal Handling and Preparation Plant, train load-out facility and rail spur, which would be used for the handling, processing and transport of coal. An infrastructure corridor would also form part of the Project, including a raw water supply pipeline connecting to the Eungella pipeline network, an electricity transmission line and a mine access road.

It is estimated that the Project would extract 15 million tonnes per annum (Mtpa) of run-of-mine coal (and up to 17 Mtpa) for approximately 28 years. The coal resource would be mined by open cut mining methods, with product coal to be transported by rail to port for export. Products would include metallurgical coal for the steel industry and thermal coal for energy production.

Net benefit to Queensland

The CBA estimates the direct and indirect impacts of the Project on the QLD community. The CBA compares the Project Case to a Base Case in order to estimate the net economic value of the incremental costs and benefits of the Project relative to the Base Case. The Base Case assumes that the Project area would be used predominately for cattle grazing (beef production). These costs and benefits are estimated using information provided by Whitehaven WS and the findings of the other technical assessments within the Draft EIS and Additional Information.

The items considered in the CBA are listed in Table i. These items have been developed in compliance with the Guideline which attributes costs and benefits of the Project to the economy of interest, the QLD community. From these components, the share of the net benefits that accrue to the QLD community are then aggregated.

Table i: Benefit and cost items for the CBA

Item	Benefit components	Cost components
Net producer surplus	Gross mining revenue Residual value of capital Residual value of land	Operating costs Capital costs (includes initial capital costs and sustaining capital costs) Rehabilitation and decommissioning costs Taxes (Federal, State & local) Royalties
Royalties	Royalties payable to QLD Government	
Company income tax	Company income tax payable to the Australian Government	
Local government rates	Council rates payable to QLD local governments	
Economic benefit to workers	Wages paid to workers	Reservation wage for workers in the mining sector
Economic benefit to suppliers	Revenue paid to suppliers	Cost of supplying goods and services
Externalities		Agriculture Aboriginal cultural heritage Air quality Ambient noise and blasting Biodiversity Greenhouse gas emissions Non-Aboriginal cultural heritage Surface water and groundwater Social Traffic and transport Visual amenity

Assessment of these costs and benefits indicates that the Project is expected to generate net benefits of approximately $882 million in NPV terms to QLD over its life, assuming a 7% real discount rate. This net benefit reflects:

- net producer surplus attributable to QLD of $134 million
- royalties payable to the QLD Government of $696 million
- company income tax attributable to QLD of $167 million
- environmental costs attributable to QLD, as a result of greenhouse gas emissions, valued at around $116 million.

An indicative estimate of the economic benefits to suppliers and workers is $5.7 billion and $254 million in present value terms respectively. For the purposes of the CBA, it is assumed that local suppliers would earn similar margins relative to what they receive under the Base Case such that there are no additional benefits to suppliers in QLD. This is a conservative estimate given that suppliers might otherwise be affected by a decline in mining activity in the region. Similarly, it is also conservatively assumed that, on average, workers employed by the Project would not receive a wage premium. This assumes that workers would receive a net wage consistent with market rates.

The Project is expected to generate environmental and social effects (both positive and negative), referred to as externalities. These externalities relate to a range of aspects such as agriculture, Aboriginal cultural heritage, air quality (including greenhouse gas emissions), noise, biodiversity, non-Aboriginal cultural heritage, water resources, social, transport, and visual amenity. With the exception of greenhouse gas emissions, after implementation of mitigation and management measures (included in the capital investment and operating costs), the residual effects associated with the externalities are expected to be immaterial and therefore have not been quantified and monetised for inclusion in the CBA.

The CBA results rely on a number of assumptions and valuations. Consequently, the sensitivity of the results to a number of parameters was analysed, as required by the Guideline, including variation in the discount rate, export coal price forecasts, cost of construction and operational input costs. In all modelled scenarios, the incremental net benefits of the Project to QLD exceed the costs. For example, in considering the potential for significantly lower coal prices over the operating period (that is, a sustained decrease in export coal price forecasts by 25% and 50%) the net economic benefit of the Project to QLD is estimated at $516 million and $195 million, respectively (Table ii).

Table ii: Overall CBA results for the QLD community

Item		Central case (NPV)	Decrease in export coal price (25%, NPV)	Decrease in export coal price (50%, NPV)
Incremental benefits to QLD	$m	$997	$944	$936
Incremental costs to QLD	$m	$116	$116	$116
Overall net benefit of the Project for the QLD community	$m	$882	$828	$820

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Economic impacts on the Local area, Region and State

Table iii: Summary of economic impacts

		Project Case
Gross Value Added ($m NPV FY22)		
Region	$m	$7,786
Rest of QLD	$m	$3,191
Total QLD	$m	**$10,977**
Employment (average FTE)		
Region	FTE	858
Rest of QLD	FTE	892
Total QLD	FTE	**1,750**

Note: Total QLD is the sum of Region and Rest of QLD. Numbers in the table may not add up due to rounding.
Source: Deloitte Access Economics calculations.

Computable general equilibrium (CGE) modelling is used to estimate the flow-on impacts resulting from the Project. The CGE model represents the dynamic relationship between economic agents and illustrates how changes in one part of the economy (such as the increase in production of coal) have flow-on impacts for other parts (such as effects on employment, income and exports). More specifically, the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM) was used to estimate the impacts.

The Project is estimated to increase GRP in the Region and GSP in QLD by approximately $7.8 billion and $11.0 billion respectively, both expressed in NPV terms. Incremental employment, including direct Project employment and flow-on employment effects (such as the crowding out that might occur in other economic sectors) is estimated to average 858 FTE a year and peak at 2,260 FTE in FY27 in the Region (Table iii).

Economic impacts to the Local economy are below the level of detail available in the CGE modelling, however, based on the percentage of the working population from the Local area in the Region, Gross Value Added in the Local area is predicted to increase in the order of $2.3 billion in NPV terms. Similarly, employment in the Local area is expected to increase by approximately 261 FTE on average, based on the same approach.

There are significant spill-over effects expected to be generated from the Project, totalling to approximately $9.8 billion in NPV terms. The construction and services sectors are expected to derive the largest benefits, as the Project draws in labour from these sectors for the construction and operations phases respectively. However, there are also crowding out effects likely to arise, both direct and indirect, totalling an estimated $4.8 billion in NPV terms. Other mining and agricultural sectors are expected to be most affected by the Project due to increased demand for labour and capital. However, the Project is expected to result in a net benefit to other industries overall, due to the significant spill-over effects predicted.

1 Introduction

1.1 Background

Whitehaven WS Pty Ltd (Whitehaven WS), a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven), proposes to develop the Winchester South Project (the Project), a predominantly metallurgical open cut coal mine and associated infrastructure within the Bowen Basin, located approximately 30 kilometres (km) south east of Moranbah, within the Isaac Regional Council Local Government Area (LGA) (see Figure 1.1).

The Project involves the development of an open cut coal mine in an existing mining precinct for export of coal products. The Project would include construction and operation of a mine infrastructure area (MIA), including a Coal Handling and Preparation Plant (CHPP), train load-out facility and rail spur, which would be used for the handling, processing and transport of coal. An infrastructure corridor would also form part of the Project, including a raw water supply pipeline connecting to the Eungella pipeline network, an electricity transmission line and a mine access road (see Figure 1.2).

It is estimated that the Project would extract 15 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal (and up to 17 Mtpa) for approximately 28 years. The coal resource would be mined by open cut mining methods, with product coal to be transported by rail to port for export. Products would include metallurgical coal for the steel industry and thermal coal for energy production.

In 2021 Whitehaven WS submitted the *Winchester South Project Environmental Impact Statement* (the Draft EIS) for assessment under the *State Development and Public Works Organisation Act 1971* (SDPWO Act). The Draft EIS was placed on public notification by the Office of the Coordinator-General (OCG) from 4 August 2021 until 15 September 2021. During and following this period, government advisory agencies, organisations and members of the public provided submissions on the Draft EIS to the OCG.

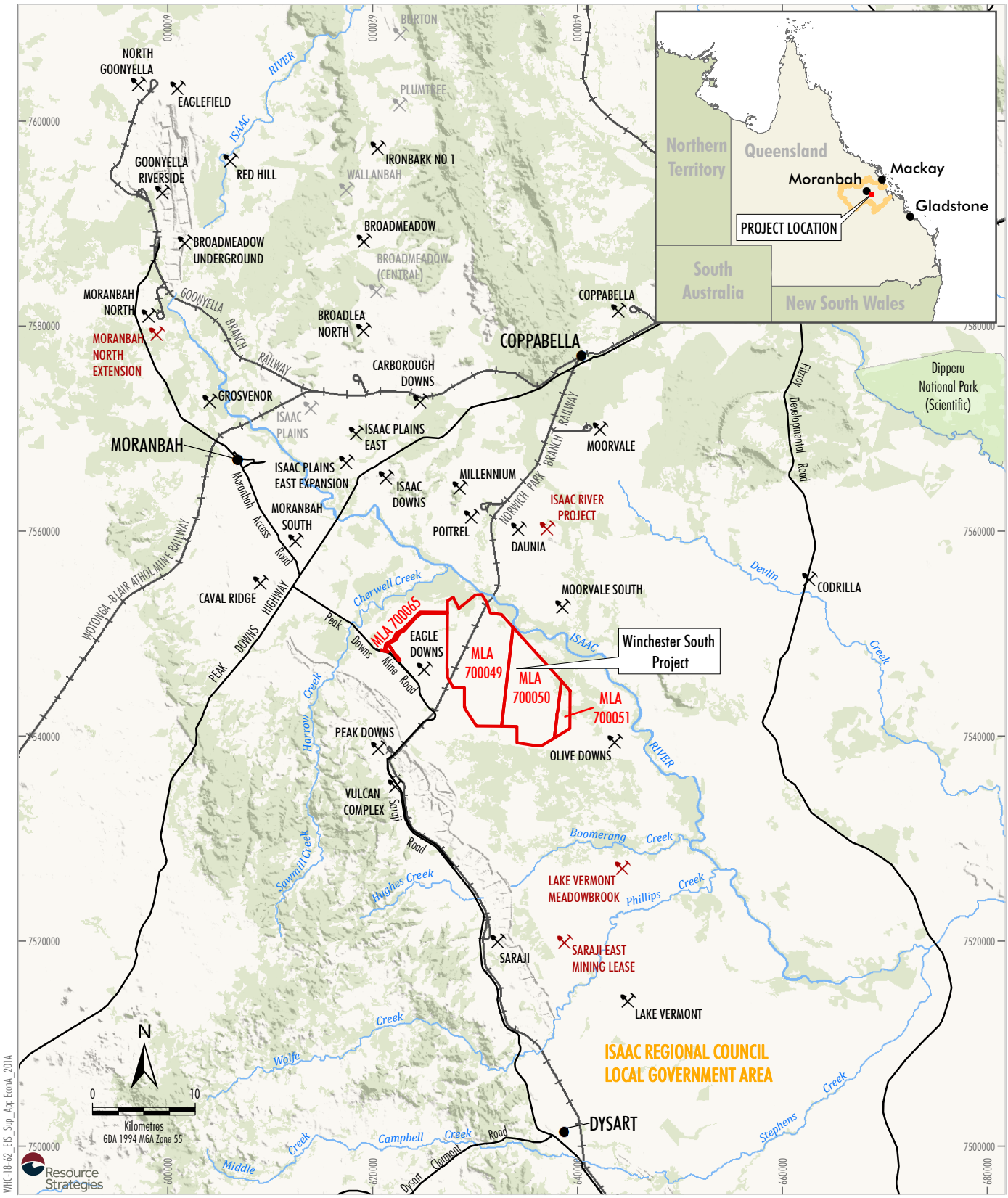
Subsequent to the public notification of the Draft EIS, Whitehaven WS reviewed the mine plan and mine schedule with the aim of reducing environmental impacts of the Project and challenging the Project final landform in response to comments raised in submissions. This review also considered new geological data, coal quality data and the outcomes of processing trials to further refine the mine plan.

On 3 December 2021, the Coordinator-General formally requested (in accordance with section 34A of the SDPWO Act) Additional Information on the environmental effects of the Project and other matters relating to the Project (referred to as Additional Information).

Deloitte Access Economics has been commissioned by Whitehaven WS to undertake an updated economic impact assessment of the optimised mine plan and mine schedule, current market conditions, and responses to issues raised in submissions, as well as satisfying the requirements of the *Terms of reference for an Environmental Impact Statement – Winchester South Project* (ToR) issued by the Coordinator-General on 4 September 2019.

Based on the Department of State Development (DSD) (2017) *Economic Impact Assessment Guideline* (the Guideline) and the Queensland Treasury (2015) *Project Assessment Framework – Cost-benefit analysis,* this report undertakes an assessment of the net economic benefits of the Project to the Queensland (QLD) community, using both Regional Impact Analysis (RIA) and cost benefit analysis (CBA).

The report examines the economic costs and benefits of the Project, relative to a baseline or 'business-as-usual' scenario where agricultural (cattle grazing for beef production) activities would occur in place of mining. The CBA is accompanied by the RIA to assess the likely effects of the Project on the local, regional and State economies.



LEGEND
- Mining Lease Application Boundary
- Approved/Operating
- Proposed
- Care and Maintenance
- Local Government Area Boundary
- Railway
- Road

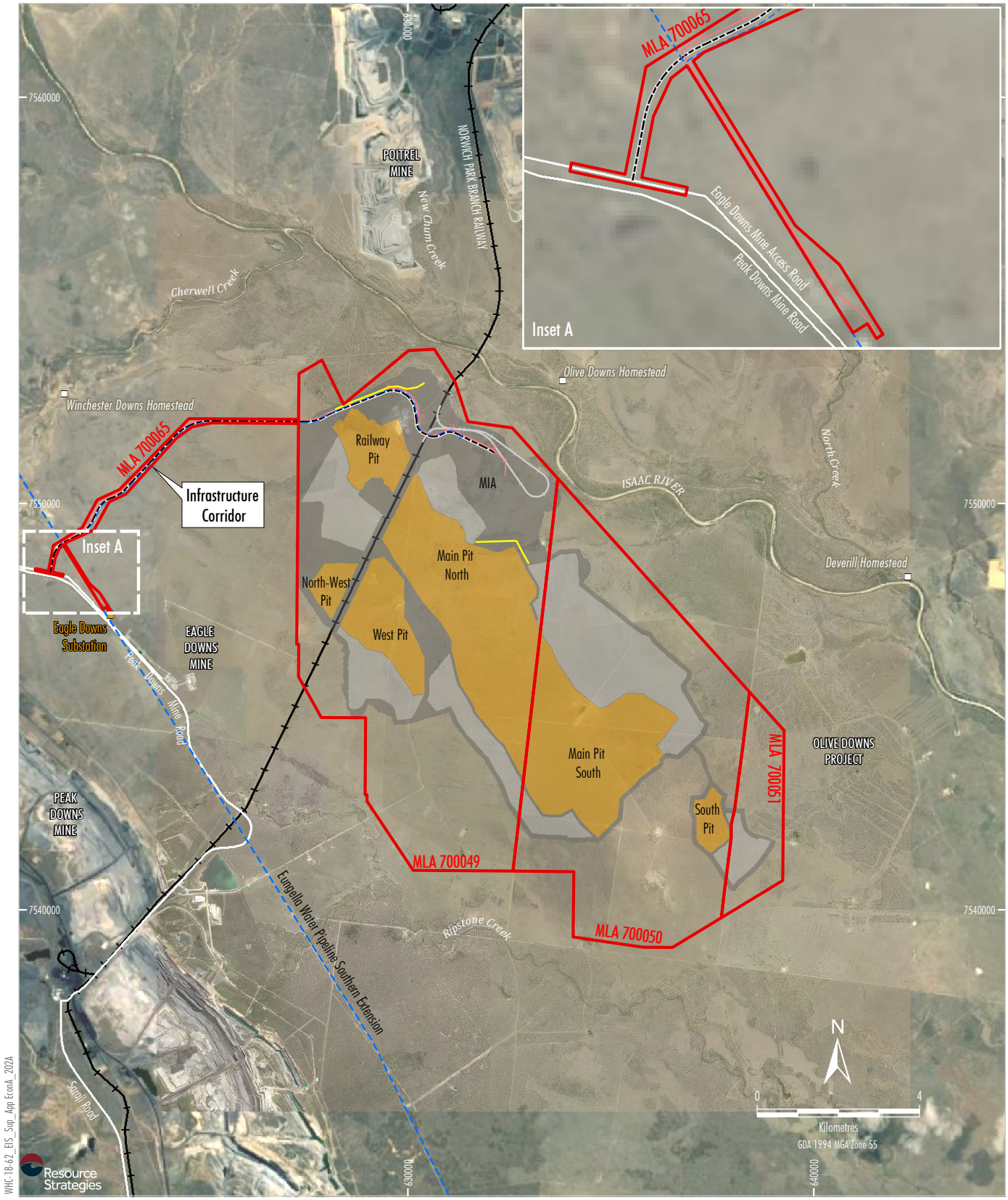
Source: The State of Queensland (2018 - 2020); Geoscience Australia (2018).

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Regional map of the proposed site for the project

Figure 1.1



LEGEND

- Mining Lease Application Boundary
- Eungella Water Pipeline Southern Extension
- Railway
- Substation

Project Component*

- Indicative Infrastructure Area
- Indicative Out-of-pit Waste Rock Emplacement
- Indicative Open Cut Pit Including In-pit Waste Rock Emplacement
- Indicative Mine Access Road
- Indicative Rail Spur and Loop
- Indicative Electricity Transmission Line
- Indicative Raw Water Supply Pipeline
- Indicative Flood Levee

*Note: * Excludes some project components such as water management infrastructure, access tracks, topsoil stockpiles, explosives magazines, power reticulation, temporary offices, other ancillary works and construction disturbance.*

Source: The State of Queensland (2018 - 2020); Whitehaven (2020)
Orthophoto: Google Image (2019); Whitehaven (2017)

WHITEHAVEN COAL

WINCHESTER SOUTH PROJECT

Project general arrangement

Figure 1.2

A Computable General Equilibrium (CGE) model is also used to explore how the Project affects the regional and State economies, as measured by changes in economic indicators such as economic activity, housing and labour. While the effects of the Project on the local economy are not computed, an indicative estimate is provided based on the share of the Local area (Isaac LGA) relative to the Region (Isaac and Mackay LGAs). The CGE analysis can be used as an extension to the CBA, noting that the CGE results may not be directly comparable, or additional, to the CBA results or other projections outlined in the EIS. This is because CGE takes a more focused view at considering the costs and benefits of the Project based on how it changes the size of the economy and the flow-on effects from such changes, while the CBA takes a much broader view by assessing all costs and benefits related to the Project.

1.2 Report structure

The chapters of this report are structured in accordance with the Guideline.

The structure of this report is as follows:

- **Chapter 2** outlines the methodology employed in this report including how the approach used aligns with the relevant guidelines.
- **Chapter 3** outlines the details of the Base Case, defines the Project Case and the expected scenario under the Project Case.
- **Chapter 4** presents the results of the CBA, identifying the net benefits of the Project Case for the QLD community.
- **Chapter 5** presents the results of the RIA, including the economic impacts to the local, regional and State economics as estimated using CGE modelling.
- **Appendix A** provides a checklist illustrating how this report has met the requirements of the relevant guidelines.
- **Appendix B** presents an overview of the CGE model.
- **Appendix C** presents the results of the Project under a non-automated scenario, and discusses the key differences with the Project Case.
- **Appendix D** outlines the assumptions underlying analysis for backfilling.
- **Appendix E** provides an overview of additional considerations from submissions received for on the economic assessment as part of the Draft EIS that was publicly notified in 2021.
- **Appendix F** provides a comparison of the key Economic Assessment outcomes compared to the Draft EIS.

2 Methodology

Deloitte Access Economics has adopted a methodology for undertaking the CBA and RIA for the Project, that addresses the ToR and aligns to relevant guidelines. This chapter reviews the ToR and relevant guidelines and discusses how these have been applied to develop the methodology adopted for this Project.

2.1 Terms of Reference

The ToR are requirements for the EIS, required for the Project in accordance with the Coordinator-General's declaration on 17 April 2019. The Coordinator-General declared the Project to be a 'coordinated project' for which an EIS is required under section 26(1)(a) of Part 4 of the *State Development and Public Works Organisation Act 1971*. The ToR was issued by the Coordinator-General in September 2019. Specifically, the ToR includes the need for an assessment of the economic costs and benefits of the Project using both CBA and RIA, consistent with the Guideline.

While the remainder of the requirements in the ToR cover topics beyond the scope of an economic impact assessment, there are particular areas which are potentially relevant to the methodology adopted, including impacts on land, biodiversity, water resources, air quality, greenhouse gases, noise, transport, social and cultural heritage. These are considered as part of the analysis in Section 4.

2.2 Relevant guidelines

The following guidelines have been used in preparing this report:

- the Guideline (DSD [2017] *Economic Impact Assessment Guideline*)
- Queensland Treasury (2015) *Project Assessment Framework – Cost-benefit analysis*
- Queensland Government – State Development, Infrastructure, Local Government and Planning (2021) *Cost Benefit Analysis Guide: Business Case Development Framework*.

The Guideline provides a specific framework for CBA and RIA prepared as part of an economic impact analysis for large resource projects declared as coordinated projects. The Queensland Treasury and Government guidelines provide a high-level framework specific for the development of a CBA that meets QLD Government standards. These guidelines state the processes and types of information and analysis required by the QLD Government to inform its assessment process.

A full account of the requirements of the ToR and these guidelines is given in Appendix A and the relevant requirements are cross-referenced against sections of the report or the Main Text of the Additional Information.

While not directly binding on this assessment, we have also had regard to other guidelines produced by the Commonwealth Government and the New South Wales (NSW) Government. These guidelines are used as they provide additional information and guidance on specific topics (such as appropriate discount rates and standard practice for valuing particular environmental externalities). In particular, the guidelines referred to are:

- Australian Department of the Prime Minister and Cabinet (2020*) Cost-benefit analysis guidance note*
- NSW Government (2015) *Guidelines for the economic assessment of mining and coal seam gas proposals* (NSW Guideline).

2.3 Implication of these guidelines

These guidelines set out the key requirements for this economic impact assessment. While Appendix A contains an item by item reconciliation of how these guidelines have been addressed or considered, it is first worth considering their implications qualitatively.

Overall, the guidelines require that the economic impact assessment be carried out using a set of standard approaches and with consideration of certain topics. The guidelines specify two components for the economic impact assessment as part of an EIS: a CBA to assess the public interest by estimating and comparing the net present value (NPV) of the Project to the QLD community, and an RIA to assess the likely impacts of the Project to the local, regional and State economies.

Cost Benefit Analysis

Following the guidelines for CBA, the analysis involves:

- Establishing a status quo (Base Case) against which to assess the economic and other impacts of changes due to the Project.
- Defining the scope of the Project.
- Quantifying changes resulting from the Project relative to the Base Case with respect to both benefits and costs, including:
  - Economic resource cost such as capital expenditure and operating costs.
  - Potential economic benefits such as royalties and company income tax from coal output.
  - Economic benefit such as income to workers and suppliers.
  - Externalities including environmental and social impacts.
- Estimating the monetary value of these changes, where feasible and material, using market prices where available, otherwise using imputed prices or a qualitative assessment.
- Consolidation of values by applying an appropriate discount rate to estimate the NPV of the Project's future net benefits.
- Undertaking a sensitivity analysis on the key variables in considering uncertainties related to specific benefits and costs.
- Assessing the distribution of benefits and costs across different groups and geographic areas.
- Reporting of results, including unquantified impacts, so as to include all materials that may be relevant to the decision maker.

The CBA has been prepared with respect to the net benefits attributable to QLD community, which is the community of interest specified in the DSD (2017) and Queensland Treasury (2015) guidelines. This means that the benefits and costs estimated in the CBA are those that accrue to the QLD community only.

Regional Impact Analysis

The assessment of the consequences of the Project on the local, regional and State economies, in accordance with the Guideline is presented in Chapter 5.

Following the relevant guidelines for RIA, our analysis involves:

- Defining the spatial area and population groups to be included and analysed.
- Quantitatively and qualitatively analysing the economic effects of the Project on these regions.
- An analysis of flow-on effects, including indirect impacts resulting from the Project due to adjustments in the economy such as price movements or changes in labour demand and supply.

The RIA draws on material presented in the CBA – for example, the CBA already identified resource costs such as capital investment costs and benefits such as revenue generated. The RIA includes the portion of these externality benefits or costs that are incurred within the local, regional and State economies.

3 Winchester South Project

The CBA methodology described in Chapter 2 provides a structured approach to assessing whether the Project is likely to result in an overall net benefit to the communities of interest. To carry out this assessment, the costs and benefits associated with the Project are compared to those under a Base Case that represents 'business-as-usual'. This comparison allows for an incremental analysis, to reach a conclusion on the projected net benefits of the Project.

This chapter defines the Base Case and the Project Case in turn.

3.1 Base Case

Land within the Project area has predominately been used for cattle grazing (beef production), with three separate areas of land within the Project area classified as "good quality agricultural land" by the Department of Local Government and Planning.[1] GT Environmental Pty Ltd assessed the agricultural land class of the land within the Project area, and classified the land as a combination of:[2]

- Class A1: Land is suitable for a wide range of current and potential broadacre and horticulture crops.
- Class B: Limited crop land, in which the land is suitable for a narrow range of crops, sown pastures, and may be suitable for a wider range of crops.
- Class C2: Pasture land, in which the land is suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than Class C1.

Under the Base Case, no mining activities would occur, and it is assumed that the land within the Project area would continue to be used predominantly for cattle grazing (beef production).

3.2 Project Case

The Project involves the development of an open cut coal mine within mining lease application (MLA) 700049, MLA 700050 and MLA 700051, located in a precinct with extensive existing mining operations in the region and serviced by well-established infrastructure. The Project would include construction and operation of a MIA, including a CHPP, train load-out facility and rail spur, which would be used for the handling, processing and transport of coal. An infrastructure corridor would also form part of the Project, including a raw water supply pipeline connecting to the Eungella pipeline network, an electricity transmission line and a mine access road, within MLA 700065 (see Figure 1.2).

The Project would consist of the following key phases:

- Construction phase: commencing in Project Years 1 to 3 (indicatively FY23 to FY25).
- Operations phase: commencing in Project Years 2 to 29 (indicatively FY24 to FY51).
- Rehabilitation and decommissioning phase: commencing in Project Years 29 to 33 (indicatively FY51 to FY55).

The CBA models from FY22 to FY55 for the Base Case and Project Case

A summary of the Project is provided in Table 3.1.

[1] Department of Local Government and Planning (2012), *Mackay, Isaac and Whitsunday Regional Plan* <http://www.dlgrma.qld.gov.au/resources/plan/miw/miw-regional-plan.pdf>
[2] GT Environmental Pty Ltd (2022), *Soils and Land Suitability Assessment Addendum– Winchester South Project.*

Table 3.1: Summary of key elements of the Project

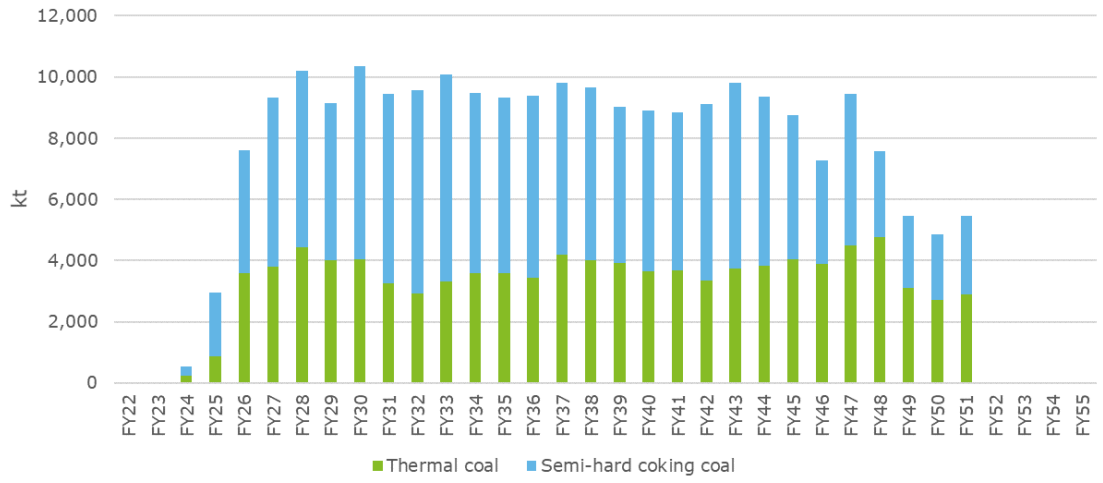
Proposed project element	Description
Extraction approach	Use of open cut mining methods to extract ROM coal (i.e., truck and excavators supported by coal blasting and dozer push operations).
Project life	Approximately 31 years, consisting of: • Three years of construction. • 28 years of mining operations (overlapping with years 2 and 3 of construction). • Two years of final landform shaping.
ROM coal	Approximately 396 million tonnes (Mt) from coal seams in the Rangal and Fort Cooper Coal Measures (Leichardt Seams, Vermont Upper Seams and Vermont Middle Lower Seam).
Direct employment	Approximately 500 personnel at the mine site.[3]
Project area	Greenfield development of open cut coal mine within MLA 700049, MLA 700050 and MLA 700051, and development of associated infrastructure surrounding the mine, including an infrastructure corridor (electricity transmission line, raw water supply pipeline and mine access road) within MLA 700065 outside of MCL 183. The Project would be located in the Bowen Basin Region in QLD, in the Isaac Regional Council LGA. The extent of the Project's open cut adheres to the QLD Government's definition of identified coal reserves in the *Mackay, Isaac and Whitsunday Regional Plan*.[4]
Interaction with other operations	The Bowen Basin has been the centre of mining and petroleum activities for several decades. Other existing, approved and proposed coal mines nearby the Project include: Olive Downs, Eagle Downs, Moorvale South, Poitrel, Daunia, Millennium, Moorvale, Isaac Plains, Isaac Downs, Carborough Downs, Moranbah South, Caval Ridge, Peak Downs, Lake Vermont Meadowbrook, Lake Vermont, Saraji East Mining Lease, and Saraji.
Key infrastructure	• A MIA, including workshops, offices and a CHPP to process and handle ROM coal. • An access road from the Eagle Downs Mine Access Road, off the Peak Downs Mine Road, to the MIA. • A new rail spur, loop and train load-out facility connecting to the Norwich Park Branch Railway to transport product coal. • A raw water supply pipeline from the Eungella pipeline network. • An electricity transmission line from the existing Eagle Downs Substation. • A water management system. • Waste rock emplacement areas for co-disposal of CHPP coal reject material and waste rock. • An on-site landfill for the disposal of certain waste streams generated on-site.
Product transport	Product coal would be transported via the proposed Project rail spur, which would connect to the Norwich Park Branch Railway and lead into the broader QLD rail network to existing port infrastructure for export.

[3] Note Whitehaven WS is investigating automation of the fleet for the Project. Direct employee numbers include consideration of automation. Employee numbers may increase depending on the extent of automation adopted for the Project.
[4] Department of Local Government and Planning (2012), *Mackay, Isaac and Whitsunday Regional Plan* <http://www.dlgrma.qld.gov.au/resources/plan/miw/miw-regional-plan.pdf>

Source: Whitehaven WS.

Approximately 396 Mt of ROM coal from coal seams in the Rangal and Fort Cooper Coal Measures would be extracted via open cut mining methods over the life of the Project. Approximately 15 Mtpa of ROM coal is forecasted to be extracted (with a forecasted peak of up to 17 Mtpa) during mining operations. Of the ROM coal, it is estimated that approximately 231 Mt would be recovered as product coal and the remainder would be rejects. Two types of coal would be produced by the Project: metallurgical coal, being semi-hard coking coal (SHCC); and thermal coal, with the majority being metallurgical coal - a necessary input for the production of steel. Figure 3.1 outlines the annual production estimates for each type of coal produced by the Project.

Figure 3.1: Estimated production schedule for the Project



Source: Whitehaven WS.

There are extensive existing mining operations in the region, serviced by well-established infrastructure. Whitehaven WS would utilise some of this existing infrastructure, in addition to developing key infrastructure for the Project listed in Table 3.1.

The Project's mining operations are expected to operate on a continuous basis - 24 hours a day, seven days a week. The Project is expected to provide direct employment opportunities for construction and operational workforces, employing approximately 500 personnel at the mine site. Whitehaven WS is investigating automation of the fleet for the Project, to improve the safety, efficiency and cost benefits of the Project, and employee numbers may change depending on the extent of automation. If a non-automated fleet is adopted, there would be no significant change to the Project elements as outlined in Table 3.1, with the exception of the direct workforce. The operational workforce would increase to approximately 750 personnel for the Non-automated Case.

Automation would likely require an automation control centre to be established (at a separate location to be decided by Whitehaven WS), where up to 24 personnel can remotely monitor and operate the autonomous fleet at the mine site. There are also indirect employment opportunities expected, through suppliers, contractors, service providers and local businesses, resulting in long term flow-on social and economic benefits to the local and regional communities.

At the completion of Project mining activities, infrastructure would be decommissioned, where an agreement to retain infrastructure is not in place with relevant stakeholders. Final landform earthworks and revegetation would be undertaken as part of the Project's agreed final landform and rehabilitation strategies.

As described in Section 1.1, Whitehaven WS reviewed the mine plan and mine schedule with the aim of addressing environmental impacts of the Project and altering the Project final landform in response to comments raised in submissions. As part of this review, the following alternative options were considered:

1. Full Backfill – backfilling all of the proposed residual voids in the Project Case final landform.
2. Partial Backfill to Above the Pre-mining Groundwater Level – partially backfilling the proposed residual voids up to the pre-mining groundwater level.
3. Covering of Exposed Coal Seams – partially backfilling the proposed residual voids to cover the exposed coal seams in the void walls.

This is discussed further in Section 4.6.

3.3 Project options

Note that in addition to clearly defining the Base Case and the Project Case, the completion of the CBA would also require a consideration of other project options and the geographic scope of the analysis.

This assessment only evaluates the Project Case put forward by Whitehaven WS. A number of other alternatives for the Project Case were considered by Whitehaven WS in order balance considerations around resource recovery, operational efficiencies, environmental impacts and social impacts. This includes the consideration of alternative mining footprint options, infrastructure arrangements and scale, mining and processing rate.

This assessment also assesses the non-automated Project case three alternative Project final landform alternatives compared to the optimised Project final landform (Project Case).

Deloitte Access Economics was not engaged to consider other alternative project options.

4 Cost Benefit Analysis – Net benefits to QLD

This chapter presents the results of the CBA, which assesses the NPV of the Project Case to the QLD community. This involves identifying incremental costs and benefits of the Project Case relative to the Base Case, and the share that is attributable to the QLD community. All costs and benefits are quantified where possible and converted to present terms.

The Project Case is estimated to provide a total net economic benefit to the QLD community of $882 million in present value terms.

The steps to this analysis and the detailed results are described in this chapter.

4.1 Scope of the cost benefit analysis

The scope of this CBA is defined by:

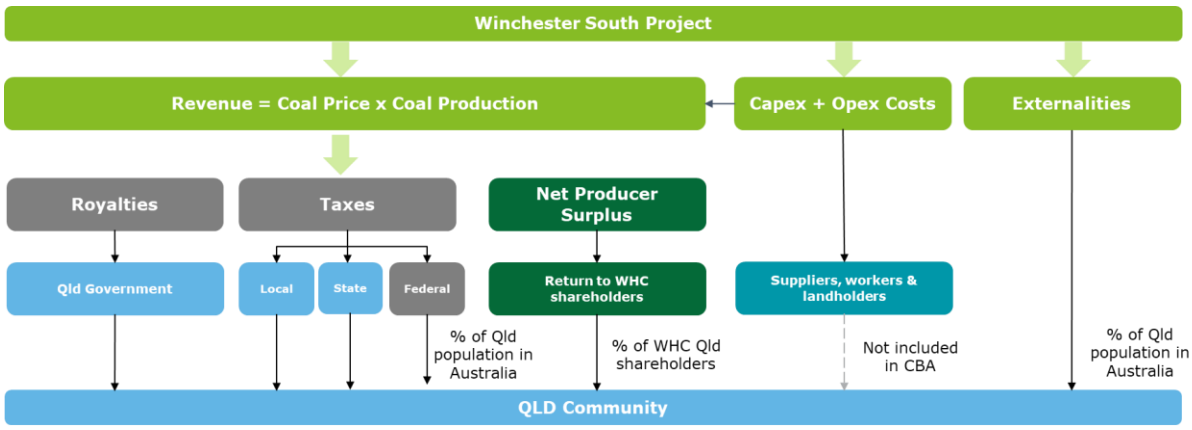
- A Base Case – identifying the 'business-as-usual' scenario against which to assess the potential economic, social and environmental changes due to the Project.
- A Project Case – full specification of the Project Case with comparisons drawn against the Base Case.
- The community of interest – defining the community for which the benefits and costs of the Project should be assessed. In this case, it is the QLD community.

The definitions of the Base Case and the Project Case for this CBA are described in Section 3.1 and Section 3.2, respectively.

4.2 Identifying costs and benefits

The costs and benefits considered in the CBA are set out in Table 4.1 below. They are organised into seven distinct categories, in accordance with the part of the community that they accrue to. For instance, the owners of Whitehaven WS would receive the net producer surplus resulting from the Project, while the royalties and company income tax would be paid to the QLD and Australian Governments respectively. Other third parties that may be affected by the Project include: local workers, suppliers and residents in the local community and adjacent LGAs. The categorisations are useful in apportioning the share of the net benefits of the Project to the QLD community (see Figure 4.1).

Figure 4.1: Contribution of the project to different stakeholders



Source: Deloitte Access Economics

Table 4.1: Benefit and cost items considered in the CBA

Item	Benefit components	Cost components
Net producer surplus	Gross mining revenue Residual value of capital Residual value of land	Operating costs Capital costs (includes initial capital costs and sustaining capital costs) Rehabilitation and decommissioning costs Taxes (Federal, State & local) Royalties
Royalties	Royalties payable to QLD Government	
Company income tax	Company income tax payable to the Australian Government	
Local government rates	Council rates payable to the QLD local government	
Economic benefit to workers	Wages paid to workers	Reservation wage for workers in the mining sector
Economic benefit to suppliers	Revenue paid to suppliers	Cost of supplying goods and services
Externalities		Agriculture Aboriginal cultural heritage Air quality Ambient noise and blasting Biodiversity Greenhouse gas emissions Non-Aboriginal cultural heritage Surface water and groundwater Social Traffic and transport Visual amenity

Section 4.3 describes the techniques used to value the items in Table 4.1 and provides the justification behind the classification of each as a net cost or net benefit. Where it is difficult to place a value on a particular item's cost or benefit in the Project, a qualitative analysis is undertaken, as recommended by the NSW Guideline.

Costs associated with the construction phase would occur during Years 1 to 3 of the Project and are included in the capital and operating costs (Section 4.3.3). Likewise, costs associated with the operational phase would occur during Years 2 to 29 of the Project and are included in the capital (sustaining capex) and operational costs. An exception to this is the costs associated with final landform shaping during the rehabilitation and decommissioning phase, where rehabilitation costs are incurred during Project Years 2 to 29 (as a result of the Project area being progressively rehabilitated) and decommissioning costs incurred during Project Years 29 and 33. Both these costs are included in the rehabilitation and decommissioning costs for the Project (Section 4.3.3).

4.3 Cost and benefits to QLD

This section explores the costs and benefits identified in Table 4.1 in detail. In particular, the costs and benefits are quantified, or qualitatively analysed, and apportioned by a share to estimate the net benefit to the QLD community. The share is determined by consideration of the level of Australian ownership of Whitehaven WS and the QLD population.

Costs and benefits are quantified using a range of approaches and data sources. These include financial information and technical assessments provided by Whitehaven WS (spanning FY22 to FY55), as well as government data publications and non-market values published in literature.

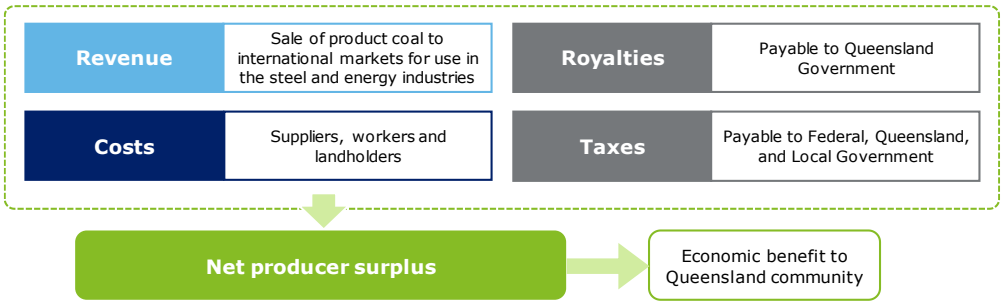
In accordance with the Guideline (DSD, 2017) a real discount rate was applied to compute the present value of costs and benefits. The estimates are presented in FY22 terms using a real discount rate of 7%, in accordance with guidance from the Australian Department of the Prime Minister and Cabinet (2020)[5] on CBA, as no specific discount rate is specified in the DSD (2017) Guideline or the Queensland Treasury (2015) *Project Assessment Framework – Cost-benefit analysis*. The use of a 7% discount rate is in line with CBA guidelines across Australia, including the NSW Guideline (NSW Government, 2015) and other economic assessments for coal mining projects in QLD[6]. A sensitivity analysis is undertaken in the report using discount rates of 3% and 10%, with the overall net incremental benefit reported for each rate. This approach is consistent with the DSD (2017) Guideline, which requires sensitivity analysis at upper and lower discount rates from the predicted discount rate.

Undiscounted estimates of each cost and benefit are reported in the text in brackets. In most cases, numbers are rounded to the nearest whole number, so there may be instances of numbers not adding up.

4.3.1 Net producer surplus attributable to QLD

The total incremental net producer surplus of the Project is estimated to be $1,062 million in present value (or $4,050 million in undiscounted terms). The incremental net producer surplus is the additional value of the Project to Whitehaven WS, calculated as the total revenue net of all direct costs, royalty payments and taxes, relative to the Base Case. Figure 4.2 shows the contribution of net producer surplus to different stakeholders, including the owners of the Project, governments, and suppliers and workers that provide input to the Project Case. Table 4.2 provides a breakdown of the costs and benefit components used to compute the net producer surplus for the Project.

Figure 4.2: Contribution of Project revenues and costs to different stakeholders



Source: Deloitte Access Economics

[5] Australian Department of the Prime Minister and Cabinet (2020), *Cost-benefit analysis guidance note* <https://www.pmc.gov.au/sites/default/files/publications/cost-benefit-analysis_0.pdf>

[6] CDM Smith (2020), *Economic Assessment of Ensham Coal Mine* < https://www.idemitsu.com.au/mining/wp-content/uploads/2020/07/Appendix-J-1-Economics.pdf>

Table 4.2: Calculation of total net producer surplus for the project

Item		Base Case (NPV)	Project Case (NPV)	Incremental (NPV)
Revenue				
Gross revenue	$m	$5.2	$9,874	$9,869
Residual value of land	$m	-	-	-
Residual value of capital	$m	-	-	-
Total	$m	**$5.2**	**$9,874**	**$9,869**
Costs				
Operating costs	$m	$3.2	$5,524	$5,520
Capital costs	$m	-	$1,621	$1,621
Rehabilitation and decommissioning costs	$m	-	$103	$103
Total	$m	**$3.2**	**$7,247**	**$7,244**
Royalties				
Ad valorem coal royalties	$m	-	$696	$696
Total	$m	**-**	**$696**	**$696**
Taxes				
Company income tax	$m	-	$830	$830
Payroll tax	$m	-	$35	$35
Local government rates	$m	$0.2	$3	$3
Total	$m	**$0.2**	**$867**	**$867**
Net producer surplus	$m	**$1.8**	**$1,064**	**$1,062**

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Of the net producer surplus, only a share is attributed to the QLD community. The share is determined by the Whitehaven WS' ownership structure and QLD's population relative to the total Australian population. As noted in Chapter 1, the Project is wholly owned by Whitehaven WS, a wholly owned subsidiary of Whitehaven, a publicly listed mining company based in Australia, with the level of Australian ownership amounting to approximately 63% (rounded to the nearest whole number) as at April 2022. Combined with QLD's population relative to the total Australian population of approximately 20%, the incremental net producer surplus of the Project Case attributed to the QLD community is approximately 13%, or $134 million in present value terms ($513 million in undiscounted terms) (Table 4.3). However, under the Base Case, there is uncertainty with the ownership of the land throughout the period of the Project. Therefore, the share attributed to the QLD community is conservatively assumed to be the share of QLD's population relative to the total Australian population (approximately 20%).

Table 4.3: Share of the net producer surplus attributable to QLD community

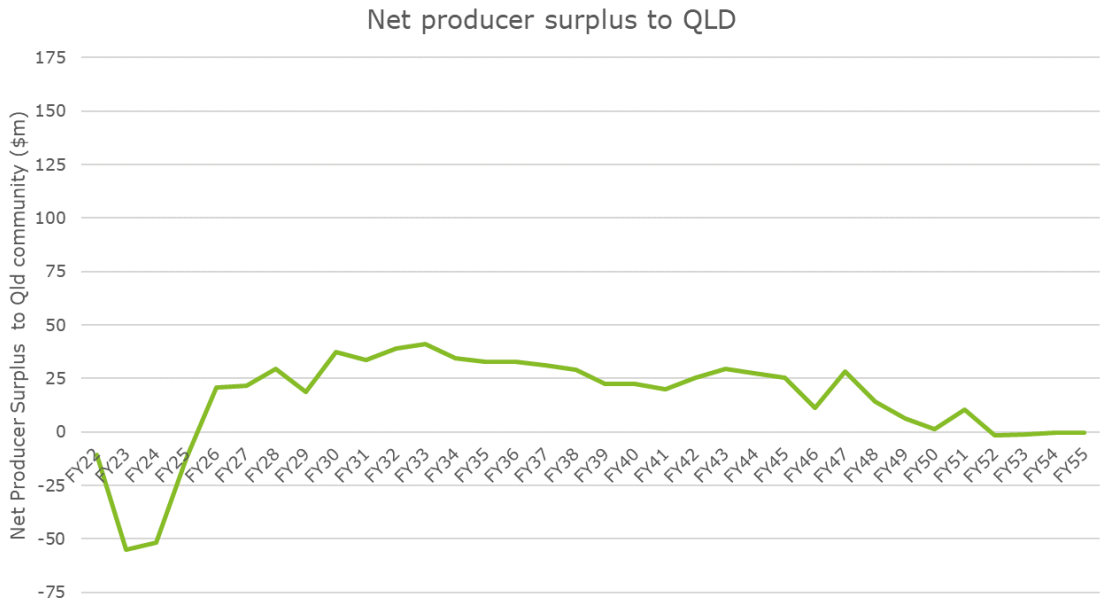
Item		Base Case (NPV)	Project Case (NPV)	Incremental (NPV)
Net producer surplus	$m	$1.8	$1,064	$1,062
QLD share of Project's ownership	%	20%	13%	-
Value of net producer surplus attributable to QLD	$m	**$0.4**	**$135**	**$134**

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Chart 4.5 outlines the profile of the net surplus attributable to the QLD community over the life of the Project.

Chart 4.1: Net producer surplus for the QLD community over the life of the Project



Source: Deloitte Access Economics

The assumptions underlying each component of the total net producer surplus estimate are detailed in the following sections.

4.3.2 Revenue

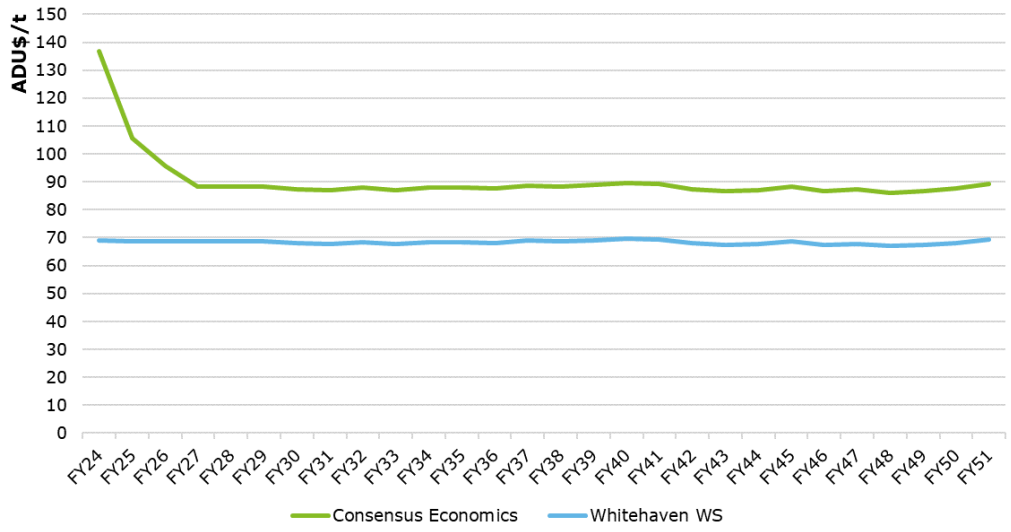
Gross mining revenue is estimated to be $9,874 million in present value under the Project Case (or $26,593 million in undiscounted terms). Approximately 75% of the revenue is generated from semi-hard coking coal and the remaining 25% is generated from thermal coal. The revenue is accrued over 28 years of the ongoing mining operations, mining approximately 396 Mt of ROM coal, of which, approximately 231 Mt of product coal would be produced. Over the life of the Project, the majority of coal produced would be metallurgical coal (semi-hard coking coal), with the remaining being thermal coal (Figure 3.1).

Revenue is modelled by Deloitte Access Economics using the estimates on production and prices provided by Whitehaven WS (based on Broker Consensus price forecasts) in relation to the mining operations from FY24 to FY55. The coal prices, reported as FY22 US dollars, are benchmark prices for common coal specifications. These prices are converted to Australian dollars and adjusted to reflect the quality of the coal mined using Whitehaven WS' exchange rate forecasts and quality adjustment parameters respectively.

The revenue estimated using Whitehaven WS' prices (used for the CBA) is compared to our internal estimate using an alternative source: Consensus Economics, and their forecast of coal prices as published in May 2022[7] Forecasts are available up to FY27, and a constant price is assumed for the remainder of the evaluation period. Similarly, coal prices are reported for common coal specifications in nominal US dollars. The prices are converted to Australian FY22 dollars using exchange rate forecasts provided by Whitehaven WS and inflation rate assumptions published by the Australian Department of Industry, Science, Energy and Resources.[8] Further adjustments have been made to reflect the quality of the coal by applying an adjustment rate based on ratio of average coal prices collated by KPMG.[9]

The prices derived from the Consensus Economics forecasts are initially high relative to Whitehaven WS' estimates as seen in Chart 4.2 and Chart 4.3 below. However, the Consensus Economics forecasts involve a decline over the next few years where prices level off to slightly higher than Whitehaven WS' estimates for high ash thermal coal, and slightly lower for semi-hard coking coal.

Chart 4.2: High ash thermal coal prices (FY22 price terms)



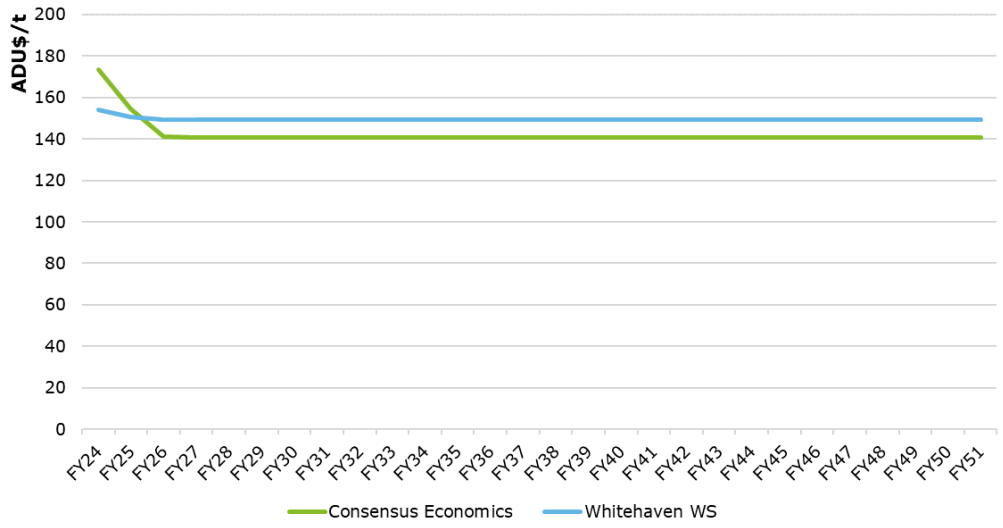
Source: Consensus Economics, Whitehaven WS.

[7] Consensus Economics (2022), *Coal price forecasts* <https://www.consensuseconomics.com/publications/energy-and-metals-consensus-forecasts/coal-price-forecasts/>

[8] Australian Department of Industry, Science, Energy and Resources (2022), *Resource and Energy Quarterly*, *March 2022* <https://www.industry.gov.au/data-and-publications/resources-and-energy-quarterly-march-2022>

[9] KPMG (2022), *Coal price and FX market forecasts December 2021/January 2022* <https://home.kpmg/content/dam/kpmg/au/pdf/2022/coal-price-fx-market-forecast-december-2021-january-2022.pdf>

Chart 4.3: Semi-hard coking coal prices (FY22 price terms)



Source: Consensus Economics, Whitehaven WS.

Under the Base Case, there would be no coal production activities and the land would be used for cattle grazing (beef production), generating a revenue of approximately $5.2 million in present value (or $13.9 million in undiscounted terms). Revenue under the Base Case is determined by the average farm's FY20 financial performance in South QLD Coastal region (where the Project is located) as collected by the Australian Department of Agriculture, Water and the Environment (ADAWE).[10] The revenue comprises sales income and other income such as rental, and interest and finance lease payments.

For both Base Case and the Project Case, the **residual value of land** is conservatively assumed to be zero. Similarly, the **residual value of capital** is assumed to be zero for both Cases, as all capital assets are expected to be fully depreciated over the life of the mine with no resale value.

4.3.3 Costs

Operating costs associated with the Project Case commencing in FY24 are estimated (by Whitehaven WS) to be $5,524 million in present value (or $15,024 million in undiscounted terms). Operating costs comprise expenditures incurred as a direct result of exploration costs associated with preparatory activities before extraction commences, extracting ROM coal, processing it into a saleable product, and delivering it to a port before loading, and other costs associated with environmental management costs such as transport management measures, cultural heritage management and water quality monitoring and local contributions.

The operating costs have been benchmarked against estimated direct mining costs based on an econometric model developed by Nehring et al. (2009).[11] The authors use a relationship between cost per tonne and deposit average thickness, stripping ratio, capital cost and the daily production rate. Other expenditures such as processing costs, overheads and freight costs are added based on experience with other projects, some industry benchmark data and with guidance from Whitehaven WS. The operating costs predicted by the econometric model compare well to those forecast by Whitehaven WS, with Whitehaven WS' estimates being slightly higher and therefore resulting in a more conservative net producer surplus.

[10] Australian Department of Agriculture, Water and the Environment (2020), *Farm survey data - broadacre farms by state* <https://www.agriculture.gov.au/abares/research-topics/surveys/farm-survey-data>
[11] Nehring et al. (2009), *Estimating average total cost of open pit coal mines in Australia* <https://www.researchgate.net/publication/43527638_Estimating_average_total_cost_of_open_pit_coal_mines_in_Australia>

Under the Base Case, the total operating cost for grazing is estimated to be $3.2 million in present value (or $8.5 million in undiscounted terms). Similar to revenue, the estimate is based on the average farm's financial performance in South QLD Coastal region, where the Project is located. The farms' cost components include: labour, materials, services, produce purchased for resale, livestock purchases and transfers onto the property, interest and payments to sharefarmers.

Capital costs over the life of the Project are estimated to be $1,621 million in present value (or $2,942 million in undiscounted terms). The costs include land compensation and capital investment incurred between FY22 to FY43, as well as sustaining capital and repayments made on leased mobile equipment (principal and interest) over FY24 to FY51. Development costs and environmental mitigation costs are also included in this estimate, comprising an allowance for biodiversity offsets, as well as funds for agreements with impacted landholders, a road infrastructure agreement with the Isaac Regional Council, and impact management and monitoring.

All mobile equipment is proposed to be leased. The equipment includes a combination of excavators and/or shovels and haul trucks, with a support fleet that includes dozers, graders, front end loaders, drill rigs and water trucks.

Capital costs do not include employees' wages during the construction phase spanning this period or other costs that were incurred prior to FY22 such as acquisition of assets, historic study, approvals and explorations costs.

Note that capital investment in an automation control centre for employees to work remotely from the mine site has been included, totalling $4 million in undiscounted terms. While the control centre could be used for multiple projects, it is assumed to be fully attributed to the Project to be conservative.

Rehabilitation and decommissioning costs are estimated to be a combined present value of $103 million (or $389 million in undiscounted terms). These costs go toward optimising landform design for final land use.[12]

Rehabilitation costs are assumed to be an ongoing cost as the waste rock emplacements and surface disturbance areas would be progressively rehabilitated. The cost is estimated by multiplying the average rehabilitation cost per bank cubic metres by the open cut waste rock quantities each year. In contrast, decommissioning activities would take place and costs are incurred in FY52 to FY55, the final years of the Project, after cessation of mining operations.

No capital costs, and rehabilitation and decommissioning costs are expected to be incurred under the Base Case as it reflects ongoing use of the land in its current state.

4.3.4 Royalties

Royalties are estimated to be $696 million in present value under the Project Case (or $1,862 million in undiscounted terms). Royalties for the production and sale of product coal are estimated by applying the ad valorem mining royalty rate, as determined by the QLD Government, to the anticipated coal revenue (excluding goods and services tax [GST]) less freight and insurance costs.[13] The anticipated coal revenue is computed using the weighted average coal price, where the weights are the annual product coal output by type and excludes GST. Furthermore, it is expected that all saleable coal would be exported to the steel and energy industries.

Chart 4.4 provides an overview of the estimated royalties for each year, ranging from $4 to $91 million (undiscounted).

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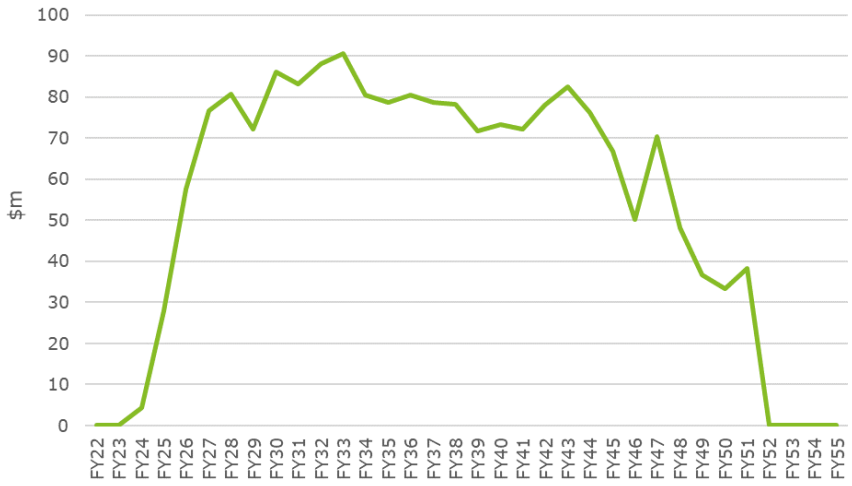
[12] Coordinator-General (2019), *Terms of reference for an environmental impact statement – Winchester South project* <http://eisdocs.dsdip.qld.gov.au/Winchester%20South/Final%20terms%20of%20reference/winchester-south-project-terms-of-reference-for-an-eis.pdf>

[13] Queensland Government, *Calculating mining royalty* (30 April 2022) <https://www.business.qld.gov.au/industries/mining-energy-water/resources/minerals-coal/authorities-permits/payments/royalties/calculating>

Chart 4.4: Estimated royalties for the Project (undiscounted)



Source: Deloitte Access Economics

4.3.5 Taxes

Total taxes accrued as a result of the mining operations are estimated to be $867 million in present value under the Project Case (or $2,321 million in undiscounted terms). These estimates include the company income tax payable to the Australian Government, payroll tax payable to the QLD Government and local government rates payable to local councils. They are explored in turn below:

Company income tax is the largest tax component, totalling to $830 million in present value under the Project Case (or $2,223 million in undiscounted terms).

The CBA is undertaken with QLD as the reference group, as such, it is expected that a portion of the company income tax would result in benefits for QLD when tax funds are transferred back to QLD. It is acknowledged that company income tax is a federal tax and this would be considered a transfer if the reference group was Australia overall.

Company income tax has been estimated for each year of the evaluation period of the Project. There are a number of challenges assessing the tax position of the entire Whitehaven WS business, as such the analysis focuses only on the project. The assumptions used in the calculation of company income tax are as realistic as possible and include an assumed accrued tax loss at the commencement of the Project and accelerated depreciation of assets. Sensitivity analysis on company income tax payable has also been undertaken and is presented in Section 4.5.

The estimate is derived by applying an effective tax rate of 30% to taxable income, computed using gross mining revenue, less operating costs, rehabilitation and decommissioning costs, royalties and depreciation on capital assets.[14]

[14] The effective tax rate is defined as the average tax rate that a corporation pays. It is calculated by dividing the total tax by the total taxable income base (effectively earnings before taxes). As of FY21, the full company tax rate set by the Australian Taxation Office is 30% (https://www.ato.gov.au/Rates/Company-tax/).

Payroll tax is estimated to be $35 million in present value under the Project Case (or $90 million in undiscounted terms). This tax component is estimated as a function of expected employee wage costs and data on the number of full time equivalent (FTE) staff employed over the course of the Project, from FY23 to FY55. Annual payroll tax payable on labour expenditure is estimated by applying a payroll tax rate to annual labour expenditure in excess of the thresholds set by the QLD Government.[15] The payroll tax rate of 4.95% is applied to labour expenditure every year, except the final year where labour expenditure is below $6.5 million and therefore subjected to rate of 4.75%.

Labour expenditure is determined by using the Australian Bureau of Statistics' (ABS) data on average mining wage in the Isaac and Mackay LGAs.[16] The wages are adjusted to FY22 dollars using wage price indices published by the ABS.[17]

Local government rates are estimated to be $3.0 million in present value under the Project Case (or $8.0 million in undiscounted terms). The rate set by the Isaac Regional Council for land used for coal mining is a function of the number of employees, and so, the rate incurred by Whitehaven WS is expected to vary each year.[18]

Under the Base Case, it is assumed that the local government rates payable include those associated with Wynette Station, for use of the land, totalling $0.2 million in present value (or $0.5 million in undiscounted terms). While the Base Case has generally referred to the farms' revenue and cost items reported by ADAWE, the local government rates payable provided by Whitehaven WS were used as they present a more conservative result, albeit marginally.[19]

4.3.6 Economic benefits to workers

The Project is expected to employ the majority of its workers from within QLD, with up to 500 personnel at the mine site and up to 24 personnel at the automation control centre in a given year.

During the construction phase, spanning FY23 to FY25, up to 95% of the workers employed are anticipated to be from the Region (Isaac and Mackay LGAs), of which 7% of workers would be employed from the local community (Moranbah, Dysart and Coppabella communities). The remaining 5% would be either from the rest of QLD or outside of QLD. It is not expected that more than 5% of workers would be employed from outside of QLD.

In the other two Project phases (operations, and rehabilitation and decommissioning), it is anticipated that up to 80% of the workers would be employed from the Region, of which 10% of workers would be employed from the local community. The remaining 20% would be employed from the rest of QLD or outside of QLD.

The economic benefits to workers include any wage premiums paid above the wage that workers could accept elsewhere in the economy. An estimate of the upper bound in economic benefits is $254 million in present value (or $658 million in undiscounted terms), derived from comparing the net wage after tax for the mining industry relative to the average net wage after tax in the Region. The net wage in the mining industry in the Region is estimated to be $92,035 after tax (or $126,239 before tax) in FY22 dollars. This figure represents the average annual income in the mining industry in this Region, which is above the average annual income in the Region of $46,223 after tax (or $55,954 before tax).

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[15] Queensland Government, *Payroll tax rates and thresholds* (30 April 2022) <https://www.business.qld.gov.au/running-business/employing/payroll-tax/calculating/thresholds>
[16] Australian Bureau of Statistics (2016), *Census of Population and Housing* <https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2900.0~2016~Main%20Features~INCP%20Total%20Personal%20Income%20(weekly)~10059>
[17] Australian Bureau of Statistics (2020), *6345.0 – Wage Price Index, Australia, Jun 2020* <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/6345.0Main+Features1Jun%202020?OpenDocument>
[18] Isaac Regional Council (2022), *2021-22 Property Rates* < https://www.isaac.qld.gov.au/downloads/file/4180/property-rates-2021-22-a4-finalweb>
[19] Using the figures provided by Australian Departure of Agriculture Water and the Environment, local government rates payable under the Base Case are estimated to be $0.1 million in undiscounted terms.

However, it is conservatively assumed that the workers do not receive a wage premium and would receive a wage consistent with market rates in the mining sector. As such, the CBA assumes that there are no wage increases for workers already working in the mining sector and the economic benefit to workers is effectively zero. Any wage increase accrued from gaining employment in the Project from outside the mining sector or from other areas of QLD is deemed to be compensation for changes in working conditions or skill accumulation, rather than a genuine wage premium.

4.3.7 Economic benefits to suppliers

The economic benefit to suppliers is to be estimated by examining the additional producer surplus that would be accrued in the Project Case relative to the Base Case. It is estimated that 90% of the Project's expenditure occurs within QLD, amounting to $5,743 million in present value (or $14,489 million in undiscounted terms). This is a combination of operational and capital expenditure and does not include wages.

As the outcomes for suppliers under the Base Case are not readily observable, this benefit is difficult to measure, and it is assumed that expenditure is incurred at market rates. Accordingly, it is conservatively assumed that suppliers to the Project Case would earn similar margins relative to what they could have receive from other sources under the Base Case. That is, the economic benefit to suppliers is assumed to be zero.

4.3.8 Externalities

Externalities, otherwise referred to as environmental and social effects, are generated as a result of the Project, and relate to a range of aspects, such as agriculture, Aboriginal cultural heritage, air quality (including greenhouse gas emissions), noise, biodiversity, non-Aboriginal cultural heritage, water resources, social, transport, and visual amenity. The residual effects associated with the externalities discussed below are considered to be immaterial, given the implementation of mitigation and management measures (included in the capital investment and operating costs), and therefore have not been quantified and monetised for inclusion in the CBA, except for greenhouse gas emissions.

4.3.8.1 Agriculture

The costs associated with foregone agricultural production, as a result of the Project, have been considered, as under the Base Case, no mining activities would occur and the land within the Project area would be used solely for cattle grazing (beef production). As such, the loss of agricultural production has been accounted in the incremental benefits associated with revenue and operating costs incurred for the Project Case compared to the Base Case. This provides a conservative approach, as the land within the Project area would be rehabilitated to support low intensity cattle grazing, with the water bodies within the residual voids providing sources of water for cattle.

4.3.8.2 Aboriginal cultural heritage

To manage potential impacts of Project activities on sites and places of Aboriginal cultural heritage, a Cultural Heritage Management Plan (CHMP) has been formed with the Barada Barna Aboriginal Corporation, the prescribed body corporate for the Barada Barna People (the Aboriginal party for the purposes of Indigenous cultural heritage management).

The CHMP includes an assessment of cultural heritage values within the Project area, and development of appropriate management strategies. Costs associated with implementing the CHMP management measures have been included in the operating costs for the Project.

4.3.8.3 Air quality

The Air Quality and Greenhouse Gas Assessment undertaken by Katestone Environmental Pty Ltd (Katestone) (2022) reports estimated total suspended particulate matter (TSP), dust deposition, coarse particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$). The levels of dust emissions are assessed against the air quality objectives for enhancing or protecting the environmental values of the air environment, being health and wellbeing and amenity.

The Project is expected to comply with the relevant air quality objectives for $PM_{2.5}$, PM_{10}, TSP and dust deposition at all sensitive receptors through the implementation of appropriate mitigation measures, except at the Olive Downs homestead, where exceedances of the 24-hour and annual average PM_{10} objectives are predicted.[20]

The Air Quality and Greenhouse Gas Assessment also considered other air pollutants such as oxides of nitrogen (NO_x), carbon monoxide (CO) and sulphur dioxide (SO_2), which may also be emitted from the mining fleet and blasting within the Project area. The overall emissions of these pollutants under the Project Case are considered to be too low to generate any material off-site concentrations.

In addition to the estimated dust emissions from the Project, emissions from nearby approved mining operations were also considered against background dust concentrations in order to assess the cumulative dust impact. This includes the emission of dust from the mining operations of Peak Downs, Isaac Plains East, Isaac Downs, Olive Downs, Daunia, Poitrel, Moorvale South and Saraji.

Costs for off-site mitigation measures have been included in the operating and capital investment costs for the Project (see Section 4.3.3).

4.3.8.4 Ambient noise and blasting

The Noise and Vibration Assessment indicates general compliance with noise requirements, with the possible exception of one sensitive receptor.[21]

The assessment indicates marginal exceedances of the sleep disturbance and low frequency noise objectives at the Olive Downs homestead, but compliance at all other sensitive receptors. Additionally, predicted Project ground vibration and airblast overpressure are expected to be below the relevant objectives. Traffic and rail noise levels from the Project are expected to comply with the Department of Transport and Main Road's noise limits.

Under the Base Case, there is no impact, as there is no material change in noise levels compared to current noise levels.

The costs associated with implementing mitigation measures for noise, including a nominal amount for off-site measures, are included in the operating and capital investment costs for the Project.

4.3.8.5 Biodiversity

The Terrestrial Ecology Assessment undertaken for the Project has focussed on assessing the impacts on biodiversity on the proposed surface disturbance extent for the Project. The disturbance footprint of the Project totals approximately 6,951 hectares, including the open cut mining area, waste rock replacement and infrastructure areas.

Where possible the Project has been located and designed to avoid and minimise impacts on biodiversity values. Matters of State Environmental Significance (MSES) and Matters of National Environmental Significance (MNES) would not be significantly impacted by the Project due to a range of impact avoidance, mitigation and offset measures.

It is proposed the offset requirements would be met through the acquisition of offset properties. The biodiversity offset costs have been included in the capital investment costs to cover the acquisition and management of the properties required.

[20] Katestone Environmental Pty Ltd (2022), *Air Quality and Greenhouse Gas Assessment of the Winchester South Project.*
[21] Renzo Tonin and Associates (2022), *Noise and Vibration Assessment* (report commissioned by Whitehaven WS Pty Ltd).

4.3.8.6 Greenhouse gas emissions

The social costs of additional greenhouse gas (GHG) emissions to Australia under the Project Case are estimated at $576 million in present value (or $1,689 million in undiscounted terms), incremental to the Base Case. On the basis of the QLD population share of Australia of 20%, the cost to the QLD community as a result of the Project is approximately $116 million in present value (or $339 million in undiscounted terms). Further, the assumption of no costs under the Base Case presents a conservative estimate of the incremental impact of the Project Case.

GHG emissions are categorised into three 'Scopes' of emissions (Scope 1, 2 and 3) for greenhouse gas accounting and reporting purposes.

The impacts of GHG emissions are estimated using the projections of the Scope 1 and Scope 2 carbon emissions for each year of mining activity in the Project Case, as well as the average cost per tonne of carbon dioxide (CO_2) emissions. The Air Quality and Greenhouse Gas Assessment provides this data in the form of annual estimates of carbon dioxide-equivalent ($CO_{2\text{-}e}$) emissions under the Project Case.

Scope 1 and Scope 2 emissions can be defined as:

- **Scope 1** – direct emissions of greenhouse gases from sources within the boundary of the facility and as a result of the facility's activities.
- **Scope 2** – emissions of greenhouse gases from the production of electricity, heat or steam that the facility will consume, but that are physically produced by another facility.

The Guideline (DSD, 2017) does not provide specific guidance on how costs associated with the greenhouse gas emissions should be considered or calculated. The use of Scope 1 and Scope 2 emissions aligns with the ToR for the Project.[22] The ToR outline that GHG emissions should be estimated for Scope 1 and Scope 2 emissions, per the Commonwealth Government's National Greenhouse and Energy Reporting Scheme.[23] Consideration of greenhouse gas emissions (being Scope 1 and Scope 2 emissions) in the CBA is detailed in the NSW Guideline (NSW Government, 2015) and supporting *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Department of Planning and Environment, 2018). These guidelines and guidance provided in the ToR have been used in the quantification of costs associated with greenhouse gas emissions.

The CBA is undertaken from the perspective of the impact on the QLD community. The scaling of QLD's share of emissions at 20% is consistent with the approach used to calculate other CBA inputs (costs and benefits). The 20% attributed to the QLD community is based on QLD's population relative to the total Australian population. This methodology is consistent with guidance provided in the NSW Guideline (NSW Government, 2015) and supporting *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (NSW Department of Planning and Environment, 2018). It is not considered appropriate to move away from this share assumption in isolation from other costs and benefits included in the CBA. Notwithstanding, sensitivity analysis was undertaken on allocating 100% of GHG emissions to the QLD community, and the Project still delivers a net benefit (See Section 4.5 for more details).

[22] Queensland Government (September 2019), *Terms of reference for an environmental impact statement: Winchester South project*, <https://www.statedevelopment.qld.gov.au/coordinator-general/assessments-and-approvals/coordinated-projects/current-projects/winchester-south-project>.
[23] Australian Government (2022), *Greenhouse gases and energy*, <http://www.cleanenergyregulator.gov.au/NGER/About-the-National-Greenhouse-and-Energy-Reporting-scheme/Greenhouse-gases-and-energy#n4>.

Scope 3 emissions are indirect greenhouse gas emissions generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business. As detailed above, Scope 3 emissions have been excluded from the quantification of costs associated with GHG emissions, as the inclusion of Scope 3 emissions would also require consideration of benefits associated with relevant GHG generating activities (e.g., power generation). The exclusion of Scope 3 emissions is in line with standard approaches to estimating greenhouse gas effects for mining projects and conventional CBA, where the potential direct costs and benefits of an activity (e.g. the Project) are considered together, in the country where the activity takes place (e.g. economic benefits and costs of Japanese steel manufacturing in a customer's industrial facility, including the Scope 1 greenhouse gas emissions of that facility).[24] Furthermore, the inclusion of Scope 3 emissions may result in double counting as it captures indirect emissions that occur along the value chain of the reporting company. Inclusion of Scope 3 emissions in each project's CBA would lead to an overestimation of the cost of emissions estimated for the economy as a whole.

In quantifying the impact in monetary terms, there are a number of reference price series used to value average cost per tonne of CO_2 emissions. These include the forecast European Union Emission Allowance Units price, which is based on future derivatives published by the European Energy Exchange, the US Environmental Protection Agency (US EPA Social Cost of Carbon), and the Australian Treasury Clean Energy Future Policy Scenario.

The forecast US EPA Social Cost of Carbon prices result in the cost of carbon amounting to \$79.0 per tCO_2-e in FY22 and \$131.7 per tCO_2-e in FY55.

The forecast US EPA Social Cost of Carbon price, however, can be seen as a relatively high estimate relative to other reference price series such as the Australian Treasury Clean Energy Future Policy Scenario prices. The cost of carbon under this reference price series, on average across the Project period, are 21% lower than that of forecast European Union Emission Allowance Units price over the life of the Project, respectively.

The European Union Emission Allowance Units is also used as a reference price, with the cost of carbon averaging 44% higher compared to the forecast US EPA Social Cost of Carbon price. These two series are considered and presented in the sensitivity analysis in Section 4.5.

4.3.8.7 Non-Aboriginal cultural heritage

The Non-Indigenous Cultural Heritage Assessment for the Project (refer to Appendix L of the Draft EIS) identified non-Indigenous historical heritage sites contained within and in the vicinity of the Project area and assessed the significance of any potential impacts on those sites due to the Project.

The Assessment identified 28 potential sites of non-Indigenous cultural heritage significance within the Project area and surrounding landscape. Overall, the assessment concludes that no items of non-Indigenous cultural heritage significance are within the Project area or immediate surrounds, therefore no heritage site would be directly impacted by the Project. It has also been assessed that the Project would not result in any material adverse cumulative impacts to heritage places. As a result, no specific actions are required by Whitehaven WS.[25]

[24] NSW Government (2018), *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*, <https://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/Integrated-Mining-Policy?acc_section=guidelines_for_the_economic_assessment_of_mining_and_coal_seam_gas_proposals>.
[25] Extent Heritage Pty Ltd (2021), *Winchester South Project, Non-Indigenous Cultural Heritage Assessment* (report commissioned by Whitehaven WS Pty Ltd).

4.3.8.8 Surface water and groundwater

The impacts of the Project on surface water and groundwater resources have been considered in the Surface Water and Flooding Assessment undertaken by WRM Water and Environment Pty Ltd and the Groundwater Assessment undertaken by SLR Consulting Australia Pty Ltd.[26, 27]

WRM Water and Environment Pty Ltd has considered the potential impacts of the Project on surface water and concluded that with the implementation of a site water management system for the Project, potential impacts to surface water quality and resources would be mitigated. It is expected that there would be negligible impacts on surface water resources, flow and water quality from the Project.

The site water management system would include the establishment of water management infrastructure and a surface water monitoring program. These costs are included in the capital investment costs for the Project, with the costs incurred to meet external water requirements for the Project included in the operating costs (see Section 4.3.3).

The Groundwater Assessment considered the potential impacts of the Project on groundwater and concluded no privately-owned bores are predicted to exceed relevant bore trigger thresholds in the Chapter 3 of the *Water Act 2000* and therefore there are no existing privately-owned bores that would be impacted by the Project. Furthermore, the Project is anticipated to have negligible adverse impacts on groundwater quality. Underground water rights would be exercised for the life of the Project, with a predicted groundwater take of up to 280 megalitres per year from Groundwater Unit 2 under the *Water Plan (Fitzroy Basin) 2011*. It is predicted there would be negligible take from the Isaac River alluvium (i.e., Groundwater Unit 1). A groundwater monitoring program would be developed and implemented for the Project, and would define a groundwater monitoring strategy, groundwater level triggers and a trigger action response plan. Costs associated with implementing the Project groundwater monitoring program are included in the operating costs of the Project (see Section 4.3.3).

4.3.8.9 Social

A Social Impact Assessment was undertaken by SMEC Australia Pty Limited to determine the social impacts of the Project.[28] A total of 18 negative impacts were identified, compared to eight positive impacts.

Of the 18 identified negative impacts, none retained a residual risk rating of 'medium' or above. Eight negative impacts were ranked as 'negligible' and ten negative impacts retained a 'low' rating assuming the effective implementation of mitigation and enhancement measures.

The main negative social impacts identified in the assessment related to the health and wellbeing of the workforce and their families. It is proposed that these impacts would be managed through the Whitehaven Coal Health and Safety Management System and other Whitehaven WS initiatives.

A Social Impact Management Plan (SIMP) has been developed and Whitehaven WS has committed to a broad range of measures which serve to improve accessibility to social infrastructure and support community sustainability, culture and wellbeing. As part of this, Whitehaven WS is committed to ensuring the Project does not adversely affect the affordability and availability of housing in local communities, by making an appropriate contribution to both permanent and affordable housing stock in Moranbah.

Of the eight identified positive impacts, six were rated as 'medium' and the remaining were rated as 'low' upon the implementation of enhancement measures. The Project is expected to significantly contribute to increasing employment opportunities for local and regional residents through application of the recruitment hierarchy.

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[26] WRM Water and Environment Pty Ltd (2022), *Winchester South Project, Surface Water and Flooding Assessment* (report commissioned by Whitehaven WS Pty Ltd).
[27] SLR Consulting Australia Pty Ltd (2022), *Winchester South Project, Groundwater Impact Assessment* (report commissioned by Whitehaven WS Pty Ltd).
[28] SMEC Australia Pty Limited (2021), *Social Impact Assessment, Social Impact Assessment* (report commissioned by Whitehaven WS Pty Ltd).

The costs of implementing the mitigation measures recommended in the SIMP (in the order of $15 million in undiscounted terms) are included in the capital investment costs and operating costs of the Project (see Section 4.3.3).

4.3.8.10 Traffic and transport

Under the Project Case, there would be an increased number of vehicles in the vicinity of the Project, which Whitehaven WS would seek to manage and mitigate potential traffic and transport impacts, (e.g. implementation of a shuttle bus service, providing car-pooling incentives and staggering of shift times). The Project may result in minor additional travel time for background traffic along a number of roads, for example at intersections near the Project. However, as the impact of traffic delays is likely to be immaterial, it has not been quantified for inclusion in the CBA.

The costs associated with construction of the intersection are included in the capital investment costs, while all other costs associated with management measures are included in the operational costs for the Project.

4.3.8.11 Visual amenity

Landscape and visual impacts of the Project on the surrounding Local area and key public vantage points are expected to be minimal as the Project is situated within a mining district. Therefore, any new mine infrastructure resulting from the Project would be generally consistent with the landscape that has existed in this area and the Project would be unremarkable in the landscape.[29]

4.4 Overall cost benefit analysis results

The costs and benefits derived from the Project, in aggregate, are estimated to deliver a net incremental economic benefit of $882 (in present value terms) to the QLD community over the life of the Project.

The overall net benefit of the Project to the QLD community is calculated based on the total direct net benefits (royalties, company tax and net producer surplus), minus the externalities. It is noted that guidance on how company tax payments should be considered in the CBA is not provided in the Guideline, as such the methodology specified in the NSW Guideline has been adopted which outlines that the proportion of company income tax attributable to the State should be estimated by applying the proportion of State's population to Australia's (i.e., 20% for QLD).

The overall results of the CBA are presented in Table 4.4, with a detailed summary of the results by item listed in Table 4.5. Each estimate is presented as NPVs using FY22 price terms and a 7% discount rate.

As shown in Table 4.4, the Project would result in significant net economic benefits to the QLD community.

Table 4.4: Overall CBA results for the QLD community

Item		Value (NPV)
Incremental benefits to QLD	$m	$997
Incremental costs to QLD	$m	$116
Overall net benefit of the Project for the QLD community	$m	$882

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

[29] Extent Heritage Pty Ltd (2021), *Winchester South Project, Non-Indigenous Cultural Heritage Assessment* (report commissioned by Whitehaven WS Pty Ltd).

Table 4.5: Breakdown of CBA results by item

Item	Base Case (NPV $m)	Project Case (NPV $m)	Incremental (NPV $m)	QLD community share (%)	Incremental benefit to QLD (NPV $m)	Incremental cost to QLD (NPV $m)
Net producer surplus	$1.8	$1,064	$1,062	13%	$134	-
Royalties	-	$696	$696	100%	$696	-
Company income tax	-	$830	$830	20%	$167	-
Economic benefit to workers*	-	-	-	-	-	-
Economic benefit to suppliers*	-	-	-	-	-	-
Externalities	-	($576)	($576)	-See Section 4.3.8	-	($116)
Total	**$1.8**	**$2,013**	**$2,012**	**-**	**$997**	($116)

* These items are discussed qualitatively in Sections 4.3.6 and 4.3.7.

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Chart 4.5 outlines the profile of the net benefits (as an outcome of the CBA) attributable to the QLD community over the life of the Project.

Chart 4.5: Net benefit for the QLD community over the life of the Project

Source: Deloitte Access Economics

4.5 Sensitivity analysis

The CBA results presented above are subject to the assumptions and valuations applied to each cost and benefit, as outlined in Section 4.3. It is therefore necessary to test the sensitivity of the net economic benefit estimate. This is accomplished by scaling the values of the parameters underpinning the estimate by using an upper and lower bound discount rate, to provide insight into the range of possible outcomes that could be expected from the Project.

Sensitivity analysis has been undertaken in accordance with the recommendations in the Guideline (see Section 2.2), which states sensitivity analysis should be undertaken using an upper, lower and predicted discount rate. Accordingly, the sensitivity analysis has been conducted using a lower bound and upper bound discount rate of 3% and 10% respectively, which is consistent with the sensitivity bounds specified in the NSW Guideline which is specific to coal seam gas and mining developments (NSW Government, 2015) and the Australian Department of the Prime Minister and Cabinet (2020*) Cost-benefit analysis guidance note*. It is noted that the selected lower bound rate of 3% is recognised in the literature as a reasonable discount rate to use when there is an interest in incorporating intergenerational concerns.[30]

Table 4.6 illustrates the variation in the overall net incremental benefits to QLD under the alternative discount rates. In all three scenarios, the Project is estimated to deliver a net benefit to all stakeholders and the QLD community as a whole. That is, the benefits for QLD are estimated to exceed the cost borne by QLD, including the quantifiable residual externality costs (GHG emissions). The estimate of net economic benefits for QLD range from around $551 million to $2,303 million, a respective 48% decrease and 117% increase on the central estimate produced using the standard discount rate of 7% (Tables 4.7 to 4.9). The fact that net benefits are higher under the 3% discount rate indicates that a large share of the costs of the Project occur early in the period of analysis with benefits being generated throughout the life of the Project.

[30] Arrow et al. (2012), *How Should Benefits and Costs Be Discounted in an Intergenerational Context? The Views of an Expert Panel* <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2199511>

Table 4.6: Breakdown of variation in the overall net incremental benefits across each discount rate

Item		3% discount rate (NPV)	7% discount rate (NPV)	10% discount rate (NPV)
Revenue				
Gross revenue	$m	$16,782	$9,869	$6,983
Residual value of land	$m	-	-	-
Residual value of capital	$m	-	-	-
Total	$m	**$16,782**	**$9,869**	**$6,983**
Costs				
Operating costs	$m	$9,429	$5,520	$3,902
Capital costs	$m	$2,188	$1,621	$1,359
Rehabilitation and decommissioning costs	$m	$207	$103	$67
Total	$m	**$11,824**	**$7,244**	**$5,329**
Royalties				
Ad valorem coal royalties	$m	$1,180	$696	$493
Total	$m	**$1,180**	**$696**	**$493**
Taxes				
Company income tax	$m	$1,413	$830	$582
Payroll tax	$m	$57	$35	$25
Local government rates	$m	$5	$3	$2
Total	$m	**$1,475**	**$867**	**$610**
Net producer surplus	$m	**$2,303**	**$1,062**	**$551**

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

The overall net incremental benefits to QLD under the alternative discount rates are outlined in Table 4.7, Table 4.8, and Table 4.9. In all three scenarios, the Project is estimated to deliver a net benefit to all stakeholders and the QLD community as a whole. That is, the benefits for QLD are estimated to exceed the cost borne by QLD, including the quantifiable residual externality costs.

Table 4.7: CBA results for the Project, 3% discount rate

Item	Base case (NPV $m)	Project case (NPV $m)	Incremental (NPV $m)	QLD community share (%)	Overall incremental net benefit of project to QLD (NPV $m)
Net producer surplus	$1.8	$2,306	$2,303	13%	$292
Royalties	-	$1,180	$1,180	100%	$1,180
Company income tax	-	$1,413	$1,413	20%	$284
Economic benefit to workers	-	-	-	-	-
Economic benefit to suppliers	-	-	-	-	-
Externalities	-	($1,024)	($1,024)	20%	($206)
Total	**$1.8**	**$3,875**	**$3,872**	**-**	**$1,550**

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Table 4.8: CBA results for the Project, 7% discount rate

Item	Base case (NPV $m)	Project case (NPV $m)	Incremental (NPV $m)	QLD community share (%)	Overall incremental net benefit of project to QLD (NPV $m)
Net producer surplus	$1.8	$1,064	$1,062	13%	$134
Royalties	-	$696	$696	100%	$696
Company income tax	-	$830	$830	20%	$167
Economic benefit to workers	-	-	-	-	-
Economic benefit to suppliers	-	-	-	-	-
Externalities	-	($576)	($576)	20%	($116)
Total	**$1.8**	**$2,013**	**$2,012**	**-**	**$882**

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Table 4.9: CBA results for the Project, 10% discount rate

Item	Base case (NPV $m)	Project case (NPV $m)	Incremental (NPV $m)	QLD community share (%)	Overall incremental net benefit of project to QLD (NPV $m)
Net producer surplus	$1.8	$552	$551	13%	$70
Royalties	-	$493	$493	100%	$493
Company income tax	-	$582	$582	20%	$117
Economic benefit to workers	-	-	-	-	-
Economic benefit to suppliers	-	-	-	-	-
Externalities	-	($397)	($397)	20%	($80)
Total	**$1.8**	**$1,230**	**$1,229**	**-**	**$600**

Source: Deloitte Access Economics calculations.

A second necessary component of a sensitivity analysis is to also vary the estimates of different inputs. The importance of testing scenarios is also recognised in the Guideline.

The variations undertaken as part of this analysis include:

- increasing export coal price forecasts by 25% and 50%
- decreasing export coal price forecasts by 25% and 50%
- increasing Project capital cost of construction by 25%
- decreasing Project capital cost of construction by 25%
- increasing operating costs (excluding labour costs) by 10%
- decreasing operating costs (excluding labour costs) by 10%
- increasing incremental royalties by 25%
- decreasing incremental royalties by 25%
- increasing company tax payable by 50%
- decreasing company tax payable by 50%
- negating company tax payable (i.e., conservatively assumes no company tax benefits generated by the Project)
- pricing the cost of carbon according to alternative prices used in the Australian Treasury Clean Energy Future Policy Scenario (21% lower than the prices used in the central case scenario, on average)
- pricing the cost of carbon according to alternative European Union Emission Allowance estimates as at 22 May, 2022 (44% higher than the prices used in the central case scenario, on average)
- attributing 100% of scope emissions to the QLD community.

The price forecasts used in the CBA were provided by Whitehaven WS (based on Broker Consensus price forecasts). As described in Section 4.3.2, a comparison was undertaken using price forecasts from Consensus Economics for thermal coal and semi-hard coking coal published in May 2022. The Consensus Economics forecasts were available up to 2027 and a constant price was assumed from FY27 for the remainder of the period.

The forecast prices were converted from nominal US FY22 dollars to Australian FY22 dollars using exchange rate forecasts provided by Whitehaven WS and inflation rate assumptions published by the Australian Department of Industry, Science, Energy and Resources.[31]

Further adjustments have been made to reflect the quality of the coal by applying an adjustment rate based on the ratio of average coal prices collated by KPMG.[32]. Forecasts for the spot price of thermal coal were available up to 2027, and the price in FY27 is used for the remainder of the project period. A discount premium was applied using a benchmark of average coal production (held constant) and a thermal coal energy rate. The variation in the thermal coal energy rate applied drives changes to the price for thermal coal over the long run.

Sensitivity analysis was undertaken on the prices, including increasing and decreasing export coal price forecasts by 25% and 50%. The range of prices for each type of coal is listed in Table 4.10. Prices are likely to fluctuate over time and applying a permanent variation seeks to smooth the temporary variations in price. A permanent change to the prices is a more conservative approach and produces more significant results than applying a temporary, large price fluctuation. This approach is consistent with recommended CBA guidelines.

[31] Australian Department of Industry, Science, Energy and Resources (2022), *Resource and Energy Quarterly*, *March 2022* <https://www.industry.gov.au/data-and-publications/resources-and-energy-quarterly-march-2022>.
[32] KPMG (2022), *Coal price and FX market forecasts December 2021/January 2022* <https://home.kpmg/content/dam/kpmg/au/pdf/2020/coal-price-fx-market-forecast-december-2021-january-2022.pdf>.

Table 4.10: Summary of average coal prices used in sensitivity testing

Price	Variation in parameter	Average price (AUD $/t)
Thermal coal (Spot)	+50%	$103
	+25%	$85
	Central	$68
	-25%	$51
	-50%	$34
Semi-hard coking coal (Contract)	+50%	$224
	+25%	$187
	Central	$150
	-25%	$112
	-50%	$75

Note: Numbers in this table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

The alternative prices for the cost of carbon have been identified in the Review of the NSW Energy Savings Scheme.[33] As the cost of carbon series used in both the central case of the CBA and this sensitivity analysis rely on assumptions that are not completely transferable to the Australian context, the sensitivity analysis series have been used to provide a range of the potential costs associated with greenhouse gas emissions.

The carbon costs were calculated using US Environmental Protection Agency (EPA) price, ranging from $79 - $132 / tonne of CO_2-e. As the Guideline (DSD, 2017) does not specify precise greenhouse gas costs to be adopted in economic impact assessments, the greenhouse gas costs adopted in the cost benefit analysis were selected in accordance with the guidance in the NSW Guidelines for the economic assessment of mining and coal seam gas proposals and other analyses provided by Deloitte Access Economics relating to other mining operations.

The sensitivity analysis was undertaken using two reference price series from the Australian Clean Energy Future Policy Scenario and the European Union Emission Allowance Units price, which is based on future derivatives published by the European Energy Exchange. The Australian prices are an average of 21% lower than the US EPA prices and range from $43 - $170 / tonne of CO_2-e. The European Union Emission Allowance Units prices are an average of 44% higher than the US EPA and range from $124 - $159 / tonne of CO_2-e.

The current market price is likely to reflect future expectations surrounding the Paris Agreement.[34] The average has been applied as a constant across the entire Project period.

The results for carbon costs are reported using the 3%, 7% and 10% discount rates. A different discount rate should not be applied to GHG emissions when compared to other components of the CBA. This is to ensure consistency across all costs and benefits identified in the CBA. This approach is consistent with the Guideline (DSD, 2017) which outlines that all costs and benefits of a project should be discounted at the same rate and sensitivity analysis should be undertaken using an upper and lower discount rate.

[33] NSW Government (2015), *Review of the NSW Energy Savings Scheme, Part 2: Options Paper* < http://www.resourcesandenergy.nsw.gov.au/energy-consumers/sustainable-energy/efficiency/scheme?a=558865>

[34] International Emissions Trading Association (2021), *GHG Market Sentiment Survey 2021* <https://www.ieta.org/Annual-GHG-Market-Sentiment-Survey>.

A sensitivity analysis of the net incremental benefit to the QLD community using a 3%, 7% and 10% discount rate based on variations of the parameters discussed above is presented in Table 4.11.

Results from the sensitivity analysis show that changes in capital cost of construction and operational input costs realise the largest changes in net benefit to QLD compared to the central case. The change in net benefit to QLD at a lower discount rate (3%) is significantly larger compared to the central case and a higher discount rate (10%) for both these parameters.

The analysis further shows that under low coal prices (25% or 50% reduction) the Project would still provide positive net benefits to the QLD community of at least $195 million in net present terms. Consequently, the net producer surplus (profit to Whitehaven WS) is still positive under the low coal price scenarios and mining operations would likely continue.

Table 4.11: Sensitivity analysis – comparison of net incremental benefits for QLD community

Parameter	Variation in parameter		Net benefits (NPV)		
			3%	7%	10%
Central	-	$m	$1,550	$882	$600
Export coal price forecasts	+50%	$m	$2,799	$1,616	$1,120
	+ 25%	$m	$2,174	$1,249	$860
	- 25%	$m	$928	$516	$342
	-50%	$m	$382	$195	$115
Capital cost of construction	+ 25%	$m	$1,386	$762	$500
	- 25%	$m	$1,678	$976	$679
Operational input costs	+ 10%	$m	$1,445	$820	$557
	- 10%	$m	$1,654	$943	$643
Royalties	+ 25%	$m	$1,801	$1,030	$705
	- 25%	$m	$1,298	$733	$495
Company income tax	+ 50%	$m	$1,602	$912	$622
	- 50%	$m	$1,497	$851	$579
	Zero	$m	$1,444	$820	$557
Cost per tonne of carbon emissions	Australian Clean Energy Future Policy Scenario (- 21 %)	$m	$1,565	$895	$612
	European Union Emission Allowance Units (+ 44%)	$m	$1,445	$818	$555
Apportionment of carbon emissions	100% attributable to Qld	$m	$731	$421	$283

Source: Deloitte Access Economics calculations.

4.6 Additional sensitivity considerations

4.6.1 Non-automated Project

As described in Section 3.2, Whitehaven WS is investigating automation of the Project fleet, and has adopted an autonomous fleet for the Project Case. However, Whitehaven WS is still considering the extent of automation, and as such, the extent may be lower than that considered in the Project Case. Therefore, analysis has also been conducted of the changes to the net economic benefits associated with the Project under a non-automated scenario, with the results of this analysis presented in Appendix C.

It is expected that the non-automated Project would also result in a significant incremental net economic benefit to the QLD community, albeit slightly lower in comparison to the Project Case (Appendix C).

4.6.2 Alternative Final Landforms

Additional sensitivity analysis was also undertaken to identify the economic costs and benefits associated with alternative final landforms for the Project. The three cases modelled include:

- full backfill of all proposed residual voids
- partial backfill of the proposed residual voids to above the pre-mining groundwater level
- covering of the exposed coal seams within the proposed residual voids.

The three alternative final landform scenarios are compared to the Project Case (Automated Case), in which three residual voids are retained (Railway Pit and South Pit mine voids backfilled). The analysis is undertaken over FY22 to FY72 to capture the delayed realisation of benefits following the closure and rehabilitation of the mine.

The costs and benefits considered in the CBA for the alternative final landforms are the same as the Project Case until coal extraction operations end and the final rehabilitation and decommissioning phase occurs (FY51 and onwards). This provides a conservative estimate of the costs and benefits associated of each alternative, as the costs would be heavily discounted. The additional rehandling of waste rock to backfill and associated duration of the Project mining fleet operation impacts rehabilitation and decommissioning costs, taxes, backfill costs and externalities. The model has been extended out to FY72 to capture the time taken to fill the proposed residual voids and the potential for grazing to occur once the residual voids have been filled. The Project is modelled from FY23 to FY72, with mining operations undertaken to FY51 in all three cases.

The assumptions and calculations used in this CBA are the same as the original Project Case, unless otherwise stated for rehabilitation and decommissioning costs, taxes, backfill costs and externalities. See Appendix D for detailed description of the methodology.

Table 4.12 breaks down the components used in the calculation of the net benefits to the QLD community. Table 4.13 then shows this relative to the Project case. All following tables report values relative to the Project Case, to highlight where differences occur.

Table 4.12: Breakdown of benefit to QLD by item

Item	Full backfill (NPV $m)	Partial backfill to above the pre-mining groundwater level (NPV $m)	Covering of exposed coal seams (NPV $m)	Project case (NPV $m)
Net producer surplus	$112	$124	$134	$135
Royalties	$696	$696	$696	$696
Company income tax	$167	$167	$167	$167
Economic benefit to workers*	-	-	-	-
Economic benefit to suppliers*	-	-	-	-
Externalities	($118)	($117)	($115)	($116)
Total	$856	$870	$881	$882

* These items are excluded from the net economic benefits to QLD community to be conservative. For more information, these are discussed qualitatively in the economic assessment report.

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Table 4.13: Breakdown of benefit to QLD relative to the Project Case

Item	Full backfill (NPV $m)	Partial backfill to above the pre-mining groundwater level (NPV $m)	Covering of exposed coal seams (NPV $m)	Project case (NPV $m)
Net producer surplus	($23)	($10)	($1)	-
Royalties	-	-	-	-
Company income tax	-	-	-	-
Economic benefit to workers*	-	-	-	-
Economic benefit to suppliers*	-	-	-	-
Externalities	($2)	($1)	($0)	-
Total	($25)	($11)	($1)	**$-**

* These items are excluded from the net economic benefits to QLD community to be conservative. For more information, these are discussed qualitatively in the economic assessment report.

Note: Numbers in this table may not add up due to rounding

Source: Deloitte Access Economics calculations.

5 Regional Impact Analysis

This chapter sets out the RIA for the Project Case. As per the Guideline, the RIA is required to identify and assess the impact across the local, regional and State economies, with specific focus on local or regional employment effects.

This chapter starts with a description of the Local area and Region, followed by an analysis of the effects on other local industries, and externalities. The chapter concludes with results of the economic impact as estimated through CGE modelling.

5.1 Background on the Region and population

The Project is located about 30 km south east of Moranbah, within the Bowen Basin Statistical Area Level 3 (SA3) area. The Guideline indicates that the impact of the Project should be considered for local, regional and State economies. Accordingly, there are two LGAs, Isaac and Mackay, defined as the 'Region' for the purposes of this RIA (shaded in green in Figure 5.1). Isaac falls within the Bowen Basin SA3 area and Mackay falls within the Mackay SA3 area. The Project lies entirely within the Isaac LGA, which is used for the Local area.

Figure 5.1: Project location and borders of relevant and nearby LGAs

Source: Australian Bureau of Statistics, *Australian Statistical Geography Standard - Volume 3 Non-ABS structures (2016).*
Note: There has been no changes to the boundaries from 2016 to 2020.

5.1.2 Population

The population of the Local area (the Isaac LGA) was 20,940 at the time of the 2016 Census. [35] Within the Region, the combined population of Isaac and Mackay LGAs, was 135,909 (or 2.9% of QLD's population).[36] Average population growth in Local area in the 10 years to 2016 was approximately 0.6% per annum, while the growth in the Region was approximately 1.3% per annum, which is lower than the average annual population growth in QLD (approximately 2.1%).[37]

Several other relevant statistics for the Local area and Region are outlined in Table 5.1 below.

Table 5.1: Population characteristics of Isaac and Mackay LGAs, 2006, 2011, 2016

Population characteristics		2006	2011	2016	2006-2016 change
Population	Local area	19,823	22,587	20,940	5.6%
	Region	120,839	135,384	135,909	12.5%
Average household size	Local area	2.8	2.9	2.7	-3.6%
	Region	2.8	2.8	2.6	-5.5%
Median age	Local area	31	31	32	3.2%
	Region	33	34	35	4.6%
Total occupied private dwellings	Local area	7,006	7,917	7,611	8.6%
	Region	44,054	48,948	51,736	17.4%
Median mortgage repayment ($/monthly)	Local area	1,083	1,900	1,521	40.4%
	Region	1,192	2,028	1,736	45.7%
Median rent ($/week)	Local area	52	63	85	63.5%
	Region	121	189	180	48.8%
Median total household income ($/week)	Local area	1,850	2,552	2,086	12.8%
	Region	1,492	2,050	1,763	18.1%

Source: Australian Bureau of Statistics, *2006, 2011 and 2016 Census of Population and Housing.*

Note: Local area is the Isaac LGA, Region is the Isaac and Mackay LGAs. The calculation of 2006-2016 change may differ from the table above due to rounding.

5.1.3 Industries of employment

Mining is the major industry of employment within the Local area and the Region, employing 59% and 22% of the employed population respectively, at the time of the 2016 Census (see Chart 5.1). For these localities, employment in the mining industry in substantially higher than in QLD as a whole, where 2.3% of the total employed population works in the mining industry.

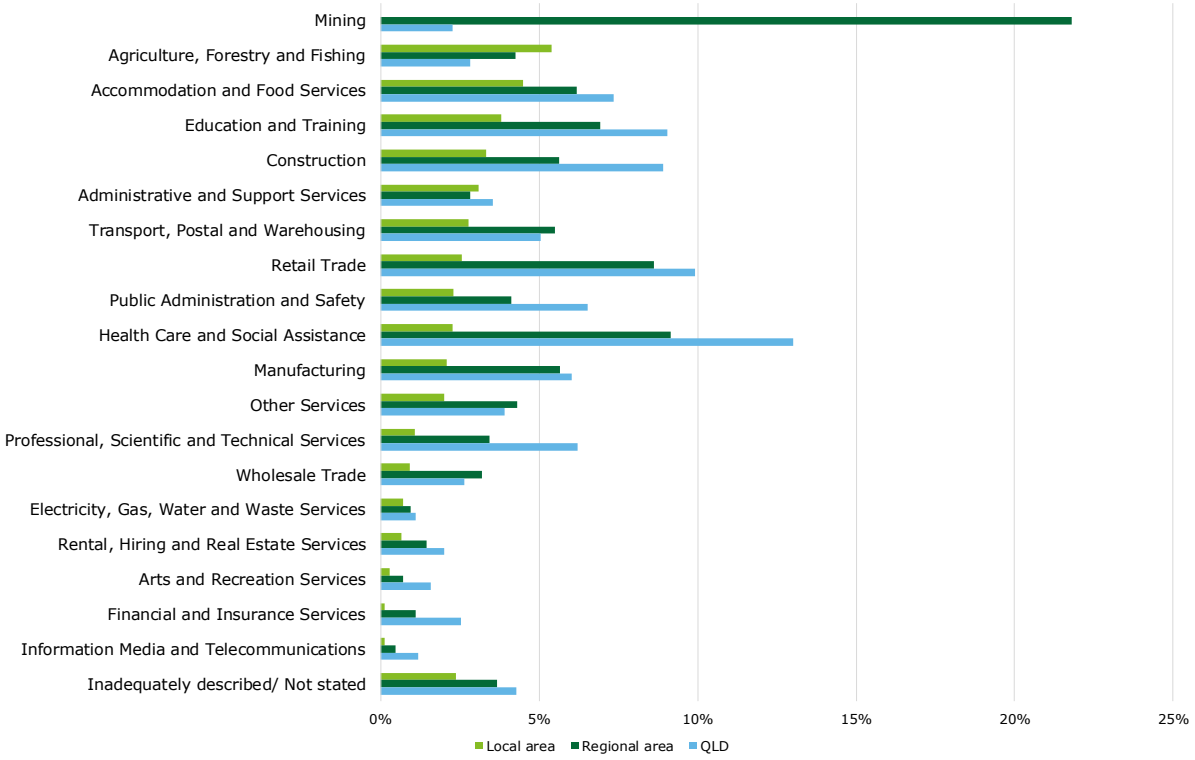
[35] Australian Bureau of Statistics (2016), *Census of Population and Housing, Time Series Profile*, Cat No. 2003.0.
[36] Australian Bureau of Statistics (2016), *Census of Population and Housing, Time Series Profile*, Cat No. 2003.0.
[37] Australian Bureau of Statistics (2016), *Census of Population and Housing, Time Series Profile*, Cat No. 2003.0.

Further, at the time of the 2016 Census, mining was the highest paying industry in the Local area and the Region, with a median weekly wage substantially higher than the median across all industries (see Chart 5.2). Within the mining industry, the vast majority of employment is in coal mining (accounting for 89% of mining industry employment in the Region).[38] The Bowen Basin has the largest coal reserve in Australia and in 2018, the SA3 accounted for 83% of QLD's total coal production.[39]

Within the Local area, there are diverse agricultural operations that contribute to employment. The agriculture, forestry and fishing industry is the second largest employer, providing employment for 5.4% of the population in Isaac LGA (see Chart 5.1).[40] The primary industry is beef cattle farming with 538 beef cattle farms within the Mackay-Isaac-Whitsunday region.[41]

The health care and social assistance industry is the second largest employer in the Region. It employed 9.2% of the working population at the 2016 Census (see Chart 5.1). This is lower than the whole of QLD, where 13% are employed in health care and social assistance.[42]

Chart 5.1: Industry of employment, Isaac and Mackay LGAs and QLD



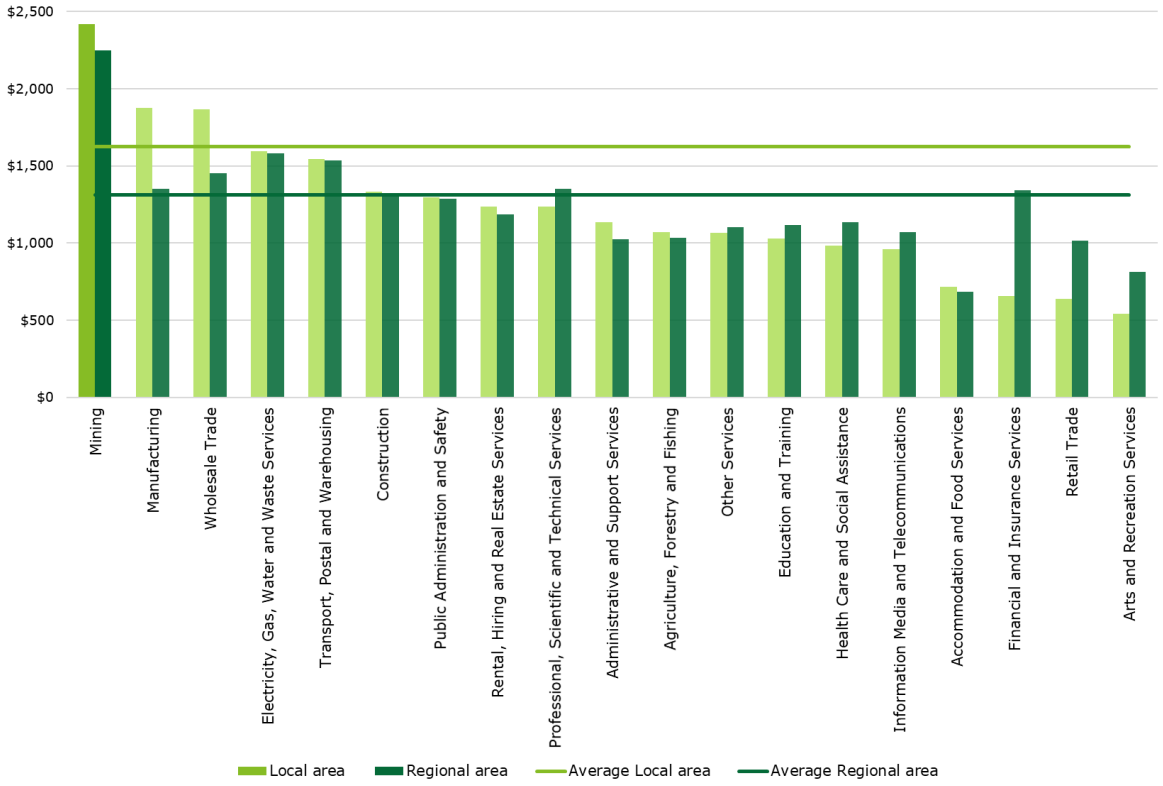
Note: Mining within the Local area accounts for 59% of employment and it has been excluded for readability.

Source: Australian Bureau of Statistics, *2016 Census of Population and Housing.*

[38] Australian Bureau of Statistics (2016), *Census of Population and Housing, Time Series Profile*, Cat No. 2003.0.
[39] Australian Trade and Investment Commission (2018), *Australian capability across the coal supply chain* <https://www.austrade.gov.au/ArticleDocuments/2814/Coal-supply-chain-icr.pdf.aspx>
[40] Australian Bureau of Statistics (2016), *Census of Population and Housing.*
[41] Australian Department of Agriculture, Water and the Environment (2020), *Regional Profile: Mackay – Isaac – Whitsunday Queensland* <https://www.agriculture.gov.au/abares/research-topics/aboutmyregion/qld-mackay#farm-financial-performance>
[42] Australian Bureau of Statistics (2016), *Census of Population and Housing.*

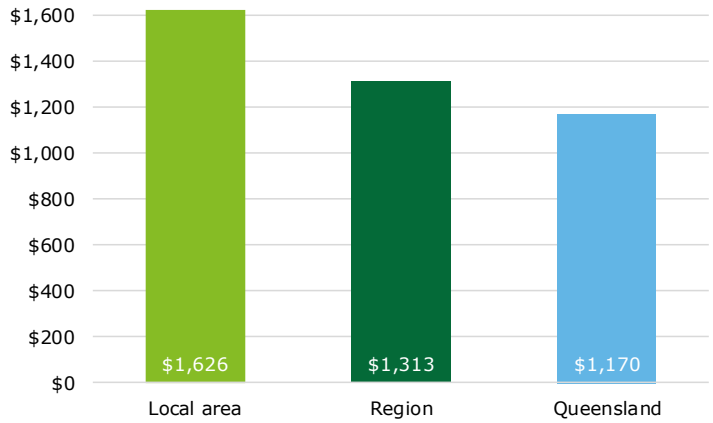
The average weekly personal income in the Local area and Region is $1,626 and $1,313, respectively, which is largely driven by high mining wages. On average, the weekly personal wage for mining is $2,419 in the Local area and $2,247 within the Region. Mining is the highest paying industry in the Region and $667 higher per week than the next highest industry (see Chart 5.2). The average wage is higher in the Local area and the Region compared to QLD (see Chart 5.3). This is driven by the fact that mining employees (on average) receive a higher wage compared to other industries, and there are higher levels of mining activity in the Local area and the Region compared to QLD.

Chart 5.2: Isaac and Mackay LGA's average weekly personal income by industry, 2016 ($2016)



Source: Australian Bureau of Statistics, *2016 Census of Population and Housing.*

Chart 5.3: Average weekly personal income, 2016 ($2016)

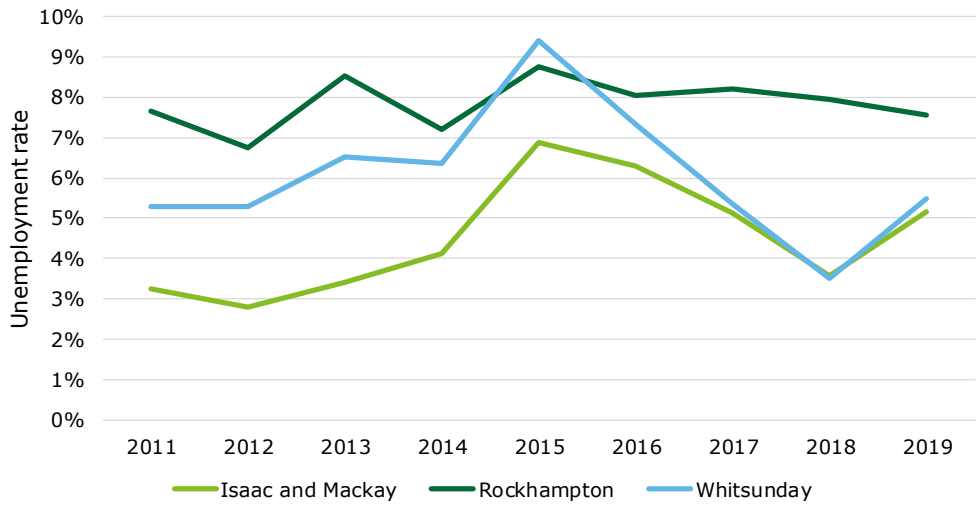


Source: Australian Bureau of Statistics, *2016 Census of Population and Housing.*

5.1.4 Unemployment

The average rate of unemployment in the Region is 5.1% and 2.1% in the Local area, as at March 2020, weighted by the labour force for each respective area.[43] This is below neighbouring LGA's Rockhampton (7.6%) and Whitsunday (5.8%). Historically, unemployment in the Region has been lower than its counterparts (see Chart 5.4). The Whitsunday LGA is a popular tourist destination and employment is dominated by accommodation and food services as well as retail trade. Within the Rockhampton LGA, the dominant employment industries are health care and social assistance and retail trade. Given the nature of tourism, there tends to be cyclical periods of job availability and may contribute to higher unemployment rates compared with the Region's, where mining is a dominant employment industry, particularly in the Isaac LGA (where the Project is located).

Chart 5.4: Isaac and Mackay LGA's average unemployment rate, 2011-2019



Source: Australian Department of Education, Skills and Employment, *Small Area Labour Markets December 2019.*

5.2 Economic impact

This section estimates the flow-on impacts of the Project. A bottom up framework is adopted to determine the likely size, timing and location of the additional activity generated by the various stages of the Project to the Region and the rest of QLD. For this, we have relied on comprehensive data on the gross mining revenue and capital expenditure associated with the Project. This commercial information includes forward development capital expenditures, production volumes and workforce requirements over the Project's design and construction, operational and rehabilitation and decommissioning phases.

5.2.1 CGE methodology

Two main techniques used to measure the flow-on economic impacts of a major project are Input-Output (IO) multiplier analysis or CGE modelling.

IO modelling is based on a system of accounts that shows the flow of economic resources between different industries and groups in the economy. IO modelling and its derived multipliers generally assume that there is an unlimited source of resources available in the economy to meet increases in demand.

[43] Australian Department of Education, Skills and Employment (2020), *Small Area Labour Markets – December quarter 2019* <https://docs.employment.gov.au/documents/lga-data-tables-small-area-labour-markets-december-quarter-2019>. Note that the March figures were reported, which excludes the impact of COVID-19 and therefore provides a picture of the typical economic conditions in the Region.

CGE modelling is an extension of IO modelling, in that it is based on a database that incorporates IO tables and the transactional details between economic agents. CGE models build on IO modelling by incorporating a system of equations and modelling parameters, based on a widely accepted body of economic theory, that model competition for resources (particularly in labour and capital markets) between economic agents. This allows for economy-wide modelling of economic impacts that incorporates any "crowding out" effects of the development.

In contrast to IO modelling, CGE modelling generally assumes that the economy and sectors within the economy are competing for the use of resources. This means that increases in demand from the Project may result in effects such as increased prices in other markets and crowding out effects (rather than just increased output). In this sense, CGE modelling is likely to provide more conservative estimates of economic impacts than the economic contribution estimates of IO modelling.

The economy-wide impacts of the Project have been projected using the Deloitte Access Economics Regional General Equilibrium Model (DAE-RGEM). The model projects macroeconomic aggregates such as Gross Value Added (GVA) and employment for the Project scenario against a reference case for each of the modelling years from FY22 to FY55. More technical detail regarding CGE modelling can be found in Appendix B.

The model has been disaggregated and customised to match the attributes of the Region. To disaggregate the Region from the rest of QLD in the model, information was used from the most recent 2016 Census on the workforce population.

The results from the economic impact analysis are presented as percentages and absolute deviations in output and employment from a baseline scenario in which the Project does not exist. The results are provided for the Region, rest of QLD and QLD overall.

Based on the gross mining revenue and capital expenditure, the modelling gauges the wider economic impacts of the development and operation of the Project at two levels:

- **Direct impacts** — the economic gains associated with 'core' commercial operations, namely the extraction and processing of coal, and revenues generated by the sale of coal exports from the Project.
- **Indirect, induced and crowding out impacts** — the economic gains in related upstream or downstream industries where the benefits associated with increased resource activity are typically the highest. As outlined above, the CGE modelling also captures any crowding out of activity in other sectors of the economy as a result of the Project.

Because of these two distinct elements, the results presented in this section may not necessarily be comparable to the output value and employment projections outlined in other areas of this CBA, which take a narrower financial view.

It is assumed that there are three key phases under the Project Case:

- Construction phase: commencing in Project Years 1 to 3 (indicatively FY23 to FY25)
- Operations phase: commencing in Project Years 2 to 29 (indicatively FY24 to FY51)
- Rehabilitation and decommissioning phase: commencing in Project Years 29 to 33 (indicatively FY51 to FY55)

5.2.2 Summary of estimated changes in the economy and flow-on effects

Table 5.2: Summary of economic impacts

		Project Case
Gross Value Added ($m NPV FY22)		
Region	$m	$7,786
Rest of QLD	$m	$3,191
Total QLD	$m	**$10,977**
Employment (average FTE)		
Region	FTE	858
Rest of QLD	FTE	892
Total QLD	FTE	**1,750**

Note: Total QLD is the sum of Region and Rest of QLD. Numbers in the table may not add up due to rounding.
Source: Deloitte Access Economics calculations.

5.2.3 Gross Value Added

GVA is the primary variable used to measure the change in economic activity, based on changes in economic output. At the national level, GVA is known as Gross Domestic Product (GDP); at the State level, Gross State Product (GSP); and at the regional level, Gross Regional Product (GRP).

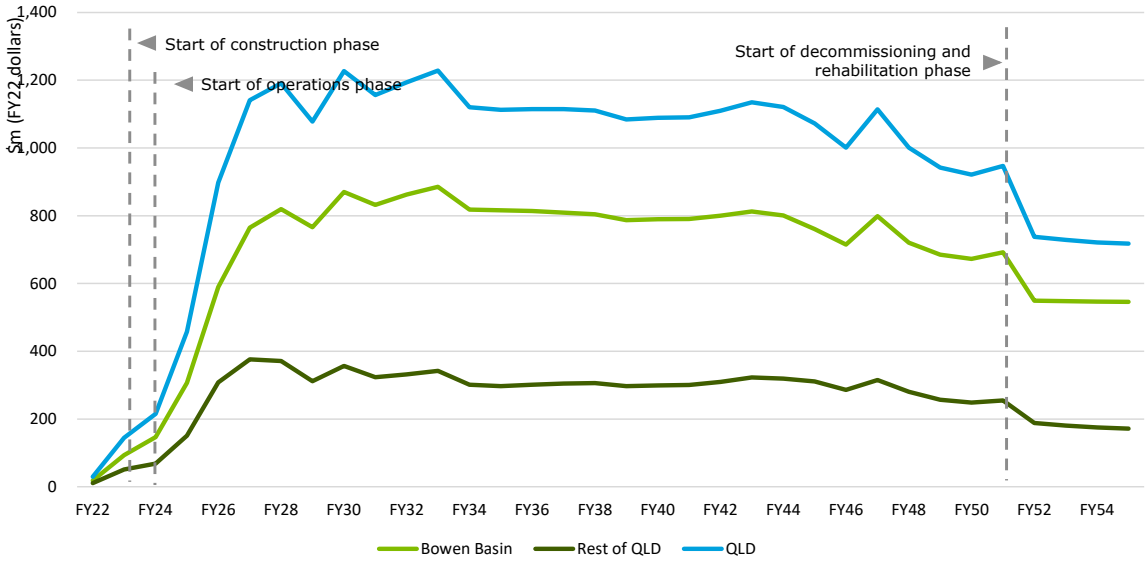
The full temporal profile of the impact on GVA in real FY22 terms as a result of the Project Case is plotted in Chart 5.5 below. The Project Case is expected to deliver a significant increase in economic activity for the Region and QLD more broadly, with an estimate increase of $10,977 million in present value in GSP. Much of the increase comes from the increase in the Region's GRP, totalling to $7,786 million in present value.

Throughout the Project, GRP in the Region tracks closely with GSP. Initially, GSP starts off low and is driven by capital investment, and then grows at a rapid pace as mining operations commence. The growth in GSP resembles the Project's coal production schedule, where ROM coal extracted and GSP sees the greatest increase in FY26 – increasing from $458 million to $898 million in present value terms. From FY26 and onwards, growth in GSP slows down as capital expenditure declines and is largely driven by the ongoing mining activities within the Region. GSP peaks at $1,228 million in FY33 and sees a gradual decline to around $718 million by FY55, and is stabilised as the rehabilitation and decommissioning phase commences. In contrast, GRP in the Rest of QLD follows a similar trend to GSP up until FY26, but remains steady as much of the change in activity occurs in the Region.

While the economic impacts to the local economy are below the level of detail available in the CGE modelling, an indicative figure can be given by applying the share of the Local area's working population relative to the Region as a whole. ABS Census data from 2016 indicates that 30% of the working population in the Region are based in Local area, suggesting that the GVA to the local economy would be in the order of $2.3 billion in present value terms.[44]

[44] Australian Bureau of Statistics (2016), *Census of Population and Housing – Place of Work.* Note that the GVA figure is only an approximation, providing an indication of the scale of impact on the Local area and is not a specific modelled output.

Chart 5.5: Gross Value Added impacts



Source: Deloitte Access Economics calculations.

5.2.4 Employment

Employment in the Project Case includes the incremental effects of direct employment at the Project site and automation control centre, flow-on effects throughout the rest of the economy and any crowding out that might occur in other sectors of the economy.

Under the Project Case, it is expected that there would be a positive effect on employment in the Region and across the Rest of QLD. It is projected that there would be an annual average increase of 858 and 892 jobs in the Region and Rest of QLD respectively.

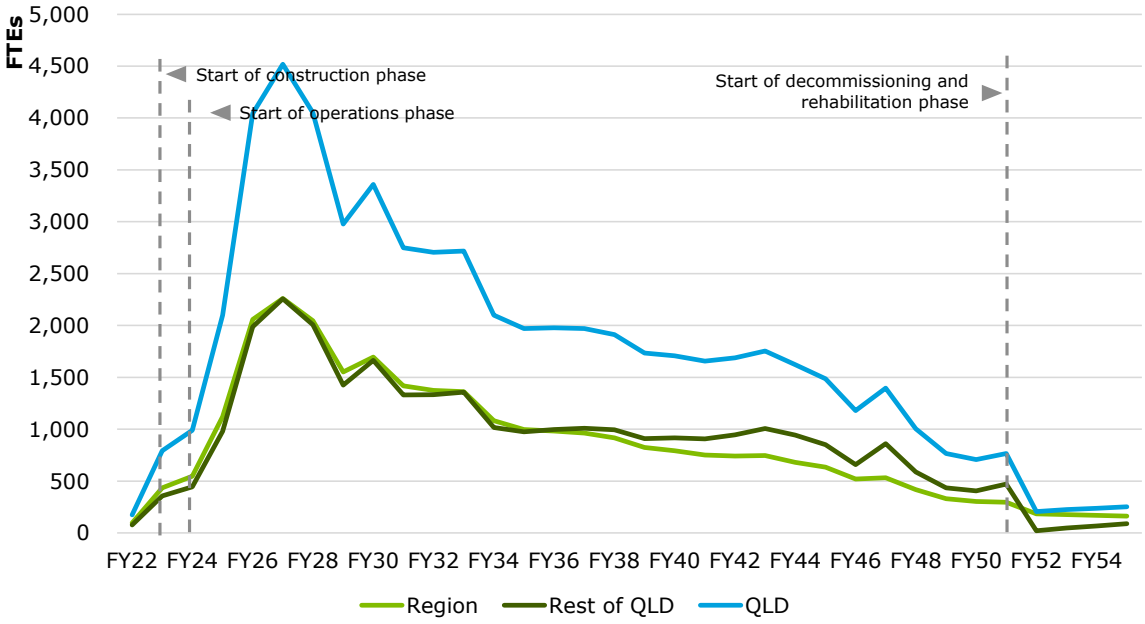
Similar to GSP, the increase in employment as a result of the Project starts off low in the first few years, with majority of the employees coming from the construction industry as part of the Project's construction phase (Chart 5.6). Employment numbers see a sharp increase in FY26 as mining operations ramp up, with an additional 1,944 FTEs employed. The increase in employment mainly occurs in the services sector as the Project lifts average incomes, and therefore, demand for output from labour intensive services sectors. FY27 is the year in which employment is expected to be the highest, reaching a peak of 4,518 FTEs, before seeing a steady decline over the remainder of the Project's life.

On average, the positive impact on employment numbers is spread equally across both the Region and Rest of QLD. By the end of the Project's life, the net impact of employment, at the State level, approaches zero.

Similar to estimating the GVA attributed to the Local area, the share of the Local area's working population (relative to the Region as a whole) is applied to the projected impact on employment in the Region. Of the 858 additional FTE created in the Region, it is estimated that approximately 261 FTE are created in the Local area.[45]

[45] Note that the employment figure is only an approximation, providing an indication of the scale of impact on the Local area and is not a specific modelled output.

Chart 5.6: Incremental employment impacts (FTEs)



Source: Deloitte Access Economics calculations.

5.2.5 Sectoral impacts

Much of the growth in QLD's economic output is reflected by the expansion of metallurgical and thermal coal mines in the Region. Furthermore, the introduction of the Project is also expected to generate significant spill-over growth for other industries, with the top eight sectors visualised in Chart 5.7. Significant direct and indirect benefits are predicted to arise from the Project, generating a total GSP of $9.8 billion in present value terms from spill-over growth for multiple sectors.

Under the Project Case, the construction and the services sectors are expected to experience a significantly large positive impact relative to the Base Case, as the Project draws on labour from sectors for the construction and operations phases respectively. These two industries collectively account for most of the economic spill-overs generated by the Project, with GSP of $5.4 billion in present value terms.

There are other related sectors that are also expected to benefit from the Project. With the exception of the trade sector, the spill-overs generated are relatively smaller than in the construction and service sectors. This includes:

- Trade sector, which benefits from increasing trade activity from both domestically through trading local goods and services and internationally through the export of coal. The sector is estimated to generate an additional $1.5 billion in present value terms.
- Petroleum and coke product manufacturing sector, which relies on metallurgical coal as a primary input. The sector indirectly benefits from lower input costs due to an increased metallurgical coal supply from the Project (driven by increased export demand which indirectly benefits the industry overall). It is expected that there would be an additional $240 million generated for this sector in present value terms.
- Transport sector, which benefits from higher general economic activity and increase in goods requiring freight, with an estimated additional benefit of $56 million in present value terms.

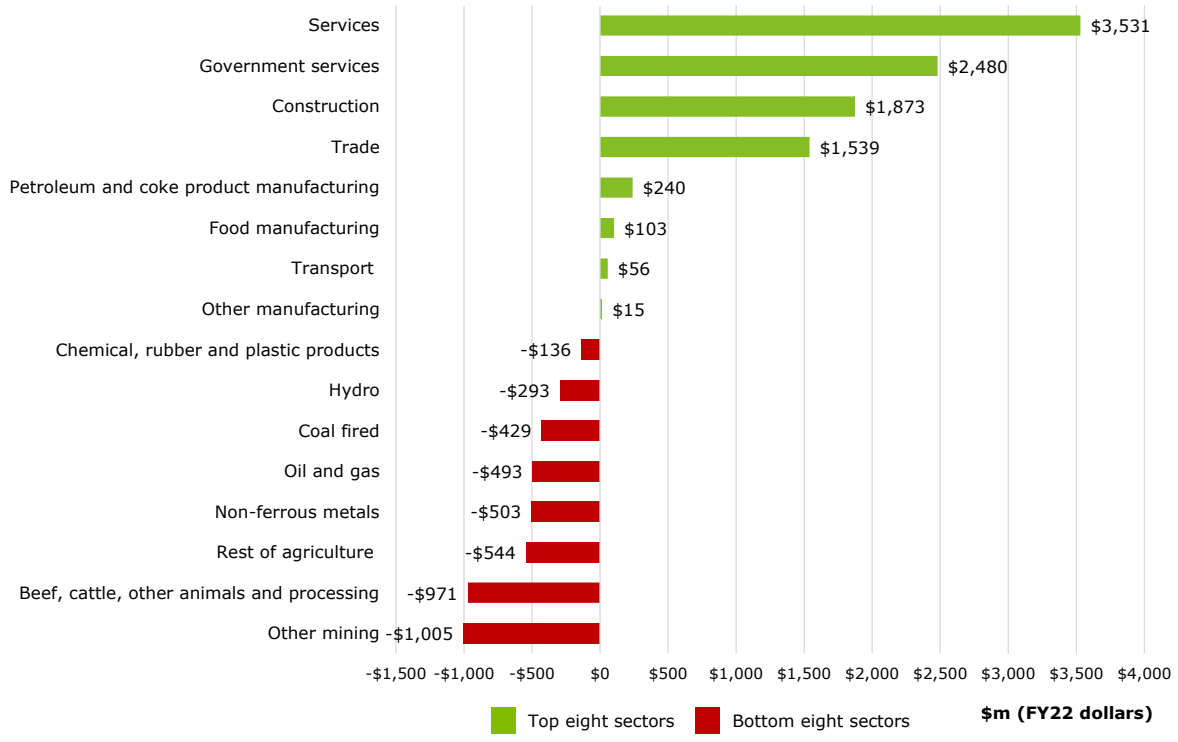
While there are significant direct and indirect spill-over effects arising from the Project ($9.8 billion in present value), there are sectors that are expected to be crowded out. The effects of crowding out are estimated to be $4.8 billion in present value terms, with a significant proportion attributed to other mining and agriculture sectors.[46] Chart 5.7 below shows the top eight sectors affected.

The crowding out effects become prevalent as the Project increases demand for factors of production (i.e., labour and capital) and diverts them from sectors that are less able to compete with higher wages or rates of return on capital, thereby lowering their production capacity. Furthermore, increased exports resulting from the Project causes an appreciation of the exchange rate and therefore acts as a headwind for sectors heavily reliant on exporting such as agriculture, manufacturing and some other types of mining.

The agriculture industry would experience some crowding out effects from the Project with an estimated decline of $1,515 million in present value terms.

Overall, the Project is expected to result in a net increase in sectoral impacts due to the significant spill-over effects predicted to other industries, which outweighs the predicted crowding out effects.

Chart 5.7: QLD's industry value-added, NPV



Source: Deloitte Access Economics calculations.

Note: Other mining is the mining sectors other than coal mining, such as oil and gas mining; Rest of agriculture is the agriculture sectors other than animal processing, dairy, and sugar products.

[46] Other mining is the mining sectors other than coal mining, such as oil and gas mining.

5.2.6 Additional considerations

As described in Section 3.2, Whitehaven WS is investigating automation of the Project fleet, and has adopted an autonomous fleet for the Project Case. However, Whitehaven WS is still considering the extent of automation, and as such, the extent may be lower than that considered in the Project Case. Therefore, consistent with the approach for the CBA, analysis has also been conducted of the changes to the economic impacts on the regional and State economies, associated with the non-automated Project. The results of this analysis presented in Appendix C.

It is important to note that this assessment assumed only that the Project's labour requirements would change. The results should be read with this in mind. Key outcomes from this analysis include the following:

- GRP for the Region is expected to be lower when compared to the Project Case. Overall, GSP for QLD is expected to be lower compared to the Project Case.
- Employment in the Region would increase in comparison to the Project Case, resulting in greater employment benefits to QLD.
- It is also expected that GVA would decline and employment would rise in the Local area relative to the Project Case, as it is approximated by apportioning a share of the economic impacts from the Region.
- The sectoral impacts are expected to be very similar to the Project Case, with the magnitude only differing slightly. The breakdown of spill-over growth is expected to be consistent with the Project Case, with the construction and services sectors receiving the greatest economic spill-overs generated by the non-automated Project. Similarly, the breakdown of crowding out effects is also to be expected to be consistent with the Project Case, with other mining and agricultural sectors experiencing the largest disbenefit under the non-automated Project.

Appendix A: Checklist

A.1. DSDMIP (2019) Terms of reference for an Environmental Impact Statement – Winchester South Project

Requirements	Addressed
11.125. Identify the potential adverse and beneficial economic impacts of the project on the local and regional area and the State. Estimate the costs and benefits and economic impacts of the proposal using both regional impact analysis and cost–benefit analysis. The analysis is to be consistent with the Coordinator-General's Economic impact assessment guideline (April 2017). Separately address each major stage of the proposed project (e.g. construction, operation and decommissioning and rehabilitation).	Detailed in Table A.1 below.
11.126. Compare the estimated costs and benefits of the site's proposed final land uses to demonstrate that a variety of configurations have been investigated to optimise the final landform design against the estimated costs and benefits of the following alternative final land uses: (a) full rehabilitation of the site with no final void(s) and non-use management areas (b) rehabilitation with partial backfilling of void(s) (c) usual practice such as overburden waste dumps and stockpiles (d) alternative location and configuration of infrastructure and structures.	4.6.2 and Appendix D and the Main Text of the Additional Information
11.127. Identify any existing or proposed incompatible land uses within and adjacent to the site and including the impacts on economic resources and the future availability and viability of the resource including extraction, processing and transport location to markets.	Included in the Main Text of the Draft EIS and Additional Information

Table A.1: Key requirements mentioned in the Guideline

Requirements	Addressed in this Report	Reference
The EIA [Economic Impact Assessment] must:		
• use best current data available	Yes	2
• use standard and consistent terms and methodologies at all stages of the project	Yes	2
• cover the full life-cycle of the project	Yes	2
• specify the modelling methodologies used	Yes	2
• adopt an appropriate discount rate for costs and benefits occurring in the future	Yes	4.4
• document all key assumptions and their rationale	Yes	4
• explain the methods used to gather information	Yes	4.3
• describe how key impacted stakeholders and communities were consulted and the data they provided	No	Addressed in the Social Impact Assessment
• express monetary values in Australia dollars adjusted to a common date	Yes	2

Requirements	Addressed in this Report	Reference
• use risk management framework to focus on the impacts with the highest probability and consequential impacts	No	Addressed in the Social Impact Assessment
• consider cumulative impacts of other developments in the region, where feasible	No	Addressed in the Social Impact Assessment
• undertake the EIA as an integral component of the EIS, together with the social and environmental impact assessments for the project.	Yes	4 and 5
The specific consideration of regional economic impacts must also provide an overview of:		
• the key stakeholders and communities of interest	Yes	4.2 and 5.1
• the local, regional, state and national economies of interest	Yes	5
• local business and industry content opportunities	Yes	5.1
• source locations of employees and contractors	Yes	4.3.6
• cost of living pressures such as impacts on housing supply and demand and household goods and services	No	Addressed in the Social Impact Assessment
• demands for other essential services and facilities	No	Addressed in the Social Impact Assessment
• expected timing and geographic distribution of impacts	Yes	5.2
• any relevant positive and negative externalities.	Yes	4.3.8
Where possible, impact modelling should also describe and quantify the following:		
• capital and operational expenditure	Yes	4.3.3
• project revenues	Yes	4.3.2
• direct impacts on gross regional product and gross state product	Yes	5.2.3
• any relevant royalties, taxes and duties	Yes	4.3.4 and 4.3.5
• any relevant site remediation costs	Yes	4.3.3
• source of goods and services, Queensland, interstate and overseas	No	Addressed in the Social Impact Assessment
• workforce and labour market impacts, including effects on wages and local labour supply and demand	Yes	5.2.4
• direct and indirect full-time equivalent job numbers at each phase of construction and operation	Yes	4.3.6

A.2. Queensland Treasury (2015) Project Assessment Framework – Cost-benefit analysis

Table A.2: Key steps mentioned in the Queensland Treasury (2015) guideline

Requirements	Addressed	Reference
Identify the outcome sought	Yes	3
Develop the project and policy options		
Status quo	Yes	3.1
Other options	Yes	3.2, 0 and 5.2.6
Undertake a preliminary evaluation of the options	Yes	4.2
Evaluate project options in detail		
Cost benefit analysis	Yes	
Determine key assumptions	Yes	4
Identify and estimate the expected economic benefits and costs of the project	Yes	
Quantify impacts that can be valued as costs and benefits	Yes	4.3
Identify the unquantifiable environmental costs and benefits and the result of any cost effectiveness analysis undertaken	Yes	4.3.8
Address findings of any Environmental Impact Assessment undertaken	Yes	4.3.8
Identification of the distribution of the environmental benefits and costs	Yes	4.3.8.1
Identification of assumptions made regarding the inclusion or exclusion of certain costs and benefits	Yes	4.2
Calculate the net present economic value	Yes	4.3.8.1
Assess risks and sensitivities	Yes	4.5, 4.6
Select preferred option		
Cost benefit analysis conclusion, recommendations and checklist	No	n/a

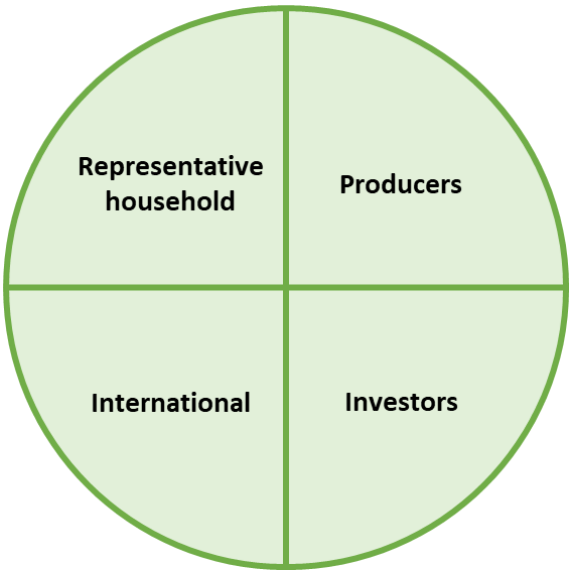
Appendix B: Computable General Equilibrium Modelling

The DAE-RGEM (Deloitte Access Economics Regional General Equilibrium Model) is a large scale, dynamic, multi-region, multi-commodity computable general equilibrium model of the world economy. The model allows policy analysis in a single, robust, integrated economic framework. This model projects changes in macroeconomic aggregates such as GDP, employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced.

The model is based upon a set of key underlying relationships between the various components of the model, each which represent a different group of agents in the economy. These relationships are solved simultaneously, and so there is no logical start or end point for describing how the model actually works.

Figure B.1 shows the key components of the model for an individual region. The components include a representative household, producers, investors and international (or linkages with the other regions in the model, including other Australian States and foreign regions). Below is a description of each component of the model and key linkages between components. Additional technical detail is also provided.

Figure B.1: Key components of DAE-RGEM



DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key assumptions underpinning the model are:

- The model contains a 'regional consumer' that receives all income from factor payments (labour, capital, land and natural resources), taxes and net foreign income from borrowing (lending).
- Income is allocated across household consumption, government consumption and savings so as to maximise a Cobb-Douglas (C-D) utility function.

- Household consumption for composite goods is determined by minimising expenditure via a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and imported sources. In the Australian regions, households can also source goods from interstate. In all cases, the choice of commodities by source is determined by a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function.
- Government consumption for composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of creating capital.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Composite intermediate inputs are also combined in fixed proportions, whereas individual primary factors are combined using a constant elasticity of substitution production function.
- Producers are cost minimisers, and in doing so, choose between domestic, imported and interstate intermediate inputs via a CRESH production function.
- The model contains a more detailed treatment of the electricity sector that is based on the 'technology bundle' approach for general equilibrium modelling developed by ABARE (Australian Bureau of Agricultural and Resource Economics) (1996).
- The supply of labour is positively influenced by movements in the real wage rate governed by an elasticity of supply.
- Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. A global investor ranks countries as investment destinations based on two factors: global investment and rates of return in a given region compared with global rates of return. Once the aggregate investment has been determined for Australia, aggregate investment in each Australian sub-region is determined by an Australian investor based on: Australian investment and rates of return in a given sub-region compared with the national rate of return.
- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.
- Prices are determined via market-clearing conditions that require sectoral output (supply) to equal the amount sold (demand) to final users (households and government), intermediate users (firms and investors), foreigners (international exports), and other Australian regions (interstate exports).
- For internationally-traded goods (imports and exports), the Armington assumption is applied whereby the same goods produced in different countries are treated as imperfect substitutes. But, in relative terms, imported goods from different regions are treated as closer substitutes than domestically-produced goods and imported composites. Goods traded interstate within the Australian regions are assumed to be closer substitutes again.
- The model accounts for greenhouse gas emissions from fossil fuel combustion. Taxes can be applied to emissions, which are converted to good-specific sales taxes that impact on demand. Emission quotas can be set by region and these can be traded at a value equal to the carbon tax avoided, where a region's emissions fall below or exceed their quota.

The representative household

Each region in the model has a so-called representative household that receives and spends all income. The representative household allocates income across three different expenditure areas: private household consumption; government consumption; and savings.

Going clockwise around Figure B.1, the representative household interacts with producers in two ways. First, by allocating expenditure across household and government consumption, this sustains demand for production. Second, the representative household owns and receives all income from factor payments (labour, capital, land and natural resources) as well as net taxes. Factors of production are used by producers as inputs into production along with intermediate inputs. The level of production, as well as supply of factors, determines the amount of income generated in each region.

The representative household's relationship with investors is through the supply of investable funds – savings. The relationship between the representative household and the international sector is twofold. Firstly, importers compete with domestic producers in consumption markets. Secondly, other regions in the model can lend (borrow) money from each other.

Some detail:

- The representative household allocates income across three different expenditure areas – private household consumption; government consumption; and savings – to maximise a C-D utility function.
- Private household consumption on composite goods is determined by minimising a CDE expenditure function. Private household consumption on composite goods from different sources is determined by a CRESH utility function.
- Government consumption on composite goods, and composite goods from different sources, is determined by maximising a C-D utility function.
- All savings generated in each region are used to purchase bonds whose price movements reflect movements in the price of generating capital.

Producers

Apart from selling goods and services to households and government, producers sell products to each other (intermediate usage) and to investors. Intermediate usage is where one producer supplies inputs to another's production. For example, coal producers supply inputs to the electricity sector or the steel manufacturing sector.

Capital is an input into production. Investors react to the conditions facing producers in a region to determine the amount of investment. Generally, increases in production are accompanied by increased investment. In addition, the production of machinery, construction of buildings and the like that forms the basis of a region's capital stock, is undertaken by producers. In other words, investment demand adds to household and government expenditure from the representative household, to determine the demand for goods and services in a region.

Producers interact with international markets in two main ways. Firstly, they compete with producers in overseas regions for export markets, as well as in their own region. Secondly, they use inputs from overseas in their production.

Some detail:

- Sectoral output equals the amount demanded by consumers (households and government) and intermediate users (firms and investors) as well as exports.
- Intermediate inputs are assumed to be combined in fixed proportions at the composite level. As mentioned above, the exception to this is the electricity sector that is able to substitute different technologies (brown coal, black coal, oil, gas, hydropower and other renewables) using the 'technology bundle' approach developed by ABARE (1996).
- To minimise costs, producers substitute between domestic and imported intermediate inputs is governed by the Armington assumption as well as between primary factors of production (through a constant elasticity of substitution [CES] aggregator). Substitution between skilled and unskilled labour is also allowed (again via a CES function).
- The supply of labour is positively influenced by movements in the wage rate governed by an elasticity of supply (is assumed to be 0.2). This implies that changes influencing the demand for labour, positively or negatively, will impact both the level of employment and the wage rate. This is a typical labour market specification for a dynamic model such as DAE-RGEM. There are other labour market 'settings' that can be used. First, the labour market could take on long-run characteristics with aggregate employment being fixed and any changes to labour demand changes being absorbed through movements in the wage rate. Second, the labour market could take on short-run characteristics with fixed wages and flexible employment levels.

Investors

Investment takes place in a global market and allows for different regions to have different rates of return that reflect different risk profiles and policy impediments to investment. The global investor ranks countries as investment destinations based on two factors: current economic growth and rates of return in a given region compared with global rates of return.

Some detail:

- Once aggregate investment is determined in each region, the regional investor constructs capital goods by combining composite investment goods in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these goods via a CRESH production function.

International

Each of the components outlined above operate simultaneously in each region of the model. That is, for any simulation the model forecasts changes to trade and investment flows within, and between, regions subject to optimising behaviour by producers, consumers and investors. Of course, this implies some global conditions must be met such as global exports and global imports are the same and that global debt repayments equals global debt receipts each year.

Appendix C: Non-automated Project

The analysis in this appendix considers the effect the extent of automation would have on the net economic benefits associated with the Project, by assessing the net economic benefits that would be incurred under a non-automated Project, referred to as the Non-automated Project.

The non-automated Project would be similar to the Project Case, with the exception of an increased operational workforce in lieu of an autonomous fleet – with up to 750 FTE in a given year. Aside from direct employment opportunities, there would be no differences in the Project's production estimates, infrastructure requisites and rehabilitation strategies, as the quantity and rate of coal extracted and produced would not change.

Whitehaven WS advised that there are cost savings under the Project Case as a result of greater productivity from automation. On average, the Project Case has a cost saving of approximately 2.3% across FY24 to FY55, which is applied to the direct mining costs estimate to reflect productivity gains.

C.1. Cost Benefit Analysis

The breakdown of the net producer surplus calculation for both the Project Case and Non-automated Case is summarised in Table C.1. The table also provides a brief description, outlining the direction and logic behind the difference in the two cases.

Overall, the **net producer surplus** is estimated to be $921 million in present value (or $3,659 million in undiscounted terms), which is lower than the Project Case. This is due to a net increase in operating costs, payroll taxes and local government rates as a result of an increased operational workforce, outweighing the decrease associated with company income tax as a result of reduced taxable income. From the perspective of the QLD community, the net producer surplus is estimated to be $117 million in present value in the Non-automated Case, which is $18 million less than the Project Case (see Table C.2).

Table C.1: Sensitivity analysis - net producer surplus

Item	Project Case (NPV) ($m)	Non-automated Case (NPV) ($m)	Change under the Non-automated Case
Revenue			
Gross revenue	$9,874	$9,874	**No change** – no changes to the quantity or rate of product coal produced by the Project and therefore no change to the revenue generated by the Project.
Residual value of land	-	-	**No change –** residual value of land is conservatively assumed to be zero in both Cases.
Residual value of capital	-	-	**No change –** residual value of capital is conservatively assumed to be zero in both Cases, as all capital assets are expected to be fully

Item	Project Case (NPV) ($m)	Non-automated Case (NPV) ($m)	Change under the Non-automated Case
			depreciated over the life of the Project.
Total	**$9,874**	**$9,874**	**No change** – no change to the total revenue generated by the Project as there are no changes to gross revenue, residual value of land or capital.
Costs			
Operating costs	$5,524	$5,690	**Increase** – lower productivity which results in an increase of approximately 3%.
Capital costs	$1,621	$1,617	**Decrease** – the costs associated with the automation control centre are not required.
Rehabilitation and decommissioning costs	$103	$104	**Increase** – the final landform for the Project would not change (i.e., no change to the rehabilitation requirements). There are additional costs in FY52 and FY53.
Total	**$7,247**	**$7,411**	**Increase** – the increase in costs associated with the operating costs is greater than the decrease in capital costs.
Royalties			
Ad valorem coal royalties	$696	$696	**No change** – royalties are calculated by applying the ad valorem mining royalty rate to the anticipated coal revenue (less GST and freight costs), which is unchanged.
Total	**$696**	**$696**	**No change** – due to no change in royalties generated by the Project.
Taxes			
Company income tax	$830	$796	**Decrease** – increased operating costs reduces company income tax, which is based on applying an effective tax rate of 30% on taxable income (gross mining revenue less operating costs, rehabilitation and decommissioning costs, royalties and

Item	Project Case (NPV) ($m)	Non-automated Case (NPV) ($m)	Change under the Non-automated Case
			depreciation on capital assets).
Payroll tax	$35	$46	**Increase** – operational workforce increases, and payroll tax is a function of expected employee wage costs.
Local government rates	$3.0	$3.6	**Increase** – operational workforce increases, and the rates payable to the Isaac Regional Council are a function of the workforce employed by the Project.
Total	**$867**	**$846**	**Decrease** – the reduction in company income tax more than offsets the increase in payroll tax and local government rates combined.
Net producer surplus	**$1,064**	**$921**	**Decrease –** due to the net increase in costs and taxes.

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

Table C.2: Sensitivity analysis - share of the net producer surplus attributable to QLD community

Item		Project Case (NPV)	Non-automated Case (NPV)	Difference (NPV)
Net producer surplus	$m	$1,064	$921	$142
QLD share of Project's ownership	%	13%	13%	
Value of net producer surplus attributable to QLD	$m	**$135**	**$117**	**$18**

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

The **net incremental economic benefit to QLD community** is expected to amount to $857 million in present value. As from Table C.3, the results are relative to the Base Case, which suggests that the Non-automated Case would still result in a significant incremental net economic benefit to the QLD community, albeit slightly lower in comparison to the Project Case.

As detailed in Table C.1, it is expected that the **royalties** for the Project would not change, as they are calculated by applying the ad valorem mining royalty rate to the anticipated coal revenue (less GST and freight costs). As there is no change to the gross revenue of the Project, since the quantity or rate of product coal produced by the Project would not change, royalties generated under the Non-automated Case would therefore remain the same as those generated under the Project Case.

In contrast, **company income tax** payable is anticipated to decrease under the Non-automated Case, as it is computed by applying an effective tax rate of 30% on taxable income (gross mining revenue less operating costs, rehabilitation and decommissioning costs, royalties and depreciation on capital assets). Due to an increase in costs, taxable income would be reduced, and subsequently lower company income tax.

Consistent with the approach for the Project Case, there would be no benefits to workers as it is conservatively assumed that the workers do not receive a wage premium and would receive a wage consistent with market rates. Accordingly, there would be no benefits to suppliers for the Non-automated Case, as it is conservatively assumed that suppliers would earn similar margins relative to what they could have receive from other sources under the Base Case.

As there would be no changes to the scope of the Project under the Non-automated Case beyond the absence of an autonomous fleet, it is expected that there would be no material changes for the costs associated with externalities.[47]

Table C.3: Sensitivity analysis – net incremental benefit attributable to QLD community

Item	Project Case Incremental benefit to QLD (NPV $m)	Non-automated Case Incremental benefit to QLD (NPV $m)	Change under the non-automated Project
Net producer surplus	$134	$116	Decrease (Table C.2)
Royalties	$696	$696	No change (Table C.1)
Company income tax	$167	$160	Decrease (Table C.1)
Economic benefit to workers	-	-	No change
Economic benefit to suppliers	-	-	No change
Externalities	$116	$116	No material change expected
Total	**$882**	**$857**	**Decrease**

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

C.2. Regional Impact Analysis

Table C.4 presents the key economic indicators: GVA and employment, for the Project Case and Non-automated Case as estimated by the CGE modelling. The table also provides a brief description, outlining the direction and logic behind the difference in the two cases.

The Non-automated Case is expected to deliver a significant increase in economic activity for the Region and QLD more broadly, albeit slightly lower than the Project Case. **GSP** for the State is estimated increase by $10.77 million in present value, and **GRP** for the Region is estimated to increase by $7.5 million in present value, both as a result of the Non-automated Case. Conversely, there is a larger positive effect on **employment** in the Region and across the Rest of QLD, relative to the Project Case. It is projected that there is an annual average increase of 926 and 1,848 jobs in the Region and QLD, respectively under the Non-automated Case. Note that the difference in change in employment (as projected in the CGE model) under the Project Case and Non-automated Case differs from the actual Project numbers as the CGE modelling considers the impact of employment in the entire economy, and not just the Project alone.

[47] Note that the externalities under the Non-automated Case are expected to be similar to the Project Case due to both cases involving the same production profile.

Table C.4: Sensitivity analysis – economic impacts

	Project Case	Non-automated Case	Change under the Non-automated Case
Gross Value Added ($m NPV FY22)			
Region	$7,786	$7,488	**Decrease** – there is reduced efficiency in the absence of an autonomous fleet, which more than offsets the increased spend on employing additional workers in the Region.
Rest of QLD	$3,191	$3,278	**Increase** – increased labour cost from employing additional workers in the Rest of QLD.
Total QLD	**$10,977**	**$10,765**	**Decrease** - the reduced efficiency in mining activities more than offsets the increased spend on employing additional workers.
Employment (average FTE)			
Region	858	926	**Increase** – more workers are employed in lieu of an autonomous fleet.
Rest of QLD	892	922	
Total QLD	**1,750**	**1,848**	

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

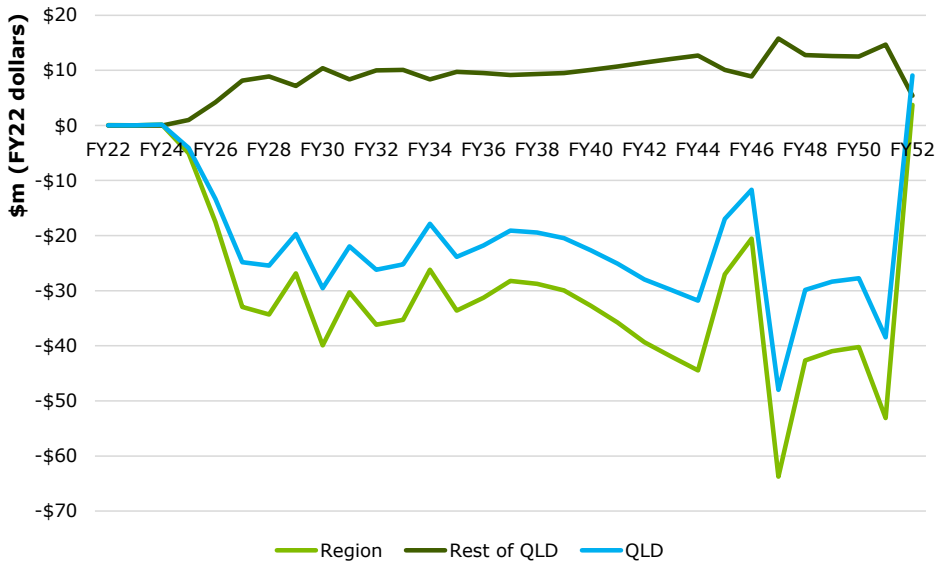
Note that GVA and employment in the local economy are not modelled in the CGE modelling, and has been approximated by applying the share of the Local area's working population (relative to the Region as a whole) to the modelled results. Using ABS Census data from 2016, 30% is applied to GRP which gives an indicative estimate of $2.3 billion increase in present value terms in economic activity in the Local area. Using the same approach on employment in the Region, it is expected that approximately 282 additional FTEs are created in the Local area.[48]

Chart C.1 shows the differences in GVA between the Project Case and Non-automated Case each year. Across the period of the Project, the Region's GRP under the Non-automated Case is consistently lower than the Project Case, while the Rest of QLD's GRP is consistently higher. The decline in GSP is due to the change in the former outweighing the change in the latter.

While the contribution to GSP is estimated to be lower under the Non-automated Case for almost all periods of the Project, it is predicted to be higher (relative to the Project Case) in the rehabilitation and decommissioning phase. During these final two years, the difference in efficiency between the two cases reduces as mining operations conclude, and most of the contributions to GSP are attributed to labour costs – with more workers estimated to be employed in the Rest of QLD (see Chart C.2).

[48] Australian Bureau of Statistics (2016), *Census of Population and Housing – Place of Work.* Note that the GVA and employment figures are only an approximation, providing an indication of the scale of impact on the Local area and are not modelled outputs.

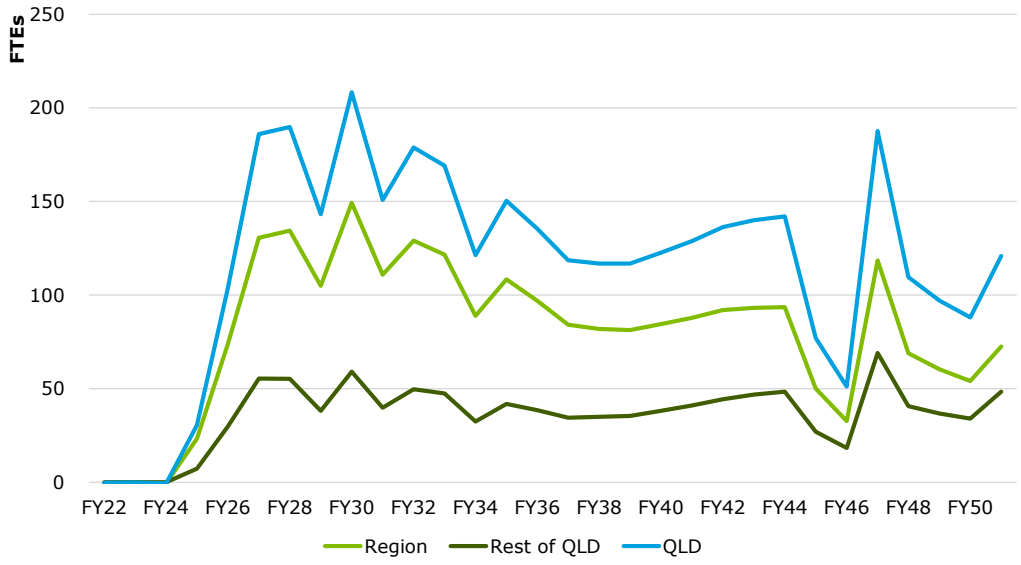
Chart C.1: Difference in Gross Value Added impacts for the Non-automated Case relative to the Project Case



Source: Deloitte Access Economics

As from Chart C.2, there is an increase in employment under the Non-automated Case, compared to the Project Case. This applies to both the Region and Rest of QLD, with the increase being more prominent in the former during most years, except for the rehabilitation and decommissioning phase where there is more employment from Rest of QLD.

Chart C.2: Difference in employment impacts for the Non-automated Case relative to the Project Case



Source: Deloitte Access Economics.

The sectoral impacts from spill-overs and crowding out is very similar in both the Project Case and Non-automated Case, with no change in the top industries affected by spill-overs and crowding out. However, the Non-automated Case sees sectors experiencing relatively more severe effects of crowding out, resulting in an overall net disbenefit increase of $301 million in present value terms, relative to the Project Case.

Appendix D: Alternative Final Landforms

The analysis in this appendix considers the net economic benefits associated with following alternative final landforms for the Project:

- full backfill of all proposed residual voids
- partial backfill of the proposed residual voids to above the pre-mining groundwater level
- covering of the exposed coal seams within the proposed residual voids.

D.1. Rehabilitation, decommissioning and backfill costs

The total undiscounted value of decommissioning costs remain the same for all alternative final landform scenarios. However, backfilling the proposed residual voids prolongs the use of the mining fleet (and therefore use of associated mine infrastructure, such as administration buildings, etc.) delaying the occurrence of the costs associated with decommissioning infrastructure.

For the Project Case (which includes backfilling of Railway Pit and South Pit mine voids), rehabilitation and decommissioning costs are estimated to be a combined net present value of $103 million (or $389 million in undiscounted terms). Rehabilitation activities would occur concurrently with mining operations from FY24 to FY55.

For the full backfill alternative, the backfilling of the proposed residual voids increases the duration the Project mining fleet operates by approximately six years, delaying decommissioning of mine infrastructure. The rehabilitation, decommissioning and backfilling costs are estimated to give a combined present value cost of $281 million (or $2,059 million in undiscounted terms).

For the partial backfill of the proposed residual voids to above the pre-mining groundwater level alternative, the rehabilitation, decommissioning and backfilling costs are estimated to give a combined present value cost of $183 million (or $1,080 million in undiscounted terms).

For the covering of exposed coal seams alternative, the rehabilitation, decommissioning and backfilling costs are estimated to give a combined present value cost of $108 million (or $427 million in undiscounted terms).

D.2. Taxes

Payroll taxes

Payroll tax is estimated to vary between $35 million and $38 million in present value across the four alternatives. This tax component is estimated as a function of expected employee wage costs and data on the number of FTE staff employed over the course of the Project, which varies for all three alternatives, as the extent of backfilling activities for each alternative affects the number of staff employed and duration of continued employment.

Local government rates

Additional local government rates are incurred as the rates are a function of the workforce employed at the Project (refer to Section 4.3.5) and the duration of employment of a proportion of the Project workforce is extended for all three alternatives to complete the additional backfill activities required. Under the Project Case, the local government rates are estimated to be $3.0 million in present value (or $8.0 million in undiscounted terms).

The additional backfilling activities for each alternative result in higher total costs in undiscounted terms, as the duration of local government rates to be paid for the Project is extended. The greater the extent of backfilling required for each alternative, the higher the costs are in undiscounted terms compared to the Project Case, although once discounted the difference is imperceptible for some alternatives.

For the full backfill alternative, the local government rates are estimated to be $3.1 million in present value (or $8.7 million in undiscounted terms). For the partial backfill above pre-mining groundwater level alternative, the local government rates are estimated to be $3.1 million in present value (or $8.2 million in undiscounted terms). For the covering of the exposed coal seams alternative, the local government rates are also estimated to be $3.0 million in present value (or $8.1 million in undiscounted terms). While the local government rates payable are different under all of the alternatives, due to the large effect of discounting future expenditure over a long period of time and the slight change in undiscounted costs, the present value of local government rates for the Project Case and the final landform alternatives do not differ greatly.

D.3. Producer Surplus

The composition of the net producer surplus for each case is detailed in Table D.1, which indicates that the main difference between the cases is the cost of rehandling waste rock and backfilling the proposed residual voids.

Table D.1: Calculation of total net producer surplus

Item		Full backfill (NPV)	Partial backfill to above the pre-mining groundwater level (NPV)	Covering of exposed coal seams (NPV)	Project case (NPV)
Revenue					
Gross revenue	$m	$9,874	$9,874	$9,874	$9,874
Residual value of land	$m	-	-	-	-
Residual value of capital	$m	-	-	-	-
Total	$m	**$9,874**	**$9,874**	**$9,874**	**$9,874**
Costs					
Operating costs	$m	($5,525)	($5,524)	($5,524)	($5,524)
Capital costs	$m	($1,620)	($1,620)	($1,620)	($1,621)
Rehabilitation, decommissioning and backfill costs	$m	($281)	($183)	($108)	($103)
Total	$m	**($7,425)**	**($7,327)**	**($7,252)**	**($7,247)**
Taxes					

Item		Full backfill (NPV)	Partial backfill to above the pre-mining groundwater level (NPV)	Covering of exposed coal seams (NPV)	Project case (NPV)
Local government rates	$m	($3)	($3)	($3)	($3)
Payroll tax	$m	($38)	($37)	($37)	($35)
Company income tax	$m	($830)	($831)	($831)	($830)
Total	$m	**($872)**	**($870)**	**($871)**	**($867)**
Royalties					
Ad valorem coal royalties	$m	($696)	($696)	($696)	($696)
Total	$m	**($696)**	**($696)**	**($696)**	**($696)**
Net producer surplus	$m	**$881**	**$981**	**$1,056**	**$1,064**

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

The net producer surplus attributed to QLD is determined by the Australian share of the Project's ownership and by QLD's population relative to the total Australian population, this calculation is summarised in Table D.2.

Table D.2: Share of the net producer surplus attributable to QLD community

Item		Full backfill (NPV)	Partial backfill to above the pre-mining groundwater level (NPV)	Covering of exposed coal seams (NPV)	Project case (NPV)
Net producer surplus	$m	$882	$981	$1,056	$1,064
QLD share of Project's ownership	%	13%	13%	13%	13%
Value of net producer surplus attributable to QLD	$m	**$112**	**$124**	**$134**	**$135**

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

D.4. Externalities

Agriculture

The mining operations undertaken during the Project mean that the opportunity to engage in agricultural production during the operational phase of the Project is foregone. By backfilling the proposed residual voids, additional parts of the land within the Project area can be made suitable

for cattle grazing (beef production), in addition to the out-of-pit and in-pit waste rock emplacements that are progressively rehabilitation over the life of the Project.

Under the Project Case, the residual void water bodies in the final landform would be of suitable quality to provide water to cattle. This enhances the agricultural production capability of the Project final landform by providing a consistent supply of water. For the purpose of quantifying the benefits associated with this land use, given the scale of the benefits associated with the residual void water bodies, this value is expected to be immaterial in net present value terms.

For the three alternatives final landforms where the proposed residual voids are progressively backfilled to varying degrees (covering exposed coal seams, partial backfilling to above the pre-mining groundwater level and full backfill), accordingly, the area associated with the residual void would provide differing land uses under each alternative.

Full Backfill Alternative

For the full backfill alternative, the proposed residual voids are backfilled and rehabilitated to provide for low intensity cattle grazing, noting realisation of the benefits associated with this land use takes four years due to time taken to place topsoil and seed/cover crops (around two years) and establish self-sustaining vegetation (conservatively two years, as this is influenced by climatic conditions) (See Table D.3 for detailed timing). The revenue associated with grazing activities undertaken on the rehabilitated land is then calculated using the average profit expected for a farm within the South Queensland Coastal region. It should be noted that the average estimated profit from grazing activity is small.

Table D.3: Timing of backfilling and establishment for grazing, by case and void

Case	Mine Void	Backfilled (Year)	Grazing Commences	Benefits Realised	Beneficial Land
Full backfill	West Pit Mine Void	FY56	FY60	FY60	98 ha
	Main Pit Mine Void	FY55	FY59	FY59	619 ha
	North-West Pit Mine Void	FY57	FY61	FY61	42 ha

Given the small land area that would be available for grazing following backfilling, the resulting agricultural externality benefits are immaterial and is essentially $0 net present terms. The expected average profit for a farm within the South Queensland Coastal region is significantly lower than the average profit for a farm within Queensland. The small amount of land and lower farming profits within the region contribute to the low agricultural externality benefits.

Partial Backfill Above the Pre-mining Groundwater Level Alternative

For the partial backfill above the pre-mining groundwater level, the residual voids are predicted to initially lose water until the partially backfilled spoil fully recovers. Following recovery of the partially backfilled spoil, the residual void water bodies oscillate between nearly dry (depth less than 10 cm) and a maximum depth of 3 m (wetting and drying cycles), and is predicted to have high salinity compared to the Project Case due to the very small volume of water body during drying cycles. An upper salinity evaporation level of 357,000 milligrams per litre (approximately 549,780 microSiemens per centimetre) has been applied to represent the maximum saturation level of salt in water (WRM Water & Environment, 2022).

Accordingly, the residual voids in this final landform alternative would not support an agricultural productive land use due to the high salinity and approximately 759 hectares of potential agricultural productive land would be lost. However, it is expected that the foregone benefits associated with income generated from cattle grazing for this area of land would be immaterial in net present terms, and therefore not quantifiable as an externality cost in the CBA.

Covering of Exposed Coal Seams Alternative

For the covering of coal seams, the residuals voids water level and salinity are the same as those for the Project Case. Accordingly, the residual void water bodies would be of suitable quality to provide water to cattle and would support a low intensity cattle grazing land use. However, consistent with the Project Case, it is expected that the benefits associated with the residual void water body agricultural use would be immaterial in net present terms and therefore have not been quantified.

Greenhouse gas emissions

The social costs of additional GHG emissions to Australia under the Project Case are estimated at $576 million in present value (or $1,689 million in undiscounted terms). As a result of extended duration of the Project fleet, and therefore the use of diesel to fuel vehicles, required to move waste rock to backfill the proposed residual voids to varying degrees under the alternative final landforms, additional greenhouse gas emissions would be produced compared to the Project Case. The costs of greenhouse gas emissions associated with the full backfill scenario is estimated at $591 million in present value terms (or $1,825 in undiscounted terms). The costs of GHG emissions associated with partial backfilling the proposed residual voids to pre-mining groundwater levels or covering the exposed coal seams are lower and estimated at $583 million in present value (or $1,748 million in undiscounted terms) and $576 million in present value (or $1,691 million in undiscounted terms), respectively.

On the basis of the QLD population share of Australia of 20%, the additional cost of greenhouse gas emissions to the QLD community as a result of the Project Case is $116 million in present value (or $339 million in undiscounted terms). For the full backfill final landform alternative, the cost to the QLD community is $118 million in present value (or $367 million in undiscounted terms). For the partially backfilled to pre-mining groundwater levels or covering of exposed coal seams final landform alternatives, the additional cost to the QLD community is $117 million in present value (or $351 million in undiscounted terms) and $115 million in present value (or $339 million in undiscounted terms), respectively.

D.5. Net Benefits to QLD

Table D.4 breaks down the components used in the calculation of the net benefits to the QLD community. Table D.5 then shows this relative to the Project case. All following tables report values relative to the Project Case, to highlight where differences occur.

Table D.4: Breakdown of benefit to QLD by item

Item	Full backfill (NPV $m)	Partial backfill to above the pre-mining groundwater level (NPV $m)	Covering of exposed coal seams (NPV $m)	Project case (NPV $m)
Net producer surplus	$112	$124	$134	$135
Royalties	$696	$696	$696	$696
Company income tax	$167	$167	$167	$167
Economic benefit to workers*	-	-	-	-
Economic benefit to suppliers*	-	-	-	-
Externalities	($118)	($117)	($115)	($116)
Total	$856	$870	$881	$882

* These items are excluded from the net economic benefits to QLD community to be conservative. For more information, these are discussed qualitatively in the economic assessment report.

Note: Numbers in the table may not add up due to rounding.

Source: Deloitte Access Economics calculations.

Table D.5: Breakdown of benefit to QLD relative to the Project Case

Item	Full backfill (NPV $m)	Partial backfill to above the pre-mining groundwater level (NPV $m)	Covering of exposed coal seams (NPV $m)	Project case (NPV $m)
Net producer surplus	($23)	($10)	($1)	-
Royalties	-	-	-	-
Company income tax	-	-	-	-
Economic benefit to workers*	-	-	-	-
Economic benefit to suppliers*	-	-	-	-
Externalities	($2)	($1)	($0)	-
Total	($25)	($11)	($1)	**$-**

* These items are excluded from the net economic benefits to QLD community to be conservative. For more information, these are discussed qualitatively in the economic assessment report.

Note: Numbers in this table may not add up due to rounding

Source: Deloitte Access Economics calculations.

Appendix E: Additional Submission Considerations

E.1. Carbon Border Adjustment Mechanism

Carbon Border Adjustment Mechanisms (CBAM) are a proposed policy that would place a fee on imports based on the carbon emissions incurred in the production of those goods. CBAM's are being considered by the European Union and China, but they have not been enacted yet. In December 2019, the EU formally proposed the introduction of a CBAM with the expectation that this will be introduced from 2023 and tariffs charged from 2026. The scheme is proposed to initially apply only to direct emissions from iron, steel, cement, fertiliser, aluminium, and electricity, with other products to be added in the future.

CBAM would only apply to Scope 1 emissions in exports. This means that a CBAM would not apply to carbon in coal and would only apply to carbon emitted during mining. An adjustment has been made to the CBA to consider the CBAM on the project. Under the project, Scope 1 emissions are 533,336 tonnes CO2e annually, on average. Given the current EU price (May 2022 average) of 79.98 euro/ tonne, this equates to 42.7 million euros per year ($67.0 million), on average. This equates to approximately $9 per tonne of coal produced, which is 8.5% of the forecast coal price value, on average. This suggests that the potential impact of a CBAM is well within the price sensitivity range analysed and if a CBAM was applied, the Project would still result in net benefits to QLD.

E.2. Approach to Computable General Equilibrium modelling

The Computable General Equilibrium (CGE) model used in the analysis (DAE-RGEM) aligns with standard approaches used in CGE modelling. DAE-RGEM is a large scale, dynamic, multi-region, multi-commodity CGE model of the world economy with bottom up modelling of Australian regions. DAE-RGEM encompasses all economic activity in an economy – including production, consumption, employment, taxes and trade – and the inter linkages between them. The DAE-RGEM model database is built based on the Global Trade and Analysis Project (GTAP) database. The model rests on the following key assumptions:

- All markets are competitive, and all agents are price takers.
- All markets clear, regardless of the size of the shock, within the year.
- It takes one year to build the capital stock from investment and investors take future prices to be the same as present ones as they cannot see the future perfectly.
- Supply of land and skills are exogenous. In the business as usual case, supply of natural resource adjusts to keep its price unchanged; productivity of land adjusts to keep the land rental constant at the base year level.

All factors sluggishly move across sectors. Land moves within agricultural sectors; natural resource is specific to the resource using sector. Labour and capital move imperfectly across sectors in response to the differences in factor returns. Inter-sectoral factor movement is controlled by overall return maximizing behaviour subject to a constant elasticity of transformation (CET) function.

As described in Appendix B, the DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key features of the model are:

- The model contains a 'regional household' that receives all income from factor ownerships (labour, capital, land and natural resources), tax revenues and net income from foreign asset holdings. In other words, the regional household receives the gross national income (GNI) as its income.

- The regional household allocates its income across private consumption, government consumption and savings so as to maximise a Cobb-Douglas utility function. This optimisation process determines national savings, private and government consumption expenditure levels.
- Given the budget levels, household demand for a source-generic composite goods are determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and foreign sources. In the Australian regions, however, households can also source goods from interstate. In all cases, the choice of sources of each commodity is determined by minimising the cost using a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function defined over the sources of the commodity (using the Armington assumption).
- Government demand for source-generic composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via Cobb- Douglas utility functions in two stages.
- All savings generated in each region are used to purchase bonds from the global market whose price movements reflect movements in the price of creating capital across all regions.
- Financial investments across the world follow higher rates of return with some allowance for country specific risk differences, captured by the differences in rates of return in the base year data. A conceptual global financial market (or a global bank) facilitates the sale of the bond and finance investments in all countries/regions. The global saving-investment market is cleared by a flexible interest rate.
- Once aggregate investment level is determined in each region, the demand for the capital good is met by a dedicated regional capital goods sector that constructs capital goods by combining intermediate inputs in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these intermediate inputs subject to a CRESH aggregation function.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Source-generic composite intermediate inputs are also combined in fixed proportions (or with a very small elasticity of substitution under a CES function), whereas individual primary factors are chosen to minimise the total primary factor input costs subject to a CES (production) aggregating function.

For this analysis, the modelling undertaken aligns with standard approaches, in that the model determines the likely size, timing and impact of additional activity generated by the various stages of the Project to the Region and the rest of QLD. The model determines the additional activity based upon the incremental capital expenditure and coal production which are the inputs or 'shocks' applied.

The results of the CGE modelling indicate that the Project supports a large number of indirect employment opportunities. Based on the CGE modelling outputs, the indirect employment multiplier is approximately 2.8 (i.e. the ratio of indirect employment to direct employment). This multiplier emerges from the model assumptions and is based on an assumed inelastic labour supply.

Appendix F: Comparison to Draft EIS

This section provides an overview of the key CBA results for the optimised project in FY22 terms compared to the approximate Draft EIS results. The figures for the draft EIS in FY22 terms are indicative estimates based upon adjustment of the FY20 figures rather than updated modelling results. These figures are presented for the purpose of comparison.

Table F.1: Comparison of optimised Project results to Draft EIS, automated

Item	Draft EIS (NPV FY20) ($m)	Draft EIS (NPV FY22) ($m)	Optimised Project (NPV FY22) ($m)
Revenue			
Gross revenue	$8,028	$9,191	$9,869
Residual value of land	-		-
Residual value of capital	-		-
Total	**$8,028**	**$9,191**	**$9,869**
Costs			
Operating costs	$4,711	$5,394	$5,520
Capital costs	$1,324	$1,516	$1,621
Rehabilitation and decommissioning costs	$35	$40	$103
Total	**$6,071**	**$6,951**	**$7,244**
Royalties			
Ad valorem coal royalties	$563	$645	$696
Total	**$563**	$645	**$696**
Taxes			
Company income tax	$679	$777	$830
Payroll tax	$28	$32	$35
Local government rates	$2	$2	$3
Total	$**709**	**$812**	**$867**
Net producer surplus	**$685**	**$784**	**$1,062**

Source: Deloitte Access Economics.

Note: Numbers in this table may not add up due to rounding.

Table F.2: Share of the net producer surplus attributable to QLD community, automated

Item		Draft EIS (NPV FY20) ($m)	Draft EIS (NPV FY22) ($m)	Optimised project in FY22 terms (NPV) ($m)
Net producer surplus	$m	$685	$784.26	$1,062
QLD share of Project's ownership	%	12%	12%	13%
Value of net producer surplus attributable to QLD	$m	**$79**	**$90.45**	**$134**

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

Table F.3: Comparison of optimised Project results to Draft EIS, non- automated

Item	Draft EIS (NPV FY20) ($m)	Draft EIS (NPV FY22) ($m)	Optimised Project (NPV FY22) ($m)
Revenue			
Gross revenue	$8,028	$9,191	$9,874
Residual value of land	-		-
Residual value of capital	-		-
Total	**$8,028**	$9,191	**$9,874**
Costs			
Operating costs	$4,818	$5,516	$5,690
Capital costs	$1,321	$1,512	$1,617
Rehabilitation and decommissioning costs	$35	$40	$104
Total	**$6,174**	**$7,069**	**$7,411**
Royalties			
Ad valorem coal royalties	$563	$645	$696
Total	**$563**	**$645**	**$696**
Taxes			
Company income tax	$658	$753	$796
Payroll tax	$37	$42	$46
Local government rates	$3	$3	$3.6
Total	**$698**	$799	**$846**
Net producer surplus	**$593**	**$679**	**$921**

Source: Deloitte Access Economics.

Note: Numbers in this table may not add up due to rounding.

Table F.4: Share of the net producer surplus attributable to QLD community, non-automated

Item		Draft EIS (NPV 2020) ($m)	Draft EIS (NPV FY 2022) ($m)	Optimised project in FY22 terms (NPV) ($m)
Net producer surplus	$m	$593	$679	$920
QLD share of Project's ownership	%	12%	12%	13%
Value of net producer surplus attributable to QLD	$m	**$68**	**$78**	**$116**

Source: Deloitte Access Economics calculations.

Note: Numbers in this table may not add up due to rounding.

Table F.5: Summary of economic impacts

		Draft EIS (NPV 2020) ($m)	Draft EIS (NPV FY 2022) ($m)	Optimised project in FY22 terms
Gross Value Added				
Region	$m	$6,638	$7,600	$7,786
Rest of QLD	$m	$2,663	$3,049	$3,191
Total QLD	$m	**$9,301**	**$10,649**	**$10,977**
Employment (average FTE)				
Region	FTE	934	934	858
Rest of QLD	FTE	960	960	892
Total QLD	FTE	**1,894**	**1,894**	**1750**

Note: Total QLD is the sum of Region and Rest of QLD. Numbers in the table may not add up due to rounding.

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Deloitte Access Economics Pty Ltd
ACN: 149 633 116
8 Brindabella Circuit
Brindabella Business Park
Canberra Airport ACT 2609
Tel: +61 2 6263 7000
Fax: +61 2 6263 7004

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