



Newstan Colliery Mine Extension Project Economic Assessment

Centennial Newstan Pty Limited

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Executive Summary

- Newstan Colliery is an existing underground coal mine located in the Lake Macquarie Local Government Area (LGA), approximately 25 kilometres southwest of Newcastle and 140 kilometres north of Sydney, NSW. It is owned and operated by Centennial Newstan Pty Ltd (Centennial Newstan).
- Mining operations at Newstan Colliery began in 1887 and upon the introduction of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), operated pursuant to continuing use rights in accordance with Part 4, Division 10 of the EP&A Act (continuing use rights). On 14 May 1999 the (then) Minister for Urban Affairs and Planning granted Development Consent DA 73-11-98 under Part 4 of the EP&A Act for the Newstan Colliery Life Extension Area. This approval enabled mining to continue within the existing mining areas as well as the expansion of mining into areas that had not previously been mined. Development Consent DA 73-11-98 has been modified on eight occasions, with the most recent modification approved on 17 January 2019.
- In August 2014, the underground operations at Newstan Colliery were placed into care and maintenance due to poor market conditions. In recent years, Centennial Newstan has commenced feasibility investigations into the recommencement of mining at Newstan Colliery. Centennial Newstan is now seeking approval for the continuation of mining within the West Borehole seam. The Newstan Mine Extension Project (the project) proposes the extraction up to 25.9 million tonnes (Mt) of Run of Mine (ROM) coal over a fifteen-year period. A detailed description of the Project is presented in Section 1.2.
- This Economic Assessment (EA) has been prepared to support a State Significant Development (SSD) application for the project under Division 4.7 of Part 4 of the EP&A Act and complies with the Department of Planning, Industry and Environment (DPIE) *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015) and *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (April 2018) to the extent practicable. Variations to application of the guidelines are acknowledged generally and specifically at relevant parts of the report.
- The economic assessment compares outcomes estimated to result from the project, with the alternative, base or 'business-as-usual' (BAU) case. Newstan Colliery is presently operated on a care and maintenance (non-productive) basis. The BAU case is essentially that project approval is not granted and mining is not resumed at Newstan Colliery. Comparisons of outcomes in respect of the range of economic effects under both scenarios are presented throughout this economic assessment.
- The mine will produce two coal products. These are a semi-soft coking (metallurgical) coal product for export (approximately 31% of total saleable production) and a thermal coal product (69% of saleable production) for sale to Newstan Colliery's principal customer, Eraring Power Station (owned and operated by Origin Energy). The proximity of the mine to Eraring permits delivery of coal to the power station by existing private haul road. This is considered as a significant advantage when compared to sourcing fuel from alternative suppliers. Alternative supply to Eraring Power Station is likely to entail greater socio-

economic and environmental costs in terms of alternative, potentially less efficient, transport requirements.

- The Cost Benefit Analysis (CBA) presented in the document is based on measures that are most relevant to the community of NSW and the region, as required in the guidelines issued by the former Department of Planning and Environment (DPE, now DPIE) in 2015 and 2017. Certain material that is stipulated in the guidelines has been excluded from this EA, on the bases of commercial confidentiality and/or corporate accounting policies that aggregate measures such as corporate taxes to whole-of-company level. The approach adopted in preparation of this report includes these limitations.
- Taking into account the exclusions noted above, royalties returned to the state, and employee benefit, are the major sources of public economic benefit generated by the project. These are valued at approximately \$80 million (royalties) and \$28 million (employee benefit) calculated as present values over the life of the project.
- An assessment of environmental impacts and their associated social implications was undertaken, to determine which of these impacts were suitable for quantitative (monetised) valuation. In aggregate, these valuations amounted to approximately \$34 million (present value) over the life of the project. It is noted that these valuations may not fully reflect the values placed on these environmental assets and the predicted effects on them by some stakeholders. In recognition of this, the CBA and the Local Effects Analysis (LEA) include more detailed discussion of the qualitative aspects of these impacts, which augment the monetised values estimated, where appropriate.
- The project will require clearing of native vegetation totalling 0.35 hectares, 0.15 hectares of which is commensurate with an endangered ecological community. This will incur 16 ecosystem credits, with a value of \$138,291.10, which Centennial Newstan will meet.
- In terms of effects on other industries, approval of the project would create additional employment and commercial activity with suppliers of goods and services to the mine. In the BAU case, these benefits would not eventuate. As the regional economy is relatively large, the potential for negative impacts is generally limited in the BAU scenario. The exception to this is Origin Energy/Eraring Power Station, which may incur additional costs in sourcing alternative fuel supply.
- The assessed net economic valuation of the project is a benefit of approximately \$74.3 million (NPV over project life). A Cost Benefit Ratio was also calculated at 3.2 (benefit to cost).
- The regional benefit relating to employee incomes is assessed as approximately \$15 million (present value) over the life of the project, based on randomised sensitivity analysis over a bounded range of possible outcomes.
- An assessment of internal commercial data indicates that a further approximately \$53 million a year in non-labour expenditure may be disbursed in the regional economy by Centennial Newstan. Approximately \$15 million of the regional sum would be spent in the local (LGA) economy annually. Total annual expenditure in NSW is estimated at

approximately \$82 million. As is the case with other identified benefits, these would not be realised in the BAU alternative.

- Certain environmental impacts that were quantified in the CBA and others that were qualitatively valued will have particular effect at local level. These include air quality, noise and traffic impacts, which entail highly localised effects. With respect to these localised impacts, four potentially impacted receptors (residences) were identified in assessing the scope of air quality and noise and vibration impacts. Visual amenity effects were also assessed on a similar basis. The specialist assessments of these effects indicate that these are likely to be within permissible levels and will not be of significant measured effect. That notwithstanding, each of these potential effects will be subject of continuous monitoring, as such effects may still be perceived by some stakeholders as impacting them in some circumstances. The BAU alternative would result in such effects being avoided.
- The conclusion of the LEA is that the project will have an overall positive economic effect on the local/regional economies and communities. Actual (i.e. physical) effects are generally assessed as being of limited impact on the local and regional communities, although it is acknowledged that some stakeholders may have perceive or experience effects differently. In the alternative BAU case, none of the projected benefits or costs associated with the project would be realised and the local and regional effects would be essentially neutral.
- From the State's perspective, there would also be impacts under the BAU scenario, although these would be less discernible, given the scale of the NSW economy. However, in essence, the project represents a more beneficial socio-economic solution for supply of fuel to Eraring Power Station, with the outcome of supporting reliable electricity supply for the state. The benefit of export of metallurgical coal product (particularly in respect of state royalties) would also be forfeited if the project did not proceed.
- A range of recommendations, largely predicated on those proposed by specialist consultants, are proposed and/or endorsed in this report, to support avoidance, management and mitigation of impacts to the extent possible.
- On balance, the project is assessed as being likely to produce a beneficial outcome for NSW and the regional and local communities.

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Abbreviations¹

ABS	Australian Bureau of Statistics
AUD	Australian Dollar
BC Act	Biodiversity Conservation Act (NSW)
CBA	Cost Benefit Analysis
CERD	Centre for Economic and Regional Development
CO ² -e	Carbon dioxide equivalent
Cth	Commonwealth
DIIS	Department of Industry, Innovation & Science (Australian Government)
DPE	Department of Planning and Environment (former, now DPIE).
DPIE	Department of Planning, Industry and Environment
DPC	Department of Premier and Cabinet
EA	Economic Assessment
EEC	Endangered Ecological Community
EEX	European Emissions Exchange
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning & Assessment Act (NSW)
EPBC Act	Environment Protection & Biodiversity Conservation Act (Cth)
ERP	Estimated Resident Population (ABS)
EUR	Euro
FCT	Flexible Conveyor Train
FTE	Full Time Equivalent
GRP	Gross Regional Product
GVA	Gross Value Added
LMCC	Lake Macquarie City Council
LEA	Local Effects Analysis
LGA	Local Government Area
LOM	Life of Mine
LULUCF	Land use, land use change and forestry
Mtpa	Million tonnes per annum
NMP	Noise Management Plan
PCT	Plant Community Type
PM _{2.5}	Particulate matter less than 2.5 microns in diameter
PM ₁₀	Particulate matter less than 10 microns in diameter
RBA	Reserve Bank of Australia
ROM	Run of Mine
SA3	Statistical Area Level 3 (ABS)
SA4	Statistical Area Level 4 (ABS)
SEARS	Secretary's Environmental Assessment Requirements (SEARs)
SSD	State Significant Development
TSP	Total Suspended Particulates
USD	United States Dollar

¹ Some other abbreviations are derived from specialist consultant reports and are presumed to be accessible to, and understood by, the consent authority and are not included in this list in the interests of brevity.

1 PART A - INTRODUCTORY MATERIAL

1.1 Introduction

1.1.1 Purpose of this report

This report forms part of the State Significant Development (SSD) application for the Newstan Colliery Extension Project (the project). Section 4.12 (formerly Section 78A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), requires that an Environmental Impact Statement (EIS), in respect of the SSD must include an Economic Assessment (EA). The assessment is required to be prepared in accordance with the NSW Government Department of Planning, Industry and Environment (DPIE)² *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015) and the supplementary *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (April 2018)³.

This EA is prepared to comply with the guidelines to the extent that these may be practicably applied, in the context of certain information that is excluded from this report as required by the proponent. Such exclusions are noted at the relevant points of this EA. Broadly, this EA includes the requisite Cost Benefit Analysis (CBA) and Local Effects Analysis (LEA) components and supporting material and analyses. In addition to the requirements of the guidelines (2015:16), the DPIE Secretary's Environmental Assessment Requirements (SEARs) for the project were also referenced in developing the assessments presented. Table 1 identifies the relevant references from the guidelines and the SEARs, as they are addressed in this EA.

Table 1: Economic assessment concordance with DPIE SEARs and guidelines

SEARs Key Issues	DPIE guidelines references		EA references	
	Guidelines	Technical Notes	CBA	LEA
Subsidence	Not separately addressed ⁴	Not separately addressed	Table 4; Table 5; Section 2.3.2; Annexure 4	Section 3.3.1.2; Section 3.3.1.13
Water (groundwater and surface water)	Section 7.1 (2015:15); 2015:24	Technical Note 6	Table 4; Table 5; Annexure 4	Section 3.3.1.3; Table 12; Table 13
Biodiversity	Section 7.1 (2015:15)	Technical Note 7	Table 4; Table 5; Annexure 4	Table 12; Table 13; Section 3.3.1.8
Soil & land resources	Not specifically addressed	Not specifically addressed	Table 4; Table 5	Section 3.3.1.12

² The guidelines and technical notes remain as published by the former Department of Planning and Environment (DPE).

³ Referred to jointly hereafter as 'the guidelines' except where specific references to either document may be required.

⁴ The guidelines refer to subsidence as a contributory factor in other specific impacts (e.g. biodiversity, heritage), which are addressed in the sections of the EA relevant to those particular impacts.



SEARs Key Issues	DPIE guidelines references		EA references	
	Guidelines	Technical Notes	CBA	LEA
<i>Air Quality (incl. GHG)</i>	<i>Section 7.1 (2015:15); 2015:24</i>	<i>Technical Notes 5 & 9⁵</i>	<i>Table 4; Table 5; Annexure 4; Annexure 5.</i>	<i>Section 3.3.1.5; Section 3.3.1.6 (GHG); Table 12; Table 13;</i>
<i>Rehabilitation & Final Landform</i>	<i>Not specifically addressed⁶</i>	<i>Not specifically addressed</i>	<i>Table 5</i>	<i>Not specifically addressed</i>
<i>Noise (reported as noise & vibration)</i>	<i>Section 7.1 (2015:15); 2015:24</i>	<i>Technical Note 3</i>	<i>Table 4; Table 5</i>	<i>Section 3.3.1.4; Section 3.3.1.9</i>
<i>Visual</i>	<i>Section 7.1 (2015:15); 2015:24</i>	<i>Technical Note 4</i>	<i>Table 5</i>	<i>Section 3.3.1.10</i>
<i>Waste</i>	<i>Not specifically addressed</i>	<i>Not specifically addressed</i>	<i>Table 5</i>	<i>3.3.1.12</i>
<i>Heritage (Aboriginal cultural & historical)</i>	<i>Section 7.1 (2015:15); 2015:24</i>	<i>Technical Notes 1 & 2⁷</i>	<i>Table 4; Table 5; Annexure 4</i>	<i>Section 3.3.1.7; Table 12; Table 13</i>
<i>Traffic & Transport</i>	<i>Section 7.1 (2015:15); 2015:24</i>	<i>Technical Note 8⁸</i>	<i>Table 4; Table 5</i>	<i>Section 3.3.1.9</i>
<i>Hazards</i>	<i>Not specifically addressed</i>	<i>N/A</i>	<i>Table 5</i>	<i>Section 3.3.1.12</i>
<i>Social</i>	<i>Throughout</i>	<i>Throughout</i>	<i>Table 5; Section 2.3.4</i>	<i>Section 3.3.1.11; Section 3.3.1.15</i>
<i>Economic</i>	<i>Throughout</i>	<i>Throughout</i>	<i>Throughout</i>	<i>Throughout</i>

1.1.2 The Proponent

The proponent for the project is Centennial Newstan Pty Limited (Centennial Newstan) (ABN 68 101 508 865), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial Coal) (ABN 30 003 714 538). Centennial Coal is a wholly owned subsidiary of Banpu Public Company Limited (Banpu), listed on the Stock Exchange of Thailand.

⁵Technical Note 5 – Air quality; Technical Note 9 – GHG.

⁶ Rehabilitation is referred to as a component of costs included in net producer surplus (Table 3.5 [2015:11]). Refer to Section 2.1 of this EA for discussion of withholding of commercially confidential information.

⁷ Technical Note 1 – Aboriginal Cultural Heritage; Technical Note 2 – Environmental Heritage

⁸ Technical Note 8 is nominally ‘transport impacts’.

1.1.3 Project overview

Newstan Colliery is an existing underground coal mine located in the Lake Macquarie Local Government Area (LGA), approximately 25 kilometres southwest of Newcastle and 140 kilometres north of Sydney, NSW. It is owned and operated by Centennial Newstan.

Mining operations at Newstan Colliery began in 1887 and upon the introduction of the EP&A Act operated pursuant to continuing use rights in accordance with Part 4, Division 10 of the EP&A Act (continuing use rights). On 14 May 1999 the (then) Minister for Urban Affairs and Planning granted Development Consent DA 73-11-98 under Part 4 of the EP&A Act for the Newstan Colliery Life Extension Area. This approval enabled mining to continue within the existing mining areas as well as the expansion of mining into areas that had not previously been mined. Development Consent DA 73-11-98 has been modified on eight occasions, with the most recent modification approved on 17 January 2019.

In August 2014, the underground operations at Newstan Colliery were placed into care and maintenance due to poor market conditions. In the intervening years, Centennial Newstan has commenced feasibility investigations into the recommencement of mining at Newstan Colliery. Centennial Newstan is now seeking approval for the continuation of mining within the West Borehole seam. The Newstan Mine Extension Project (the project) proposes the extraction of up to 25.9 million tonnes (Mt) of Run of Mine (ROM) coal over a fifteen-year period.

It is the commercial prerogative of Centennial Newstan to assess market conditions and strategic considerations in respect of operation of the mine, within consent parameters. Optimising operation of the mine advances the State's interest in extraction of the resource and is consistent with Centennial Newstan's stewardship of the resource on behalf of the state, consequent to the grant of consent to mine the resource.

1.2 Project description

The project proposes the extraction up to 25.9 Mt of ROM coal over a fifteen-year period. Bord and pillar mining is proposed using continuous miner methods that will include areas of first workings, partial extraction and total extraction. A mix of metallurgical and thermal coal product is proposed to be extracted at a maximum rate of 4 Mtpa. It will be delivered to the Newstan Colliery Surface Site via a series of existing underground conveyors. Once the coal reaches the Newstan Colliery Surface Site it will be handled in accordance with the approved operations for the Northern Coal Logistics Project (SSD-5145), managed by Centennial Coal's Northern Coal Services business unit.

Other key features of the project include:

- Utilisation of the Newstan Colliery Surface Site to provide parking, bathhouse, administration and workshop facilities for the underground workforce. A small number of administrative, maintenance and monitoring personnel will also be located at Awaba Colliery Surface Site.
- Transportation of personnel and materials to and from the underground mining area via the existing worker and materials drift at Newstan Colliery Surface Site.

- Continued operation of the two existing ventilation fans at Newstan Colliery Surface Site and the installation and operation of three new ventilation fans at the existing ventilation shaft at Awaba Colliery Surface Site.
- In-seam gas drainage, with gas transferred to a new gas flaring facility to be located within the existing disturbance footprint of Awaba Colliery Surface Site.
- Extraction of underground water via the existing Fassifern Pump Station at Newstan Colliery Surface Site and ongoing groundwater management.

The project proposes the continuation of underground mining within an established mining precinct that has been operating at some level for over 130 years. The project has been developed and refined in consultation with the community, regulatory agencies, infrastructure owners, and other stakeholders to maximise environmental, social and economic outcomes by following the ‘avoid, minimise, offset’ hierarchy.

The potential impacts of the project have been minimised by optimising the use of existing surface infrastructure and equipment, developing a low-impact and flexible mine design, minimising surface disturbance for gas drainage and greenhouse gas abatement, and proposing a complementary suite of mitigation measures and management strategies to be implemented during construction, operation, and decommissioning and closure.

Full details of the project, including description of existing land and infrastructure to be used, are provided in Table 2, which is drawn from the EIS document (GHD 2020).

Table 2 – Project overview

Aspect	Description
Proponent	Centennial Newstan Pty Ltd
Project duration	15 years
Project schedule	2021 - 2035
Resource	Estimated 25.9 Mt of recoverable ROM coal within the West Borehole seam, at depths of between 140 m and 320 m
Mining method	Bord and pillar mining using a combination of first workings, partial extraction and total extraction.
Annual production rate	Up to 4 Mtpa ROM coal
Product coal	All surface coal handling and transportation operations undertaken at Newstan Colliery will form part of SSD-5145 for the Northern Coal Logistics Project and as such do not form part of the project. The Northern Coal Logistics Project has sufficient project life (up to 31 December 2045) and coal processing and transportation capacity to accommodate the project’s maximum production rate (4 Mtpa) and total production over the mine life (25.9 Mt) without exceeding the throughput limits imposed under SSD-5145.
Project considerations	A combination of first workings only, partial extraction, and total extraction using bord and pillar mining methods has been adopted to minimise subsidence impacts to sensitive built and natural surface features and to mitigate multi-seam subsidence impacts associated with the Awaba workings in the overlying Great Northern seam.

Aspect	Description
	Conservative buffers have been adopted in the mine design to minimise subsidence impact risks to overlying infrastructure such as the Main Northern Railway, Eraring Power Station and Eraring Ash Dam and sensitive surface water features such Stockyard Creek, Kilaben Creek, and Stony Creek.
Mine infrastructure area and access	The project will utilise the existing surface facilities at the Newstan and Awaba Collieries. Awaba Colliery Surface Site will be upgraded as part of the project and be utilised for: • Power supply • Compressed air and nitrogen inertisation • Greenhouse gas capture and abatement • Ventilation • Communications • Parking • Administration. Newstan Colliery Surface Site will be utilised for: • Access to underground workings (as approved under DA 73-11-98) • Parking, offices, bathhouse facilities and workshop (as approved under SSD-5145) • Ventilation (during first workings).
Coal handling, processing and transport	ROM coal will be transported via underground conveyor to the Newstan Colliery Surface Site at a rate of up to 4 Mtpa. Once it reaches the surface it will be handled in accordance with the approved operations for the Northern Coal Logistics Project (SSD-5145). No coal handling operations at Awaba Colliery Surface Site are proposed as part of the project. Product coal transport does not form part of the project. The project proposes the transportation of ROM coal via underground conveyor to the Northern Coal Logistics Project, at which point the processing and product coal transportation will be undertaken as approved under SSD-5145.
Coal reject management	Reject management does not form part of the project. Reject management for the coal to be extracted during operation of the project is already approved under SSD-5145. The Northern Coal Logistics Project has sufficient capacity to accommodate the processing of the ROM coal from the project over the mine life (25.9 Mt) without exceeding the limits imposed under SSD-5145.
Ventilation and gas drainage	Operation of existing ventilation fans at Newstan Colliery Surface Site during first workings, then construction of three new fans at the existing ventilation shaft at Awaba Colliery Surface Site and operation of those fans during extraction. Construction and operation of a gas flaring facility within previously disturbed areas at Awaba Colliery Surface Site.
Water supply	Upgrade existing reticulated water system at Awaba Colliery Surface Site. Use of recycled wastewater for mining and dust suppression.
Water and wastewater management	Extraction of underground water via the Fassifern Pump Station. Underground water management and transfers between coal seams and the Newstan Colliery Surface Site. Surface water management at the Newstan Colliery Surface Site will continue as approved under SSD-5145 and does not form part of the project. Surface water management at the Awaba Colliery including the utilisation of existing and approved licensed water discharge points.



Aspect	Description
Communications and electrical supply	Upgrades to 33 kV switchyard and 11 kV switch room at Awaba Colliery Surface Site. Upgrades to underground electrical equipment. Upgrades to the communications network.
Exploration and other investigations	Exploration will be ongoing throughout Centennial Newstan's lease areas for the life of the project.
Disturbance area	1,153 ha (Extension of Mining Area). All proposed surface facilities are within previously disturbed areas at Awaba Colliery and Newstan Colliery Surface Sites.
Construction	Construction of new and upgraded surface facilities at Awaba Colliery Surface Site. Key works will include drilling and construction of services and gas drainage boreholes, enlargement of the existing Pollution Control Dam, and construction of the gas flaring facility and ventilation fan site.
Construction duration	11 months
Construction hours	Monday to Friday: 7.00 am to 6.00 pm Saturday: 8.00 am to 6.00 pm Sundays and public holidays: no work
Operating hours	24 hours a day, seven days a week
Peak operational workforce	320 Full Time Equivalent (FTE) personnel
Peak construction workforce	50 FTE personnel (indicative)
Temporary construction facilities	If required, they will be located within previously disturbed areas at Awaba Colliery Surface Site.
Rehabilitation and closure	The rehabilitation and closure strategy for the project will include: - Progressively rehabilitating minor surface disturbance areas (e.g. drill pads, access tracks, surface cracking) to their previous land use. - Removing underground plant and equipment at the completion of mining. - Filling and sealing mine accesses (drifts and shafts) in accordance with relevant guidelines and standards. - Removing or finding a beneficial reuse for mine infrastructure at Awaba Colliery Surface Site and rehabilitating surface disturbance areas. - Rehabilitation of the Newstan Colliery Surface Site will be in accordance with SSD-5145 and does not form part of the project.
Project capital cost	\$130 Million
Sustaining capital (e.g. for equipment replacement)	\$98 Million

1.3 Alternative approaches considered in development of the proposed project

1.3.1 Description of alternatives

The EIS prepared for the project by GHD (2020a) reports that a review of feasible alternatives to the proposed development has been undertaken to demonstrate that the preferred option constitutes the most appropriate scenario to meet the identified project requirements. The following alternatives have been considered by Centennial Newstan during preliminary planning for the project:

- Not proceeding with the project.
- Alternative locations and designs for various infrastructure components of the project.
- Alternative methods for extraction of the resource.
- Alternative environmental management techniques for moderate or higher risk impacts. (GHD 2020a:9).

For the purposes of economic assessment, the first of these alternatives is considered in detail in this economic assessment and is assumed as the base case. It is also referred to in the document as the 'business-as-usual' (BAU) scenario for the project. The other alternatives listed are alternative project design approaches, which are assumed as having been assessed and ranked in arriving at the development of the preferred project proposal being assessed herein. Given that Newstan Mine is currently being operated under a care and maintenance regime, it is not producing commercial quantities of coal. In essence therefore, the base case is that none of the benefits or costs of production at the mine under grant of consent would be realised. Consequently, the BAU outcomes would be neutral as compared with current circumstances.

1.3.2 Negative effects of the base case

The base case scenario, in which project approval is not granted, would effectively result in the cessation of all operations at the mine. Beneficial outcomes associated with royalties accruing to NSW; additional direct employment created and resultant employment benefit to workers at the mine associated with the incomes derived; and indirect employment supported by firms providing goods and services to Newstan Mine, would not be realised. As surface facilities at Newstan remain in use in relation to the ongoing operation of Mandalong Mine, such operations would continue until the cessation of operations at Mandalong. A subsequent period of decommissioning and rehabilitation would ensue. This would entail a limited amount of commercial activity, which would ordinarily be outsourced. As these decommissioning and rehabilitation works would also be required under the project scenario, albeit at a later time, notionally, the net effect of these works is essentially zero, although of slightly higher economic value under the base case, given the notionally earlier timing of those works. IEMA (2019) has prepared a detailed strategy in relation to this aspect of the project. That document also forms part of the EIS. The strategy has been reviewed and it is considered that the identified programs cannot be appropriately valued at present, as the strategy assumes progressive assessment of the decommissioning and rehabilitation processes, prior to actual planning and implementation.

1.3.3 Positive effects of the base case

The positive effects of the base case would be the avoidance of environmental and related potential stakeholder effects assessed in the relevant specialist consultant reports included in the EIS, the economic effects of which are assessed and analysed in Sections 2 and 3.

2 PART B: COST-BENEFIT ANALYSIS (CBA)

2.1 Withholding of certain information from the economic assessment

It is advised that, consistent with the longstanding approach of Centennial Coal with respect to economic assessments, Centennial Newstan maintains that the internal financial appraisal process and its outputs in respect of the project are highly commercially sensitive. Aggregated capital cost assessments are reported in Table 2. However, more detailed information is not disclosed. The output of detailed project modelling is of no consequence to consideration or assessment of third-party or externalised economic effects of the project, which are those of interest in a public assessment process and those which are addressed in the guidelines. The publication of such information has the potential to jeopardise commercial negotiations and outcomes in which Centennial Newstan may be involved either at the time of publication of this information or subsequently. This is particularly relevant in respect of sales to domestic customers, most notably electricity generators. Publication of this information may also be prejudicial to the commercial interests of such relevant Centennial Newstan customers. As such, this material is considered by Centennial Newstan as being unsuitable for presentation in a document which is intended for public exhibition. This information is excluded from this EA on that basis, but has evidently been prepared and can be made available to the consent authority as required. It is noted that in the context of the guidelines, the exclusion of this material equates to exclusion of the 'net producer surplus' calculation from the assessment. It is also relevant that the ownership of Centennial Newstan and therefore Newstan Colliery is overseas based, as described in Section 1.1.2. As such, no material element of net producer surplus would accrue to NSW.

It is also advised that due to corporate reporting arrangements within Centennial Coal, in part relating to the aggregated reporting of group financial performance for the purpose of corporate income tax assessments, the assessment of economic benefit excludes specific provision for such taxes. The bases for this treatment are explained in greater detail in Annexure 1. The annexure also discusses the exclusion of certain state-levied taxes. It is also noted that the guidelines (2015:10) stipulate exclusion of, for example, payroll taxes. The guidelines indicate that these should be included in the reporting of costs, which is excluded from this report on the basis described above.

It is further noted that the guidelines (2015:4)⁹ state that 'in the case of a mine, the CBA would need to cover 30 years from when the mine begins operating'. As the mine life for the project is 15 years (2020-2035 as nominated by Centennial Newstan), there will be no economic benefit generated by the project thereafter, in terms of production. As a consequence, valuation beyond 2035 will not alter these outcomes. Conversely, certain environmental effects assessed as costs may continue to be incurred after cessation of mining. Notwithstanding that the relevant effects may be considered

⁹ Note that this refers to *footnote 5* as it appears in the guidelines.

as not meeting conventional interpretations of threshold materiality in the context of the project, these have been valued to 30 years post-commencement¹⁰, as per the guidelines.

2.2 Assessment of economic benefit of the project

As is provided for in the guidelines (2015:1), the collective public interest of households in NSW and the economic benefit of the project to the NSW community are the foci of the CBA. The assessments reported below have been developed in this context and that of the discussion on exclusion of material presented in Section 2.1. The principal or central estimates provided in these assessments are Present Values (PV) and Net Present Values (NPV) at the discount rate of 7%, with sensitivity testing at 4% and 10% (DPIE 2015:4).

2.2.1 Royalties

The assumptions adopted for calculation of royalties are presented in Annexure 3. The assessments are presented in Tables 3 and 3a. Royalties are of primary interest to the community, as they effectively represent the return to government for licensing Centennial Newstan to mine the resource. The application of royalty revenues to the provision of state-provided infrastructure, goods and services, is the practical return to the community.

2.2.2 Economic benefit to workers

The definition of economic benefit to workers presented in the guidelines (2015:13) forms the basis of the estimate presented in Tables 3 and 3a. The method for calculating this estimate is presented in Annexure 2. The upper and lower bound estimates are based on the two 'labour surplus' estimates calculated in the annexure. The estimates represent an assessment of the disposable residual of employee incomes that are available for expenditure in the local and regional economies, principally in the form of consumption activity. An assessment is also presented for the median employee income for the regional workforce more broadly. Comparison between the mining and median incomes establishes that, as is the case with other higher-income jobs, the potential economic contribution of mining jobs is relatively greater than that of lower income occupations.

As is discussed further in the LEA, this element of economic benefit has particular effect in the local and regional economies in which workers are expected to reside. Given the location of the mine in the lower Hunter Valley, there is a relatively large labour pool from which potential employees may be sourced. This being the case, a significant proportion of the employment benefit assessed is likely to be disbursed in the regional economy. Employee households are clearly the main beneficiaries of this surplus income, however, given the scale of the regional economy, derived effects¹¹ may be interpreted as being limited in the broader context.

2.2.3 Aggregate economic benefit

The estimates described in Sections 2.2.1 and 2.2.2 are presented severally and in aggregate in Table 3. Two forms of sensitivity analysis, based on DPE/NSW Treasury recommended discount rates (refer

¹⁰ This entails assumption of commencement of the project as identified in Table 2.

¹¹ 'Second round / flow-on effects' – DPIE 2015:23.

to Section 2.2) and on bounded Monte Carlo analysis output (including confidence intervals as upper and lower bounds), are presented in Table 3a¹².

Table 3: Estimate of economic benefit

Economic Benefit	Estimation assumptions	Assessed benefit
NSW Government royalties	Refer to Annexure 3	Assessed PV ≈\$80.4 million
Employee benefit	Refer to Annexure 2	Assessed PV ≈ \$27.6 million
Other Federal, State and Local government taxes, rates etc.	Refer to Annexure 1	Not quantitatively estimated
Total economic benefit PV		≈ \$108.0 million

Table 3a: Sensitivity analyses, economic benefit

	Discount rate (\$ million)		
	4%	7% (central)	10%
Royalties	95.1	80.4	68.8
Employee benefit	33.2	27.6	23.4
Total economic benefit	128.3	108.0	92.2
	Monte Carlo [at 7% discount rate] (\$ million)		
	95% CI lower ¹³	Simulation mean	95% CI upper
Royalties	80.4	80.6	80.8
Employee benefit ¹⁴	27.6	27.6	27.7
Total economic benefit	108.0	108.2	108.5
	Monte Carlo – high (at 4%) & low (at 10%) discount rate results (\$ million)		
	95% CI lower ¹⁵	Simulation mean	95% CI upper
Royalties	82.2	82.9	83.6
Employee benefit	28.1	28.3	28.5
Total economic benefit	110.3	111.2	112.1

Estimation based on DPIE's central discount rate of 7% returns an assessed economic benefit of \$108.0 million. The randomised sensitivity test assessment across the full range of discount rate based assessments (low assessment at 10% discount rate to high assessment at 4% discount rate) indicates that the economic benefit may be in the range of approximately \$110 million to \$112 million.

2.3 Assessment of the economic cost of the project

2.3.1 Explanatory material on cost assessments

Taking into account the matters disclosed in Section 2.1, from the perspective of NSW and the community in the locality (SA3)¹⁶, the quantitative or monetised assessment of costs essentially relates to valuations of environmental and related effects and their associated social aspects, that can be validly calculated. These are relevant for consideration from the perspectives of both the CBA

¹² The analyses reported in this document were conducted as lower and upper bounded, 1000 iteration simulations.

¹³ Confidence interval.

¹⁴ Rounding to the nearest \$100K results in same nominal outcome.

¹⁵ Confidence interval.

¹⁶ ABS Lake Macquarie – West Statistical Area Level 3.

and the LEA. In assessing the impacts, the listing of effects to be considered in the guidelines (2015:16) and the SEARs for the project, were adopted as the bases of the assessments presented.

A summary of effect valuations is presented in Table 4. The method generally employed for valuations is benefit transfer, as described in the Technical Notes (DPE 2019:10), which also describes the limitations of this method. The exceptions to this are the assessments for Greenhouse Gas (GHG) effects and water resources (groundwater and surface water), which are detailed in Annexures 5 and 4 respectively. Summarily, these assessments are direct valuations based on recent price/cost data for the relevant effects.

The limitations in respect of benefit transfer were taken into consideration in determining which effects could be valued and the appropriate existing studies that could be applied with a level of validity. Detail of the reports and other assumptions used in valuations are included in Annexure 4, however brief outlines of relevant assumptions are presented in Table 4.

In the context of the scale of the project demonstrated by the estimates presented in Table 3, it is evident that some of these assessments may not be considered as meeting conventional threshold levels of materiality when considered individually. For the purposes of ensuring that this interpretation of these effects is taken into account, the sum of valuations for all effects can be considered as material in magnitude. Furthermore, the qualitative aspects of these effects may alter the materiality of potential impacts, particularly in relation to the views of some stakeholders. These aspects are outlined in Table 5, and discussed in the LEA (Part C).

Sensitivity analysis outputs based on discount rate adjustments are presented in Table 4a. Assessments based on Monte Carlo analyses which were calculated for economic benefit, were not prepared for the lower value economic costs as these were assessed using only one benefit transfer assessment, thus precluding generation of the lower and upper bound estimates required to support such analyses. However, the higher value estimates (principally those based on direct valuation) assume upper and lower bounds.

Table 4: Quantitative assessment of environmental, social and transport costs

Description of impact	Assessment assumptions	Assessment outcome
Aboriginal Cultural Heritage ¹⁷	7 items of Aboriginal cultural heritage identified (3 assessed as at low risk of potential subsidence impact): \$8.35 per capita p.a. for each 1,000 places protected); SA3 population (78,923) assumed (as the locality) ¹⁸	PV = \$70,692 (estimated to 2050 [30 years post-commencement])
Historic heritage	5 of 6 listed or potential heritage items may be subject to impacts. Assessment combined with Aboriginal Cultural Heritage Assessment. 8 items assessed in total.	
Groundwater	Cost range \$44/ML to \$524/ML (Refer to Annexure 4)	\$2,688,071
Biodiversity	0.35Ha of native vegetation to be cleared; valuation assessed at \$187 p.a. (refer to Annexure 4). 6 threatened flora and 11 threatened fauna species identified under BC Act ¹⁹ (Refer to Table 5 & Annexure 4).	\$2,507 \$2,041,969 (total) PV = \$2,044,477
Surface water	1.6km of streams directly above directly above proposed mining area; mean of \$2.03 per household per year (refer Annexure 4).	PV = \$739,623
Air quality	PM _{2.5} emissions (6.312 tonnes per year); unit damage cost \$110,000/tonne, operational stage.	PV = \$7,018,127
Greenhouse Gas	Refer to Table 4 (t CO ₂ -e) volumes; Annexure 5 (pricing/cost assumptions)	PV = \$21,157,138 (Scope 1 & 2)
Noise & vibration	<i>Not quantitatively assessed on basis of impacts unlikely to be material</i>	-
Traffic	<i>Not quantitatively assessed on basis of impacts unlikely to be material</i>	-
Subsidence	Impacts accounted for in qualitative and/or quantitative assessments for Aboriginal cultural heritage, historic heritage groundwater and surface water	-
Soil and land resources	<i>Not quantitatively assessed on basis of impacts unlikely to be material</i>	-
TOTAL ASSESSMENT		PV = \$33,718,127 (≈ \$33.7 million)

¹⁷ The Cultural Heritage Impact Assessment reported no historical heritage objects/sites in the Study Area.

¹⁸ Sources: Niche (2019); Allen Consulting Group (2005); ABS (2019). SA3 population (2018); ABS 2020.

¹⁹ 5 threatened flora species were also identified under the EP&BC Act; however these are coincident with species listed under the BC Act.

Table 4a: Sensitivity analyses, economic cost

	<i>Discount rate (\$ million)</i>		
	4%	7% (central)	10%
Total economic cost	40.9	33.7	28.5
	<i>Monte Carlo [@ 7% discount rate] (\$ million)</i>		
	95% CI lower²⁰	Simulation mean	95% CI upper
Total economic cost	33.6	33.7	33.8
	<i>Monte Carlo – high (@4%) & low (@10%) discount rate results (\$ million)</i>		
	95% CI lower²¹	Simulation mean	95% CI upper
Total economic cost	35.0	35.4	35.6

2.3.2 Net public infrastructure costs

No material costs are anticipated to be imposed with respect to public infrastructure, as the significant majority of mine infrastructure and services are already in place. The subsidence report (MSEC, 2019) notes the potential for minor subsidence effects in relation to the Main Northern Railway. However, MSEC (2019:iv) concludes that ‘it is considered feasible to implement robust management strategies to ensure that the Main Northern Railway remains safe and serviceable during and after the proposed mining’. The majority of other infrastructure identified in the subsidence report is privately owned. Consequently, management of effects in relation to such infrastructure would be matters for resolution between Centennial Newstan and the respective infrastructure owners.

2.3.3 Loss of surplus to other industries

The mine’s location places it in a large regional economy. Based on 2018 data, REMPLAN (2020) assessed employment at 61,601 jobs and 280,855 jobs for the Lake Macquarie LGA and the Hunter region respectively. Economic output was reported as approximately \$19.9 billion for Lake Macquarie and \$104.6 billion for the Hunter region. As such, any positive or negative effects on other industries are likely to be largely subsumed in an economy of this scale.

Briefly, there is likely to be an increase in relation to commercial activity between Centennial Newstan and its supporting operations, and the NSW and regionally based businesses with which these business units are likely to trade over the course of the project. Some commercial relationships will also be maintained into the post-mining decommissioning and rehabilitation processes. It is noted that relationships with some proportion of these suppliers are pre-existing in respect of goods and services procured for current Centennial Coal operations, including Mandalong Mine and Myuna Colliery, and Northern Coal Logistics/Services. As such, any loss of surplus is likely to be of comparatively lower order when compared to the potential for positive effects.

The BAU scenario (no further productive operations) would eliminate the prospect of additional commercial opportunities for relevant industry sectors and businesses. Correspondingly however, this would also mean that there would be no prospect of attributable loss of surplus to other industries in comparison with the current situation, notwithstanding the lower likelihood and cost of

²⁰ Confidence interval.

²¹ Confidence interval.

this. It is likely that an alternative fuel source may be required for Eraring Power Station for the remainder of its operating life. Although it is not possible to identify potential alternative supplier/s, an alternative supplier would obtain the benefit of that commercial relationship.

As is discussed further in the LEA, Eraring Power Station may be negatively affected if the project did not proceed. Alternative suppliers may be located geographically further from Eraring Power Station than Newstan Colliery, and probably unlikely to access the existing transport infrastructure (conveyors and private haul roads). This may result in increases in the cost of alternative supply. In addition to the direct cost to Origin Energy/Eraring, there is the prospect that the additional cost may be passed on to electricity consumers, thereby affecting them also. Alternative suppliers may also produce additional externality costs associated with the alternative transportation methods and distances required to provide supply.

2.3.4 Distributional impacts

The potential for additional commercial activity is noted in Section 2.3.3. From a commercial perspective, given the established network of firms with which Centennial Coal customarily trades, any distributional effect is likely to be positive. Additional firms may also be retained by Centennial Newstan over time. This would result in a redistribution of the benefits as between firms, however, this would be an outcome of competition between such firms. There is further potential for some distributional effects resulting from recruitment of the workforce for the mine, however given the scale of the workforce in the regional and surrounding economies, any effects on individual firms are likely to be broadly distributed and relatively short term. It is noted that Lawrence Consulting (2018) identified a mining workforce of 12,604 in the Hunter Region (22,821 for NSW), based on a major industry survey conducted for the NSW Minerals Council.

From the perspective of individuals and households, the various assessments of environmental impacts indicate that there is limited prospect of effects at this level. Positive effects of additional employment, both direct and derived, are considered in greater detail in the LEA, however in terms of material effects, these would chiefly relate to households directly associated with the mine and its operations.

As the majority of significant infrastructure required to support the project is already in place, effects on social cohesion or specific groups within neighbouring communities are considered as being of relatively low probability, as is reflected in the various specialist reports. This is due to the assessed relatively low potential for disruption to existing community activity. As is noted elsewhere in this report and in the Social Impact Assessment prepared by Hansen Bailey (2020), this assessment does not preclude the possibility that some individuals may perceive impacts associated with the project. The potential for this outcome will require ongoing monitoring on the part of Centennial Newstan. It is noted that this is standard practice for Centennial Coal operations in the regions in which they are located.



Table 5: Summary of environmental/biophysical effects assessments				
Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
NEWSTAN COLLIERY EXTENSION ECONOMIC EFFECTS Consultant: Aigis Group	The project will result in an overall positive economic contribution at a State, regional and also to the local community level.	NSW Government royalty income from extended mining LOM: PV ≈ \$80 million. Additional local, state and federally levied rates, fees and taxes (unquantified) contributed Up to 320 FTE positions established and supported over the life of the project. Assessed total PV of economic benefit accruing to workers: ≈ \$28 million. Randomised sensitivity assessment of local/regional accrual based on a variety of potential scenarios: ≈ \$15 million Indicatively, approximately ≈\$15 million spent with LGA suppliers, ≈\$53 million spent with regional suppliers and ≈\$82 million with NSW-based suppliers per year over the productive life of the mine. Derived benefits of additional supplier surpluses, employment supported and downstream economic stimuli. Supply of fuel to Eraring Power Station is likely to represent a favourable socioeconomic outcome compared with potential alternative supply arrangements potentially involving less efficient transport task.	No material effects in local labour market anticipated, due to regional scale. Environmental and associated social costs quantitatively estimated: PV ≈ \$36 million	Socio-economic benefit will be enhanced by compliance with existing Centennial Coal & Centennial Newstan policies for management of impacts, and adoption of specialist consultants' recommendations as is appropriate.



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
SUBSIDENCE Consultant: MSEC	Natural and built features have been identified within or in the vicinity of the Study Area including; Schedule 2 streams (Stony Creek, Stockyard Creek and an unnamed watercourse), other drainage lines, steep slopes and rock outcrops, the Main Northern Railway, a railway loop line, a mine haul road and other local roads, bridges, potable water pipelines, 132kV transmission lines, 33kV powerlines, an optical fibre cable, Aboriginal heritage sites and the Eraring Power Station including power generation facilities, ash dam, transmission lines, conveyors and other associated infrastructure (MSEC 2019:ii). Predicted effects for each of these categories of features or infrastructure vary and are addressed in Section 6 of the Subsidence Report.	No benefit assessed.	The potential impacts on surface water, groundwater and ecology are discussed by the other specialist consultants on the project (MSEC 2019, various references). Accordingly, those quantified/monetised and qualitative assessments are presented in the relevant sections of this table and Table 4. It is noted that the majority of subsidence-related effects are qualitatively assessed in this report, on the basis of the findings and conclusions of the relevant specialist reports.	Section 6 of the Subsidence Report (MSEC 2019) provides effects management approaches for relevant infrastructure and features in the project Study Area and more broadly.



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
GROUNDWATER Consultant: GHD	Groundwater Impact Assessment (2020[c]); Section 6.2 (Predictions); Existing mining at Newstan Colliery and surrounding mining operations has resulted in depressurisation of the coal seams in the vicinity of Newstan Colliery. Cumulative impacts of mining in the vicinity of Newstan Colliery will result in drawdown of the West Borehole Seam up to 9.5 km to the north east at the end of proposed mining. The majority of this drawdown is attributable to existing mine workings. Drawdown in the West Borehole Seam due to proposed workings is limited to 2 km from the proposed workings at the end of mining. Proposed mining does not result in impacts to the alluvium or shallow regolith. Impacts on the alluvium and the shallow regolith has previously occurred above the existing Newstan Colliery Great Northern Seam workings, Awaba and Cooranbong. Negligible impact on the Eraring Ash Dam is predicted due to the proposed workings. This is based on the modelling assumption that there will be no seam to surface fracturing.	No benefit assessed.	Assessed cost PV ≈ \$2.7 million (based on drawdown schedule to end of productive mining [2034 per GHD], after which dewatering will cease and the mine will be permitted to flood). Risk rating for effects on groundwater users is reported as low (GHD 2020[c]:13).	Recommendations contained in Section 6.3 of the Groundwater Impact Assessment (GHD 2020[c]:67).



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
NOISE AND VIBRATION Consultant: EMM	Operational noise emissions from the project are predicted comply with the PNTLs and noise limits in PA 10_0038 at all assessment locations. Maximum noise levels from the project are predicted to be below the sleep disturbance screening criteria. Construction noise levels predictions satisfied the relevant NMLs at all assessment locations and hence proposed construction activities at the Awaba Colliery Surface Site are unlikely to cause noise impacts at any sensitive receivers. Off-site road traffic noise levels are predicted to satisfy the relevant noise limits at the nearest residential locations for both construction and operational project-related traffic (EMM 2019[b]:34). 4 sensitive receptors (EMM 2019[b]:7) assessed.	As Awaba Colliery is currently in care and maintenance, it was not possible to validate the adopted sound power levels or the relevance (or not) of modifying factors to account for annoying noise characteristics. Hence, Centennial Newstan will undertake noise measurements to validate sound power levels of on-site plant and equipment and off-site noise emissions, once the Awaba Colliery Surface Site is operational. (EMM 2019[b]:34).	Effects not quantitatively assessed on the basis of materiality. Qualitative discussion of potential for effects presented in LEA.	Noise emissions from the project will continue to be managed in accordance with the existing Noise Management Plan (NMP), which describes the short-term and long-term monitoring program for Newstan and Awaba Collieries including both attended and real-time, unattended noise monitoring. As the mine has been in care and maintenance, the NMP will be updated if the project is approved. (EMM 2019[b]:34).



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
BIODIVERSITY Consultant: RPS	Biodiversity Assessment Report (BDAR) [in relation to matters to be assessed under the <i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i> [NSW]. The majority of the potential impacts related to this project are indirect impacts, such as; subsidence, cracking, sinkholes and plug-hole failures. In order to accurately determine the credit liability incurred by the project, a robust BACI (Before-After-Control-Impact) monitoring program is proposed for all relevant threatened species and ecological communities if potential impacts are identified through LIDAR monitoring (2020[a]:79) Direct impacts will be incurred through the proposed installation of infrastructure at Awaba (2020[a]:71) Approximately 0.35 hectares (ha) of native vegetation will be cleared for ancillary facilities. This includes an area approximately 0.15 ha of PCT 178 which is commensurate with Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC [Endangered Ecological Community] (2020[a]:79). Biodiversity Inventory Report (BIR) [in relation to matters to be assessed under the <i>Biodiversity Conservation Act 2016 (BC Act)</i> and <i>Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)</i> [Cth] 6 threatened flora & 11 threatened fauna species recorded in the Study Area (2020[b]).	Biodiversity offset credits (16 units) in respect of clearing of native vegetation. Estimated value of credits: \$138,291.10	0.35 ha of native vegetation to be cleared, including 0.15 ha commensurate with PCT 1718 EEC. Estimated PV (assessed to 30 years post-commencement): ~ \$2.5K Contingent valuation for threatened species recorded in the study area: PV (assessed to 30 years post-commencement): ~ \$2.04 million. Total PV ~ \$2.04 million Valuation of threatened species included on the basis of the precautionary principle. BIR (2020[b]:69) notes as follows: <i>In order to accurately determine the credit liability incurred by the project, a robust BACI monitoring program is proposed for all relevant threatened species and ecological communities if potential impacts are identified through LIDAR monitoring.</i> Proportional clearance within Study Area are presented in Annexure 4 and discussed in LEA Section 3.3.1.8.	Adaptive Management Strategy to be adopted. Refer to Section 6.4, <i>Biodiversity Assessment Report</i> [BDAR] (2020[a]:72-73). BACI monitoring program is proposed for all relevant threatened species and ecological communities if potential impacts are identified through LIDAR monitoring (2020[a]:79). Offset liability assessment presented in BDAR, Section 8.1.2 (2020[a]:76). 16 credit units, estimated value of \$138,291.10.



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
AQUATIC ECOLOGY Consultant: GHD	The frequency of discharges to Stony Creek via LDP017 is likely to increase as a result of the project. As discharges through Newstan LDP017 are in response to heavy rainfall, any change to the water quality in the receiving environment of Stony Creek is predicted to be minor and temporary, and unlikely to adversely affect freshwater aquatic communities. The influence of increased volumes of fresh water on benthic macroinvertebrates in the intertidal zone of Stony Creek is unlikely to be discernible from the response of the community to seasonal variation and long-term climate variability (2020[b]:77). Increased flow velocities in LT Creek resulting from Newstan LDP001 discharges of up to 14.5 ML/day (which are approved under the Northern Coal Logistics Project) have the potential to affect macroinvertebrate community composition. However, as no substantial increase in LT Creek flow velocity is expected (GHD 2020b), such impacts are unlikely. (2020[b]:77). The risk of subsidence-related impact on aquatic ecology was assessed as moderate for Lords Creek, Stony Creek, Kilaben Creek and Stockyard Creek, with the risk of impacts associated with increased flow velocities being high in the Lords Creek catchment, and the risk of water and sediment quality impacts being high in the Stony Creek and Kilaben Creek catchments. There is a low risk of subsidence related impacts in the unnamed tributary of Muddy Lake, assuming that there is no impact of the project on the existing status of the Awaba seepage (2020[b]:77)	No benefit assessed.	Not quantitatively assessed, as no material effects predicted.	Recommendations contained in Section 6, <i>Mitigation, management and monitoring</i> (2020[b]:76)



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
SURFACE WATER & FLOODING Surface Water Consultant: GHD Flooding Consultant: EMM	SURFACE WATER Potential impacts; water & salt balance: Increased volume and frequency of discharge via Newstan LDP001, LDP017 and the Awaba seepage; Decreased water levels in the Awaba underground and decreased volume and frequency of discharge via the Awaba seepage. Potential impacts; surface water flow: Changes to the alignment and longitudinal profiles of watercourses are expected to be minor and generally comparable to existing conditions; No measurable impact to remnant ponding; Minor changes in catchment areas resulting in no measurable impact to stream flows; No increase in potential for sinkholes to develop compared to existing conditions. Potential impacts; surface water quality: Discharges via Newstan LDP001 will continue to meet the water quality requirements of EPL 395; Discharges via Newstan LDP017 will occur in response to heavy rainfall, and as such will result in negligible and temporary impacts to water quality in the receiving environment of Stony Creek; Similar exceedances of water quality DGVs to those observed under existing conditions are expected, though surface deformations in the watercourses could result in: reduced DO concentrations through evaporative concentration, and elevated	Effects assessed as being generally consistent with those for existing conditions, therefore neutral effects assessed. Low likelihood of effects on downstream water users (addressed further in LEA). For detailed discussion of potential downstream user impacts refer to Section 10.2, (GHD 2019[a]:103).	Cost assessed at PV ≈ \$739.6K, based on extent of identified watercourses directly above proposed mine workings.	Refer to Section 13, <i>Mitigation, monitoring and management measures</i> (GHD, 2019[a]:108).



SURFACE WATER & FLOODING (CONT)	salinity and metal concentrations through the weathering of fractured bedrock; Potential impacts on the water quality of the Awaba seepage include increased salinity associated with changes in the interaction between the underground void and the Eraring Ash Dam, and increased salinity in the case that oxidisation of metal sulphides in the void occurs in response to changes in water levels. Potential impacts; downstream water users: No measurable decline in water flows or quality expected; Adverse impacts to downstream water users unlikely to occur. Potential cumulative impacts: No other licensed discharges to LT Creek and Stony Creek identified; The Awaba Waste Management Facility is outside the extent of predicted subsidence associated with the proposed Extension of Mine Area. FLOODING In general, the impact of potential subsidence on flood behaviour was found to be localised around channel gradient changes within the subsidence impact areas. Flood impacts were contained predominantly on undeveloped Crown land and private land holdings relating to Eraring Power Station. Localised flood impacts in these areas relate to potential maximum subsidence predictions which are unlikely to occur at the same time due to staged extraction.			
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Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
ABORIGINAL CULTURAL AND HISTORICAL HERITAGE Consultant: Umwelt	Aboriginal Cultural Heritage Assessment (ACHA): The project is unlikely to result in direct impacts to the Aboriginal archaeological sites present and the risk of indirect impacts to these sites is also low and can be mitigated (2020[a]:112). Historical Heritage Assessment (HHA) This assessment has determined that five of these six listed or potential (unlisted) heritage items may be subject to impacts as a result of the project (2020[b]:62). It has been determined that no additional potential (unlisted) historical heritage items, elements or sites are present within the project area (2020[b]:62)	No assessed effects.	Combined estimate of effects assessed as PV = \$70.7K	Refer to Section 9, <i>Management and Mitigation Strategies</i> and Section 10, <i>Recommendations</i> (ACHA 2020[a]:113-115) Refer to Section 9, <i>Management and Mitigation Strategies</i> and Section 10, <i>Recommendations</i> (HHA 2020[b]:63-66)



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
AIR QUALITY Consultant: SLR Consulting Australia	Only sensitive receptors in proximity to the Awaba Colliery Surface Site are assessed and presented for this project. 4 sensitive receptors identified (SLR 2020:19). It is concluded that the proposed operation is highly unlikely to cause any additional exceedances of the 24-hour average PM₁₀ criterion at the identified receptor locations (2020:81). The incremental impacts predicted due to the estimated [PM^{2.5}] emissions from the project are very low and represent a negligible contribution to the total cumulative concentrations (2020:81). Based on the results of this assessment, it is concluded that incremental concentrations due to the activities proposed as part of the project are unlikely to result in any additional exceedances of the air quality criteria at the nearest sensitive receptors (2020:81). NOTE: Material additional to the AQIA in relation to volume of outputs, permitting direct assessment of potential costs, is presented in Annexure 4.	Nil direct benefit assessed	Quantified/monetised assessment of operations stage PM_{2.5} emissions: PV ≈\$7.02 million. PM₁₀ emissions 6.312 tonnes per annum; TSP emissions 37.848 tonnes per annum. Post operation effects are also likely to be associated, however these are not quantified in the AQIA or the <i>Conceptual Rehabilitation and Closure Strategy (IEMA, 2019)</i>.	Refer to Section <i>Dust Management and Mitigation</i> (SLR 2019[a]:67-69).



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
GREENHOUSE GASES (GHG) Consultant: SLR Consulting Australia	Annual Scope 1 and Scope 2 GHG emissions from the project operations are significantly less than the annual emissions estimated for MOD8. This is due to the proposed introduction of flaring of the fugitive CH₄ emissions, rather than venting it direct to atmosphere. [2020:78] Annual emissions: Scope 1, 38,398 (t CO₂-e); Scope 2, 13,904 (t CO₂-e); Scope 3, 9,972,682 (t CO₂-e) [Table 48, 2020:79]. Annual average total GHG emissions (Scope 1, 2 and 3) generated by the project represent approximately 0.03% of total GHG emissions for NSW and 0.009% of total GHG emissions for Australia, based on the National Greenhouse Gas Inventory for 2017 (2020:80). Estimated GHG emissions for the project may also be assessed in relation to Australia's national Paris Agreement GHG emissions reduction target, i.e. a 26-28% reduction on 2005 levels by 2030. This translates into a range of 435-447 Mt CO₂-e/annum (including land use, land-use change, and forestry - LULUCF) allowed emissions in 2030. Under both these emission scenarios, the Extension Project would represent approximately 0.012% of Australia's national emissions. It is concluded that the Extension Project will have a minimal impact on Australia's ability to meet its emission reduction target (2020:80)	Nil direct benefit assessed	Quantified/monetised cost of Scope 1 and Scope 2 emissions: PV ≈ \$21.2 million, 2021 – 2035. As the above estimate is for the operational period only, it is likely to be an underestimate, as it does not provide for emissions in the postproduction decommissioning/ rehabilitation stages of the project. However, this is unlikely to be of significant magnitude, as fugitive emissions and flaring (Scope 1) eliminated and electricity consumption (Scope 2) will be greatly reduced. Scope 3 emissions were not quantitatively assessed, consistent with DPIE Technical Notes (2018:45), which in part note that: 'it is noted that the Scope 3 accounting framework is inconsistent with established national accounting rules under the UN Framework Convention on Climate Change, and could potentially result in 'double counting' of emissions when applied in conjunction with Scope 1 and 2 because emissions 'ownership' would be attributed to both the producer and end-user of a product, service or fuel' (2018:45).	Refer to Section 11.10 <i>Abatement and Avoidance of Emissions</i> (SLR 2019[a]:80).



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
TRAFFIC Consultant: EMM	The assessment concluded that the additional daily traffic movements during construction will have a negligible impact on the assessed road network as each assessed road will remain within its current Austroads threshold band. Therefore, road widths will remain generally compliant with the relevant Austroads design standards (EMM 2019[c]:47). The proposed operational traffic will not exceed what was modelled and approved under the development consent for the Northern Coal Logistics Project. During operations, project-related traffic movements will push Wakefield Road into a higher threshold band; however, the existing road width and condition are considered to be acceptable as the future daily traffic volumes will be at the lower range of the Austroad threshold band. (EMM 2019[c]:47). The future construction and operation workforce are not anticipated to create a high demand for public transport services, pedestrian and cycling activities (EMM 2019[c]:47). All [intersection] delays at intersections are considered negligible and will likely to be unnoticeable to the existing road users. All assessed intersections will remain at LOS A during operations (EMM 2019[c]:40).	Potential for impacts associated with operations-related heavy road vehicle movements largely mitigated by use of haul roads to Eraring Power Station.	Effects not quantitatively assessed on the basis of materiality. Notional and actual quantified/monetised costs to community associated with vehicle and plant use captured in air and GHG emissions estimates.	Due to the number accidents reported on the assessed road network, it is recommended that the project workforce be made aware of a number of traffic-related safety matters prior to commencement of their employment including: nearby schools and hours of school zone speed limit enforcement; the level crossing location on Miller Road; varying speed limits along the assessed access routes; general road safety rules (e.g. do not drive under the influence of alcohol and medication); and fatigue management measures (EMM 2019[c]:48).



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
VISUAL AMENITY Consultant: GHD	Sensitive visual receivers within the project viewshed are limited to the following: • Some (approx. 15) residential properties in the Nelinda Street/Dora Street/Adelaide Street area, Awaba. • Commuters and pedestrians using Awaba Station footbridge. • Road users on Wilton Road, travelling south near Sydney Street, Awaba. • Road users on Wilton Road, travelling north from the Awaba Waste Transfer Station. (2019[b]:16) Assessments based on four (4) viewpoints in respect of the above receivers resulted in negligible effects assessed for three (3) viewpoints and low effects for one (1) viewpoint (2019[b]:24 [Table 5.1]). The assessment found that the visual impacts from the project range from negligible to low significance (2019[b]:26).	Nil assessed as impacts are unlikely to be material.	Nil assessed as impacts are unlikely to be material.	Refer to Visual Impact Assessment Section 5.2.1, <i>Proposed actions to mitigate impacts</i> (2019[b]:24).
SOIL AND LAND RESOURCES Consultant: SLR Australia	The project will have negligible effect impact to soil and land resources within and surrounding the study area. (2019[b]:48) The project will have negligible impact to agricultural resources or enterprises within and surrounding the study area (2019[b]:48)	Nil impacts assessed	Nil impacts assessed	Any required works in respect of soil management contained in Section 5 <i>Disturbance Management</i> (SLR 2019[b]:41)



Impact	Environmental Assessment Commentary	Social and Economic Benefits	Social & Economic Costs/impacts	Description of Environmental Controls & Mitigation Measures
HAZARDS AND WASTE	Not assessed, as these are matters dealt with through operational plans. No external effects are likely to be imposed on third parties	Not assessed	Not assessed	Managed under operations plans should consent be obtained.

2.4 Net economic cost/benefit of the project

Combining the outputs of Tables 3 and 4, the Net Present Value (NPV) for the CBA element of the project is presented in Table 6. The table also reports the Cost-Benefit Ratio (CBR) for these project assessments.

Table 6: CBA Estimate of net economic cost/benefit (\$ million)

Economic benefit/cost	PV @ 4%	PV @ 7% (central)	PV @ 10%
Assessed benefit	128.3	108.0	92.3
Assessed cost	40.9	33.7	28.5
Project CBA NPV	87.4	74.3	63.8
Project CBR	3.1	3.2	3.2

At each discount rate, the direct benefits of the project to NSW are greater than the assessed costs. Table 6a presents a combined assessment based on the benefit and cost sensitivity analyses reported in Tables 3a and 4a. The central discount rate assessments are contained in Table 6, and are thus not replicated in Table 6a.

Table 6a: Sensitivity analyses, economic benefit

	<i>Monte Carlo [@7% discount rate] (\$ million)</i>		
	95% CI lower ²²	Simulation mean	95% CI upper
Assessed benefit	128.3	108.0	92.3
Assessed cost	33.6	33.7	33.8
Net benefit	94.7	74.3	58.5
	<i>Monte Carlo – high (@4%) & low (@10%) discount rate results (\$ million)</i>		
	95% CI lower ²³	Simulation mean	95% CI upper
Assessed benefit	110.3	111.2	112.1
Assessed cost	35.0	35.4	35.6
Net benefit	75.3	75.8	76.5

2.5 Sensitivity testing – alternative benefit and cost assumptions

The guidelines indicate a series of additional sensitivity testing parameters, which essentially test the central assumptions of the CBA based on adjustment of operating outcomes (DPIE, 2015:18). On the basis of the exclusion from this economic assessment of certain elements of economic benefit in particular (refer to Section 2.1 and Annexure 1), adjustments relating to corporate taxes are not applied. As net public infrastructure costs are unlikely to be imposed on the state or locality (refer to Section 2.3.2), these are similarly not assessed.

²² Confidence interval.

²³ Confidence interval.

Table 7: Sensitivity analysis – adjusted performance assumptions

ID	Economic Benefit	PV @ 4%	PV @ 7% (central)	PV @ 10%
1	Assessed benefit royalties -25%	109.3	91.9	78.4
2	Assessed benefit royalties +25%	152.1	128.1	109.4
3	Assessed cost (low)	35.7	29.4	24.8
4	Assessed cost (high)	46.1	38.0	32.1
6	High (2-3)	116.4	98.7	84.6
7	Low (1-4)	63.2	53.9	46.3

Sensitivity analyses based on price adjustments, with the objective of producing a zero NPV are not presented in this assessment. This is on the basis of the relationship between such adjustments and sensitive information with respect to costs and revenues that such analyses may expose. This material is excluded on the same basis as is described in Section 2.1. In any event, in terms of quantitative assessments, the magnitude of the outcomes of the various sensitivity analyses presented in this report indicate that from the public interest perspective in respect of royalty revenues, the likelihood of a zero NPV outcome cannot be considered as material.

3 PART C: LOCAL EFFECTS ANALYSIS (LEA)

3.1 Spatial area and community demographic profiling

The general demographic profile for the local and regional communities is presented in the Social Impact Assessment (SIA, Hansen Bailey 2020) and is consequently not replicated in this economic assessment. For the purposes of this LEA, spatial and population parameters are based on the locality defined in the guidelines as the SA3 (as identified in Section 2.3.1).

3.2 Regional economic profile

3.2.1 Effect of employee incomes

3.2.1.1 Contextual comparison with broader local incomes

The central estimate of ‘labour surplus’ as a proxy for the additional disposable income available for disbursement by employee households was estimated in the CBA at approximately \$27.6 million over the life of the project. The method on which the assessment was made is presented in Annexure 2. This demonstrates that the assessment takes into account consideration of alternative employment outcomes, represented by inclusion of the reservation wage and transfer payments (typically unemployment benefits) in the model. Table 8 summarises relevant inputs and outputs of the model and compares these with ABS²⁴ median and mean wage and salary incomes for the LGA, noting that corresponding data is prepared by ABS at SA4 level only, under the main statistical geographic area structure. This precludes direct comparison with SA3 data.

Table 8: Comparison of employment income data

Income measure	Estimate
Wage assumption	\$135,000
Reservation wage	\$126,329
Mean ‘labour surplus’/income residual (average of assessments)	\$9,039
Median employee income SA4 (2017, nominal)	\$49,997
Median employee income SA4 (2017 adjusted) ²⁵	\$48,833

As is the case with other comparatively highly remunerated occupations, these data demonstrate the greater extent to which mine employee incomes can be reasonably assumed to contribute to the relevant local and regional economies, in comparison with those of many other employees resident in the LGA. Evidently, mining employees have greater capacity for discretionary expenditure, and consequently the absence of these incomes from the regional economy under the BAU scenario may result in relatively greater impacts than would eventuate for a comparable failure to create a similar number of FTE positions in other regional industries.

²⁴

https://itt.abs.gov.au/itt/r.jsp?RegionSummary®ion=14870&dataset=ABS_REGIONAL_LGA2018&geoconcept=LGA_2018&maplayerid=LGA2018&measure=MEASURE&datasetASGS=ABS_REGIONAL_AS_GS2016&datasetLGA=ABS_REGIONAL_LGA2018®ionLGA=LGA_2018®ionASGS=ASGS_2016

²⁵ Adjusted on the same basis as the reservation wage. Refer to Annexure 2.

The likelihood of the workforce being resident in the locality (SA3), or the region more broadly is also relatively high. The workforces at Centennial’s nearby Mandalong Mine and Myuna Colliery are largely resident in the region (refer to Figure 1 and Figure 2), particularly in the Lake Macquarie LGA, in which those two mines and Newstan are situated. It is expected that the Newstan workforce will also be largely resident in the immediate area, and almost entirely in the broader region. This being the case, the proportion of incomes spent by workforce members and their households in the regional economy is likely to be relatively high.

Figure 1 Mandalong workforce residential LGA (December 2018)

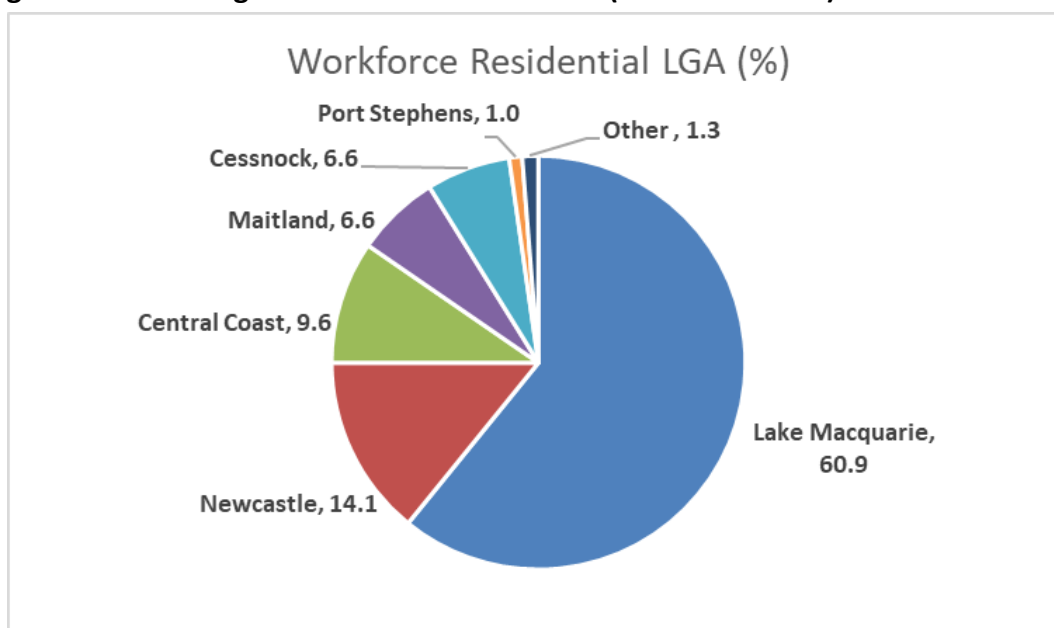
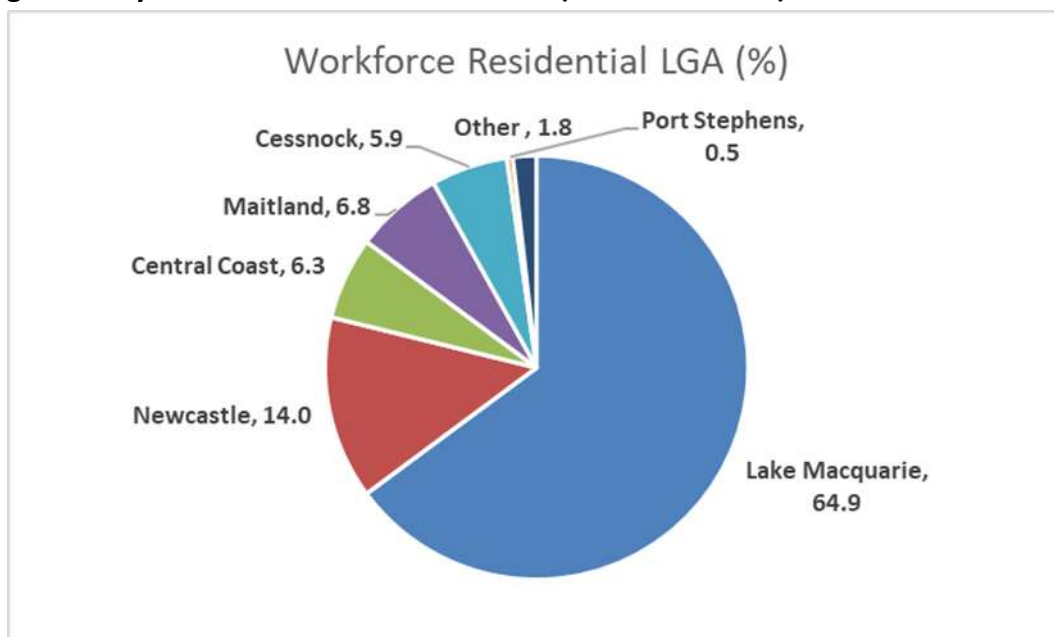


Figure 2: Myuna workforce residential LGA (December 2018)



3.2.1.2 *Alternative assessment of incomes*

An additional sensitivity assessment of employee incomes is presented in Table 9. This assumes the total assessments of employee benefit presented in Table 3a at the various discount rates as the upper bound of potential contribution. Assessments at 75%, 50% and 25% are also estimated, to demonstrate a range of possible outcomes. As the regional economy is large and diversified, it is likely that a significant proportion of workforce households' disposable incomes would be spent in the region. This is particularly the case in relation to regular household consumption expenditure. The outputs of a bounded Monte Carlo simulation are also reported, which assumes the lowest assessment (25% at 10% discount rate as the lower bound) and highest assessment (75% at 4% discount rate as the upper bound).

Table 9: Labour surplus sensitivity analysis

	7%	10%	4%
100% employee benefit	\$27,615,022	\$23,446,967	\$33,154,594
75% employee benefit	\$20,711,267	\$17,585,225	\$24,865,946
50% employee benefit	\$13,807,511	\$11,723,484	\$16,577,297
25% employee benefit	\$6,903,756	\$5,861,742	\$8,288,649
Monte Carlo outputs high & low			
	Sim mean	95% CI Lower	95% CI Upper
Employee benefit	\$15,315,521	\$14,974,081	\$15,656,961

Applying a randomised method to the range of possible outcomes, there is a 95% likelihood that the surplus or disposable incomes of Newstan Colliery employees disbursed in the regional economy may be between \$15.0 and \$15.7 million over the life of the project, based on the range of potential outcomes in Table 9. As stated above, in a large regional economy that is likely to accommodate a significant element of household needs in terms of the available goods and services, the actual outcome has the potential to be greater than this. However, it is recognised through the arbitrary sensitivity adjustments also presented in the table, that a range of alternative outcomes may eventuate, which acknowledges the reality of different economic behaviours of different workers and their households.

3.2.2 *Non-labour activity in the regional and NSW economies*

As Newstan Colliery is currently in care and maintenance status, there is no relatively recent internal financial data on which to base a direct assessment of non-labour economic activity and its potential derived economic effects. An indicative approximation of the proportion and scale of expenditure with regionally and NSW based businesses for the most recently available financial year is presented in Table 10²⁶. Mandalong Mine is adopted as a proxy for the project, given its regional colocation with Newstan Colliery. As Mandalong has a higher nominal annual output (6 Mtpa) than the proposed Newstan operations (4 Mtpa), an adjusted assessment ($\approx 67\%$) is presented for Newstan.

²⁶ Adjustments have been made to expenditure figures to maintain commercial confidentiality.

It is reiterated that the assessment presented must be considered as indicative only, and as such does not represent a predicted outcome for any or all operational years for the Newstan Mine Extension Project. The data demonstrate that a significant level of non-labour commercial activity can be expected to be transacted annually by the mine in the regional and state economies, under the proposed project.

Table 10: Non labour spend, local, regional NSW (1 year, indicative)

Measure	Local (LGA)	Regional	NSW
<i>Mandalong supplier transactions</i>			
Number of firms/entities	57	278	428
Total transaction value	\$22.9 million	\$79.6 million	\$121.9 million
<i>Derived Newstan supplier transactions</i>			
Number of firms/entities	38	186	287
Total transaction value	\$15.3 million	\$53.3 million	\$81.7 million

As is the case with other quantitatively and qualitatively assessed economic measures, in the event of the BAU case, the additional economic activity associated with the project would not eventuate.

3.2.3 Indicative economic flow-on effects

As is recognised in the guidelines, ‘second round effects can be extremely important for local communities’ (2015:23). The guidelines also propose a range of techniques for providing an indicative assessment of the scale of such effects, and identify broad limitations in respect of several of these. These methods include multiplier analysis. For the purposes of providing an indicative analysis, implied multipliers derived from the NSW Minerals Council NSWMC report ‘NSW Mining Industry Expenditure Impact Survey 2016/17’ (2018) are reported in Table 11.

Table 11: NSWMC Mining Expenditure Impact Survey 2016-2017 implied multipliers – Lake Macquarie LGA & all Hunter LGAs

LGA	Value Added	Employment
LMCC LGA	1.132	16.367
Hunter LGAs	1.185	12.457

Although multipliers tend to overvalue some economic effects, as stated above and recognised in the guidelines, they may be used to provide an indicative assessment of potential outcomes. Table 11 demonstrates that operations at Newstan are likely to support further employment and contribute to additional economic value creation.

3.2.4 Effects on other industries

Section 2.3.3 in the CBA presented a discussion of the propensity of the project to affect the surpluses, or performance, of other industries. As was discussed in that section, the operations of one entity are likely to be subsumed to some extent in such a large regional economy. However, from the perspective of cumulative regional economic growth, it remains that the project would provide positive economic stimuli. As such, the effects on

other industries are likely to vary. Some suppliers and related industry operators are likely to benefit from the activities of Newstan Mine. Others may experience negative effects as a consequence of competition for employees, for example. However, the magnitude and duration of such negative effects would be unlikely to be significant, with a comparatively large and skilled workforce resident in the region. The CBA discussion also addressed the BAU alternative. Should the project application not be approved, none of the economic benefits of the project would be realised. Similarly though, no other industries would be affected, thereby neutralising the potential for negative effects in that case.

The regional industry (or specifically, business unit) that is likely to be most affected by either the project or the BAU alternative is Origin Energy's Eraring Power Station. The potential shortfall in projected locally sourced fuel supply that would result if the project did not proceed would need to be met by other suppliers. The identities and/or locations of specific alternative suppliers cannot be established with any degree of certainty. However, as these are likely to be geographically further from Eraring than Newstan Colliery, and probably unlikely to access the existing transport infrastructure (underground conveyors and private haul roads), the cost of alternative supply would be likely to increase. In addition to the direct cost to Origin Energy/Eraring, there is the prospect that the additional cost may be passed on to electricity consumers, thereby affecting them also. There may also be an increase in externality effects associated with the increased transport task required for procuring fuel from mines more distant from the power station.

The second component of production, export metallurgical coal, would be likely to have a limited impact on relevant transport and logistic operators in the BAU circumstance. Rail and port infrastructure operators in particular would not be contracted to handle this product if the project did not proceed. The effect is considered unlikely to be material, in the context of the scale of coal exports from the Port of Newcastle.

3.3 Environmental and social impacts on the community

3.3.1 Environmental impacts

Those environmental impacts which are suitable for quantitative analysis were assessed in the CBA. In addition, a discussion of qualitative effects of the various environmental aspects of the project was reported in Table 5. The qualitative implications for these environmental impacts may be particularly relevant at the regional level, but most particularly at the level of certain residents or other land users assessed as being in close proximity to the mine and its operations. Recreational activity by occasional visitors and environmental 'use' must also be taken into account, particularly in some instances. The environmental considerations, and those most susceptible to any effects in relation to these which are discussed in the following sections, are those considered to be most salient for communities and households within the region, but in the immediate area in particular.

The qualitative assessments of impacts presented in this section are an integral part of assessing the scope and scale of potential impacts. These assessments seek to take into account the perceptions and the potential for experienced impacts of relevant stakeholders.

Although these elements of social, and to some extent economic, impact are subjective, they provide for consideration of aspects of localised impacts that may not be adequately expressed in the quantitative assessments reported in the CBA and in various parts of the LEA. Those quantified valuations may not equate with stakeholder values in respect of environmental effects, for example. The extent to which these effects may be experienced by stakeholders is reflected in the range of avoidance, mitigation and management recommendations proposed by specialist consultants, for each category of effect. These anticipate the possibilities of impacts that may not otherwise be addressed in the EIS. The Social Impact Assessment (Hansen Bailey 2020) presents further, detailed discussion of these elements and the appropriate mechanisms for assessing and addressing these.

3.3.1.1 Attribution of quantitatively estimated environmental effects

Table 12 presents a quantified assessment of the local or regional distribution of those environmental impacts quantified in the CBA. These are assessed as being proportionally distributed, on the basis of population. Some impacts are likely to be experienced by those in close proximity to sites, or in the case of Aboriginal heritage, those who may have a cultural interest in the sites or artefacts identified. Other effects, such as GHG impacts, are more broadly distributed. These are apportioned to the regional population as a proportion of the NSW population (as is provided for in the guidelines)²⁷. It is noted, however, that in the instance of GHG emissions, the notional cost of these may also be considered as a nationally distributed impact, which would significantly reduce the proportional assessment presented below.

Table 12: Regional distribution of quantified environmental effects

Environmental effect	Basis of attribution	Assessed effects ²⁸
Aboriginal cultural & historical heritage	100%	PV ≈ \$70.7K, local/regional Aboriginal communities (potentially 3,868 residents of the SA3 [ABS ERP 2018] ²⁹ , 4.9% of SA3 population).
Air quality	100%	PV ≈ \$7 million, immediate area, including 4 sensitive receptors (residential, therefore potentially ≈11 residents). ³⁰
GHG	SA3/NSW population	Share of total PV ≈ \$209,030, (based on ABS ERPs 2018).
Biodiversity	100%	PV ≈ \$2.04 million (27,145 households in SA3).
Surface water	100%	PV ≈ \$793.6K (27,145 households in SA3).
Groundwater	100%	PV ≈ \$2.7 million (27,145 households in SA3).

²⁷ E.g. DPIE Technical Notes 2018:20

²⁸ PVs at 7% discount rate.

²⁹ 78,923 (ABS Data by Region 2020); proportion of people of Aboriginal or Torres Strait Islander descent 4.9% (ABS Census 2016).

³⁰ Based on 2.4 people per household for the SA3 and LGA (ABS Census 2016).

3.3.1.2 *Subsidence effects*

The combination of first workings only, partial extraction, and total extraction using bord and pillar mining methods, has been adopted to minimise subsidence impacts to sensitive built and natural surface features, and to mitigate multi-seam subsidence impacts associated with the Awaba workings in the overlying Great Northern Seam.

Conservative buffers have been adopted in the mine design to minimise subsidence impact risks to overlying infrastructure such as the Main Northern Railway, Eraring Power Station and Eraring Ash Dam and sensitive surface water features such Stockyard Creek, Kilaben Creek, and Stony Creek. There is also inherent flexibility in the proposed bord and pillar mining method, as it provides Centennial Newstan with the ability to vary mining activities as required in response to unforeseen geological or environmental constraints.

Certain subsidence-related effects are most likely to manifest as indirect impacts in other categories of effect, such as water resources, biodiversity and Aboriginal cultural and historical heritage. These are discussed in Table 5 and in relevant subsections in the LEA.

3.3.1.3 *Water resources*

Material extracted from the specialist reports is presented in Table 5. With respect to surface water, it was concluded that no measurable decline in water flows or quality are expected. Consequently, adverse impacts to downstream water users are unlikely to occur.

With respect to groundwater, GHD (2020[c]) reported that any effects are likely to be related to existing historical works, although a slight decrease in groundwater is expected in future years. From the economic valuation perspective, the salient finding is that the risk of effects on groundwater users was assessed as low.

Quantitative assessments have been prepared to recognise the value of water in the Macquarie-Tuggerah Lakes Basin catchment (refer to Annexure 4 for further detail). That notwithstanding, the specialist consultant assessments maintain that effects are not likely to be of material scale.

3.3.1.4 *Noise and vibration*

Four (4) potentially sensitive receptors were identified. These are all residential premises. Construction noise levels were assessed as being unlikely to affect sensitive receptors. Operations (principally at the Awaba Colliery surface site) were assessed as resulting in a negligible night-time exceedance at one receptor, in noise enhancing conditions. Sleep disturbance screening criteria are predicted to be met. Traffic noise was assessed as being within relevant limits. Vibration was assessed as being negligible and below levels of human perception at all stages. On these bases, it is unlikely that any economic cost or benefit will be experienced by sensitive receptors or others as a consequence of the estimated effects.

3.3.1.5 *Air quality*

The quantitative assessment of this impact is presented at the SA3 level in Table 12. In summary, the qualitative assessments of the impacts (PM_{2.5}, PM₁₀ and TSP) 'concluded that

incremental concentrations due to the activities proposed as part of the project are unlikely to result in any additional exceedances of the air quality criteria at the nearest sensitive receptors' (SLR, 2019[a]:81), noting that these receptors are the same as those in respect of the noise and vibration assessment. Individually, the different emissions were assessed as representing a very low to negligible likelihood of additional exceedances (PM₁₀) or contribution to cumulative concentrations (PM_{2.5}). As a result, it is unlikely that any material economic cost or benefit will be experienced by sensitive receptors or others as a consequence of the estimated effects.

3.3.1.6 Greenhouse gas (GHG) emissions

The potential for localised or regional effects of GHG emissions specifically produced through the project is unlikely to be realised by, or be apparent to, these communities. However, it is the cumulative effect of emissions in the context of existing conditions that may contribute to impacts on those communities and at the broad scale, and which may be of concern to elements of the various communities considered in the EA. It is acknowledged that there is a general awareness and acceptance of the negative effects of GHG emissions. However, in the current societal and political environment, it is not feasible to immediately discontinue the coal-fired electricity generation which the project would support in the state, without major disruption to the social and economic fabric of NSW. If approved, the project will operate at the determination of the policy and investment environment as it evolves. In doing so it will ensure that major disruption is avoided to the extent possible. With respect to the export component of production, the product is metallurgical coal, as opposed to thermal coal.

3.3.1.7 Aboriginal cultural heritage

The quantified assessment of potential effects is presented in Table 12. This was calculated based on the assumption of the Aboriginal community being the principal community of interest in respect of potential impacts. The risk of impacts to sites is assessed as low (as identified in Table 5). In the context of the project and other quantified effects, the economic benefit or cost of this impact may be considered as not material. However, the specialist consultant report provides recommendations with respect to managing potential impacts.

It is noted that historical heritage was also assessed. This was assessed as unlikely to result in impacts on the community. As such, the assessed economic cost ascribed to this category of impact is not considered to be of material scale.

3.3.1.8 Biodiversity

The quantified assessment of potential localised effects is presented in Table 12. There will be a direct biodiversity impact as a result of clearing of 0.35 ha of native vegetation, comprising three PCTs. 0.15 ha of the area to be cleared comprises a plant community type that is commensurate with an identified EEC (PCT 1718). As is presented in Annexure 4, the proportion of disturbed area of all three PCTs is less than 0.1% of the total area of these communities identified in assessing the project. The clearance of PCT 1718 represents less

than 1% of the identified area of that community. As the surrounding areas possibly include other comparable areas of the identified PCTs, the areas to be cleared are limited in scale. Centennial Newstan will incur offset liabilities, estimated at \$138,291.10 in respect of direct and/or any contingent effects, and will meet its obligations in respect of such liabilities.

The assessment included in the CBA for potential effects on threatened flora and fauna are contingent. As is identified in Table 5, the probability and magnitude of effects is indeterminate prior to operations commencing and will be subject of monitoring to determine any such effects should these eventuate. For the purposes of this EA, these potential effects have been valued on the basis of the precautionary principle.

Given the presence of comparatively large areas of alternative, similar habitat and the contingent nature of any possible effects on threatened or other native species, it is considered as of low probability that any significant number or proportion of residents of the SA3 would discern any effects relating to these project outcomes.

3.3.1.9 Traffic and transport

It is noted that impacts associated with traffic, such as noise and vehicle emissions, are addressed in the relevant specialist assessments of those effects. Regarding traffic effects more specifically, although the project is likely to result in additional traffic movements, these are assessed as being within the capacity of existing road and intersection infrastructure. As such, material effects on other road users are assessed as being unlikely, and will therefore result in no material economic cost or benefit.

3.3.1.10 Visual Impacts

Impacts were assessed from four (4) potentially sensitive viewpoints. Each of these were assessed as likely to experience no significant impacts. The assessment determined that the likelihood of effects ranges from negligible to low. It is considered unlikely that any qualitative cost or benefit will result from this aspect of the project.

3.3.1.11 Social impacts

The CBA and LEA quantifies the potential effects of the project to the extent practicable. However, these valuations may not fully reflect the values that individual stakeholders place on any or all of the potential effects. The LEA in particular attempts to take into consideration such qualitative effects, however this is again in the context of presentation of an economic assessment of the project. It is acknowledged that stakeholder perceptions and values are subjective and may not be exhaustively addressed in the EA. However, the Social Impact Assessment prepared for the project is understood to further address the potential subjective, qualitative stakeholder perceptions of the project. Given their nature, there is no satisfactory basis for ascribing monetary values to these potential stakeholder concerns.

3.3.1.12 Operational impacts – hazards & waste

A qualitative discussion of the potential for mining interaction with the Eraring Power Station ash dam is presented in Section 3.3.1.13. Management of hazards and waste are

matters that are provided for in operational plans, including those relating to the safety and welfare of the workforce. Given the relatively isolated nature of the relevant sites and controls over access to these, it is considered unlikely that any impacts of this nature, or associated with management of these issues, will affect external parties.

3.3.1.13 Mining interaction with the Eraring ash dam

The continued use and structural integrity of the ash dam may be considered as a matter of interest to certain residents. Such interest is likely to relate to the prospect of the impact of naturally-occurring seismic events (earthquakes and tremors).

A separate report on this matter was prepared by SCT Operations Pty Ltd, in respect of the project. The report found that *inter alia*, ‘Micro-seismic events are expected to be associated with caving above the extracted FCT [flexible conveyor train]³¹ panels in the Newstan MEP [Mine Extension Project]. These are likely to have a magnitude on the Richter Scale of less than 1.0 based on experience at other sites. A program of monitoring seismic energy released during subsidence above early FCT panels at the Newstan MEP is recommended. Gibson and Dimas (undated) present data indicating that on average there is one natural earthquake in the Newcastle Lake Macquarie area each year with a Richter Scale magnitude of 2 (i.e. ten times as much energy released as that expected from mining subsidence)³². On this basis, it appears unlikely that mining induced seismicity would have any potential to create a significantly higher risk of liquefaction [of ash dam material] compared to the natural background risk’ (2019:28).

Filling of the mine voids below the earth embankment proposed by Origin Energy is likely to be a Dams Safety NSW pre-requisite for that augmentation project. This void filling is expected to obviate any potential for pillar instability. The small pillars formed in the ‘5 South Panel’ of the former Awaba Workings in the overlap zone between Awaba Colliery and the ash dam are only lightly loaded and would not be expected to be destabilised by earthquake activity. These pillars were formed after the 1989 Newcastle earthquake.

The method of filling the Eraring Ash Dam has potential to generate a ‘soil’ mass that would be capable of liquefaction. Subsidence movements associated with the proposed mining in the West Borehole seam would be expected to occur slowly enough to dissipate excess pore pressures and prevent liquefaction. It is also noted that no workings are proposed in the area around the dam wall prescribed by Dam Safety NSW

The magnitudes of micro-seismic event generated ground movements caused by mining in the West Borehole seam are expected to be less than the magnitude of annual average background seismic events that occur naturally. Mining subsidence is therefore not expected to create a liquefaction hazard at the Eraring Ash Dam, greater than the risk from naturally occurring seismic events.

³¹ Mining machinery used in extraction

³² i.e. Richter Scale magnitude of less than 1.0.

Based on this assessment, it is considered unlikely that operations proposed for the project would create any elevated risk of negatively affecting the structural integrity of the ash dam. According to the SCT assessment, the likelihood of a mining-related event is remote. Consequently, it is not practicable to ascribe potential economic benefits or costs in relation to this aspect of the project. However, it is recognised that some individuals or groups within the population may apprehend such risk, despite its apparently low likelihood of occurrence.

3.3.1.14 Cumulative effects of the project

As the proposed project essentially entails Newstan Colliery being reactivated to full operational status from its current care and maintenance status, the majority of effects of the project should be considered as increasing existing or background activity levels. From this perspective therefore, all of the effects can be considered as cumulative to the extent that they will increase the existing levels.

Such effects are also likely to be particularly focused on stakeholders in the area of the mine. The specialist assessments in relation to these effects generally conclude that the extent of any additional (i.e. cumulative) effects will be within established exceedance limits. In this respect, localised effects are unlikely to entail major impacts on stakeholders.

An additional source of cumulative impacts is the combined effect of the project and other planned activities in the area. Works on increasing the capacity of the Eraring ash dam are discussed in Section 3.3.1.13. The discussion demonstrates that mine design has been undertaken to avoid interaction with this planned infrastructure work. As such, no cumulative effects are predicted in respect of this matter. No other potential sources of cumulative effects were identified during preparation of the EIS, or this EA.

3.3.1.15 Management of local environmental and social impacts

Table 5 reports the mitigation and management recommendations in respect of each of these impacts. Implementation of these should contribute to alleviating the extent of these effects, particularly in respect of the localised impacts. The SIA (Hansen Bailey, 2020) forming part of the EIS for the project, recognises that notwithstanding actual effects and the reduction in these associated with mitigation and management strategies, some stakeholders may continue to perceive or experience effects. The SIA includes recommendations in respect of ongoing engagement and consultation mechanisms for stakeholders that offer the best means for managing such potential circumstances.

3.4 Summary of quantified local effects

Table 13 presents a summary of those quantified, localised effects that are assessed as being attributable to the region.

Table 13: Summary of quantified regional effects			
Effect	Assessment (SA3)	High	Low
<i>Assessed benefits</i>			
Employee benefit (PV \$million) ³³	14.9 - 26.5	15.2 - 31.8	14.6 - 22.5
Employment (FTE)	320	-	-
Non-labour expenditure (\$million/p.a.)	15.3	-	-
<i>Assessed externality costs</i>			
Aboriginal cultural heritage (PV \$K)	70	-	-
Air quality (PV \$million)	7.02	-	-
Biodiversity (PV \$million)	2.04	-	-
GHG (PV \$K)	221	241	200
Surface water (PV \$K)	740	839	641
Groundwater (PV \$ million)	2.7	4.96	0.416

³³ Based on Monte Carlo sensitivity analysis, Table 1a. Figures presented are for total and adjusted employee benefit.

4 Part D: Conclusions and recommendations

4.1 Conclusions

4.1.1 CBA

Based on quantitative analyses of central assumptions and a variety of alternative scenarios, the conclusion of the CBA is that the project represents a sound economic outcome, on a number of bases. Returns to the NSW community, chiefly expressed in this report as royalty revenues, remain positive in the various scenarios presented. It is noted that a variety of other taxes are excluded from the assessment (refer to Annexure 1). In this respect the estimated contribution to governments, and by association the public, is conservative. In addition, employee incomes and the associated benefits of additional employment, from both state and regional perspectives, are also positive. Commercial transactions between Newstan Colliery and the suppliers of goods and services with which it will trade are an additional source of benefit in the state, regional and local economies.

A number of derived effects were also assessed in the CBA, particularly in qualitative terms. Supply of fuel to Eraring Power Station over the duration of its remaining operating life is likely to represent a comparatively socioeconomically efficient outcome. This is principally related to the advantages of proximity and existing transport and logistics infrastructure available to Newstan Colliery, but which may not be accessible or of practical use to alternative suppliers. Although alternative solutions under the BAU outcome cannot be determined with any certainty, it is likely on the above bases that this would be less economically efficient and also result in a high likelihood of less desirable social impacts, such as additional externality costs associated with the required alternative transport methods and potentially the greater transportation distances involved.

4.1.2 LEA

The LEA demonstrates the economic contribution of coal mining at the local and regional levels. The most obvious measures of these contributions are through potential employment and derived benefit associated with employees and their households, and commercial interrelationships between Newstan Colliery and its regional supply chains. The alternative BAU outcome would result in none of these benefits being realised in the local and regional economies.

The project would result in a number of environmental effects, which collectively are likely to most directly affect regional and local communities and/or specific elements of those communities. Notwithstanding that some stakeholders may perceive these effects as being of greater or lesser significance, the magnitude of effects identified by specialist consultants and assessed in this report is comparatively limited. Recommended mitigation and management strategies for each category of effect are presented as part of specialist assessments. Adoption of these will minimise the effects of the project to the greatest extent possible. As is the case with the potential for beneficial outcomes, the BAU scenario would result in none of the assessed costs being realised.

4.1.3 Economic assessment

The conclusion of this economic assessment is that, on balance, the economic effects of the project at regional and state levels are positive. The project represents the most economically and socially efficient available option for ongoing supply of fuel to Eraring Power Station over its remaining operating life, noting the potential influence of changing circumstances over time (refer to Section 3.3.1.6). This has broad socioeconomic implications for government, industry and households at state and regional levels.

The economic assessment recognises that there are costs associated with the project. It is submitted that these are quantitatively of lesser magnitude and would be likely to be considered as qualitatively tolerable by the broader NSW community, which the project would indirectly serve. However, some effects may be experienced more acutely by some stakeholders, particularly those living in close proximity to the mine, which is recognised in the LEA in particular.

The BAU alternative would effectively result in Newstan Colliery becoming permanently inoperative. This would eliminate both the benefits and costs associated with the proposed project.

4.2 Recommendations

Consequent to the analyses presented in this economic assessment, the following recommendations are proposed. These are intended to maximise the benefits of the proposed project and minimise the socioeconomic costs to the extent possible.

1. The Newstan Colliery Mine Extension project be approved, with a view to NSW obtaining the benefit of mining royalties and increased employment and commercial activity and security of electricity supply in the context of the current policy environment.
2. The recommendations proposed by specialist consultants in respect of addressing environmental effects should be employed to the extent practicable.
3. Centennial Newstan continue its programs of community consultation and engagement with local and regional stakeholders in particular.
4. Recommendations from the Social Impact Assessment (Hansen Bailey 2020) in respect of managing such impacts, be employed by Centennial Newstan, should those be supplementary to existing initiatives.

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Annexure 1

Treatment of economic effects of taxation components

As discussed in Section 3.4.1, a comparative assessment of the economic contribution of various federal, state and local government taxes, rates and charges is excluded from this analysis. The reasons for this approach essentially relate to changes in methodological assumptions, some of which are necessitated by clarifications provided in the DPIE guidelines. In essence, the guidelines in particular indicate that tax components be treated separately, whereas they were previously presented on the basis of a combined internal estimate. These are described below.

Corporate taxes (Federal)

The DPIE guidelines include provision for reporting of federally levied corporate income taxes as a component of the economic benefit of projects³⁴, which has necessitated a review of method in terms of estimation of assessment of notional tax liability. Tax liability in respect of Centennial Newstan comprises part of tax assessment for Centennial Coal Pty Ltd at aggregate level for the entire company, and not by individual operations. Therefore, Centennial Newstan will not report corporate taxes as a stand-alone operation. Furthermore, given the extent of Centennial Coal's portfolio of operations and their varied performance in any given year, a proportional estimate of entire group tax liability cannot be validly attributed to individual operations. Even less so can a reliable assessment of taxes be made over the life of an individual project in the context of this volatility. As a result, corporate tax is not reported in this assessment. The necessary exclusion of this material will contribute to a conservative estimate of benefit, as ordinarily some component of tax paid by Centennial Coal/Centennial Newstan would be returned to NSW.

NSW State Government taxes and Local Government rates, local authority charges etc.

The treatment of State-levied taxes varies. The DPIE guidelines note *'that a new mine will also pay other taxes, such as payroll tax and personal income tax. The majority of these taxes will have been generated without the project, as people would have been employed elsewhere'*. As it is recognised in the EA that some proportion of the new workers may represent a reallocation of the existing regional labour pool, DPIE's assumption is apposite to the current assessment. Accordingly, these taxes are excluded from the analysis in the EA. Other state taxes and local government rates and charges are not anticipated to change as a result of the modification, as consent boundaries etc. remain unchanged.

The combined effect of the exclusion of these items does not negate the fact that they comprise part of the beneficial outcomes of the project. Rather, their exclusion should be considered as resulting in a conservative estimate, albeit in the form of a relatively small incremental change.

³⁴ Calculated as a population-based proportional return to NSW.

Annexure 2

Estimation of net economic benefit to workers

Internal data on current local/regional operations is assumed as indicative of the residential status of Newstan Colliery workforce members. The conclusion is that the workforce is likely to be largely resident in the immediate region (refer to Table 9). There is a relatively large existing coal mining workforce in the region (approximately 55% of the total NSW coal mining workforce). The regional industrial base would also support a conclusion that the majority of workers will originate within the region. This being the case, the EA presents an assessment of the potential economic contributions of the workforce on the basis of regional residence.

The assessment method presented below permits calculation of the residual or surplus economic contribution (labour surplus) of future employees of Newstan Colliery, taking into account alternative employment outcomes. The approach taken is to adopt a 'reservation wage' and compare this to the assumed wage level for ongoing employment, producing an estimate of 'labour surplus'. The reservation wage is derived as:

$$RW = (1 - p)AW + pB$$

Where:

RW = reservation wage;

p = probability of a worker remaining unemployed and thus claiming unemployment (Newstart Allowance) benefit. The Australian Government Job Outlook website³⁵ was referenced to obtain information to inform an assumption on this probability. Findings for relevant occupations are included in Table A2.

Table A2: Job outlook information

Identifier	Occupation	Unemployment	Employment growth	\$/week (median)	\$ annualised
1	Drillers, Miners & Shot Firers	lower	stable	2,500	130,000
2	Mine Deputies ³⁶	lower	stable	2,812	146,224
3	Mining Engineers	lower	decline	3,118	162,136
4	Other Construction and Mining Labourers	average	moderate	1,683	87,516
5	Geologists, Geophysicists & Hydrogeologists	lower	very strong	2,192	113,984
6	Production Managers	lower	moderate	2,258	117,416
7	Earthmoving Plant Operators	lower	stable	1,491	77,532

Based on internal information, the workforce comprises ~90% operations (mining) personnel and ~10% staff/management personnel. Category 1 was assumed as the average wage for operations (mining) personnel and the average of categories 2,3 and 5 for staff. These

³⁵ Information current at January.

³⁶ Included in the occupational group 'Other Building and Engineering Technicians'.

estimates were then used as a basis for assessing the assumed alternative wage. Applying the proportional distribution based on the structure of the proposed workforce resulted in an estimated median industry income of \$131,100. Incidence of unemployment is assumed as average, therefore, the unemployment rate for NSW may be considered as reflecting the likelihood of a displaced employee being unable to find work. At December 2019, the unemployment rate for NSW was 4.7%. For the purposes of recognising the higher level of unemployment in the region, an estimate is also provided based on the unemployment rate for the Newcastle Lake Macquarie SA4, reported at November 2019, of 5.1%³⁷.

AW = assumed alternate wage. In this instance the alternate wage is assumed as the median wage for the mining sector, adjusted for the structure of the proposed workforce (\$131,100 annualised).

B = Newstart Allowance. The benefit is assumed at partnered level, \$504.70 per fortnight³⁸ (each) annualised (\$26,244). Therefore, the reservation wage would be alternatively:

$$\begin{aligned} &(0.953 \times \$131,100) + (0.047 \times \$26,244) \therefore \\ &\quad \$124,938 + \$1,233 = \mathbf{\$126,171} \\ &\quad \mathbf{OR} \\ &(0.949 \times \$131,100) + (0.051 \times \$26,244) \therefore \\ &\quad \$124,414 + \$1,338 = \mathbf{\$125,752} \end{aligned}$$

The average reported in parts of the main report is **\$125,962**.

The assumed wage rate at the time of preparation of the economic impact assessment was estimated at \$135,000³⁹. Consequently, the difference, and the labour surplus value assumed for estimation of the employment effects in the regional economy is **\$8,829 (Estimate 1)** and **\$9,248 (Estimate 2)**.

³⁷ Australian Government Department of Employment website (2020): *Labour Market Information Portal*.

³⁸ Australian Government Department of Human Services (2020)

³⁹ Based on internal data at January 2020.

To permit equivalent comparison of the relative effect of these mining wages in the local and regional economy, the corresponding calculation was made for the median employee income for the Newcastle – Lake Macquarie SA4⁴⁰. This was \$49,997.

$$(0.953 \times \$49,997) + (0.047 \times \$26,244) \therefore \\ \$47,647 + \$1,233 = \mathbf{\$48,880}$$

OR

$$(0.949 \times \$49,997) + (0.051 \times \$26,244) \therefore \\ \$47,447 + \$1,338 = \mathbf{\$48,785}$$

The average reported in parts of the main report is **\$48,833**.

⁴⁰ ABS Data by Region. Most recent estimate (2017). Data for this SA4 were used based on the assumption that employees will have similar residential distribution to Mandalong Mine. 75% of the Mandalong workforce were resident in the SA4 (2018). Use of the median wage is consistent with the calculation method for the mining income assumption.

Annexure 3

Assumptions adopted for assessment of mining royalties

Table A3.1: Estimation assumptions

Description	Assumption adopted
Royalty rate	7.2% (other underground coal)
Deductions (beneficiation allowance and levies)	\$10.00/tonne. Preparation of ROM coal for sale as two products (as below) requires two beneficiation processes.
Prices – semi-soft coking coal (export)	Based on KPMG consensus price forecasts for September/October 2019, as per Table A3.2. The long-term prices for 2024 is the nominal long-term price and is applied to all outyears. Due to limited forecast information for the product, the KPMG low & high and mean prices were adopted. The nominated mean price is that calculated by KPMG across all 9 contributors (refer to Figure A3.1 for original USD estimates).
Prices – domestic thermal ⁴¹	Fixed price assumption/estimate provided by Centennial Newstan. Can be disclosed to DPIE upon request.
Exchange rate (USD:AUD)	RBA long-term average exchange rate 31 January 2000 to 31 July 2019; AUD 1 = USD 0.7821 (0.78 assumed).
Discount Rate	7% (DPE guidelines)
Sensitivity testing	By discount rates at 4% and 7% (DPE guidelines); By bounded Monte Carlo-style random number test of 1000 iterations, producing simulation mean and 95% confidence intervals.

Table A3.2: AUD price assumptions; semi-soft coking coal (export component of production)

	2020	2021	2022	2023	2024	Long term price assumption
KPMG Consensus (low) AUD	102.6	102.6	102.6	109.0	102.6	Long term price adopted for 2024-2035 (\$102.6)
KPMG Consensus (high) AUD	158.7	154.5	147.4	142.3	134.6	Long term price adopted for 2024-2035 (\$134.6)
Average AUD	137.1	134.4	126.9	127.4	116.4	Long term price adopted for 2024-2035 (\$116.4)

Note: DIIS (Australian Government)⁴² pricing data was also reviewed. However prices were restricted to high-quality metallurgical coal and only projected to 2021. These were therefore not used. It is noted that these were relatively consistent with KPMG Consensus estimate.

⁴¹ Price assumption advised by Centennial Newstan.

⁴² Department of Industry, Innovation and Science, Resources and Energy Quarterly September 2019. Australian Government, Canberra.

Figure A3.1

Semi-soft coking coal (USD/t Nominal)

Year ended 31 December	Reporting date	2019	2020	2021	2022	2023	LT (2019)
Contributor 5	4-Oct-19	121.0	114.0	114.0	104.0	106.0	105.0
Contributor 6	4-Oct-19	127.0	119.5	120.5	115.0	n/a	90.0
Contributor 7	4-Oct-19	94.0	106.0	102.0	97.0	111.0	90.0
Contributor 10	2-Oct-19	108.0	108.0	n/a	n/a	n/a	n/a
Contributor 11	2-Oct-19	122.0	102.0	96.0	95.0	95.0	85.4
Contributor 13	26-Sep-19	95.0	80.0	80.0	80.0	85.0	80.0
Contributor 14	25-Sep-19	123.6	123.8	119.0	112.0	100.0	88.4
Contributor 16	23-Sep-19	115.6	100.0	100.0	90.0	n/a	90.0
Contributor 20	12-Sep-19	122.0	109.0	107.0	n/a	n/a	98.0
Low		94.0	80.0	80.0	80.0	85.0	80.0
High		127.0	123.8	120.5	115.0	111.0	105.0
Average		114.2	106.9	104.8	99.0	99.4	90.8
Median		121.0	108.0	104.5	97.0	100.0	90.0
Previous bulletin (June/July 19)							
Average		118.9	112.8	108.3	102.2	97.8	91.0
Median		121.0	109.0	105.5	97.0	97.5	90.0

Annexure 4 – assumptions supporting economic assessments of environmental effects

Air quality

Assumption	Source				Comments/derived estimate
Valuation	PAE Holmes (2013): Methodology for valuing the health impacts of changes in particle emissions – final report. Prepared for NSW Environment Protection Authority (EPA).				Unit damage cost, Newcastle-Maitland SUA (ABS Significant Urban Area) \$110,000 damage cost/tonne of PM _{2.5} .
Output volumes	Pollutant	Kg/month	Derived kg/p.a.	Derived tonnes/p.a.	Outputs presented in AQIA cannot be directly valued using the chosen method. The volumes presented in this table are provided by SLR, supplementary to the AQIA (January 2020).
	TSP	3,154	37,848	37.848	
	PM ₁₀	526	6,312	6.312	
	PM _{2.5}	526	6,312	6.312	

Aboriginal cultural heritage

Assumption	Source				Comments/derived estimate
Valuation	Allen Consulting Group (2005): Valuing the Priceless: The Value of Heritage Protection in Australia, Research Report 2, Heritage Chairs and Officials of Australia and New Zealand, Sydney. < http://www.heritage.nsw.gov.au/docs/Research_ValuingthePriceless_2005.pdf >				3 Aboriginal cultural heritage sites and 5 historical heritage sites may be impacted: \$8.35 per capita p.a. for each 1,000 places protected); SA3 population (78,923) assumed (as the locality) ⁴³

⁴³ Sources: Niche (2019); Allen Consulting Group (2005); Population estimate at 2018 (ABS 2020).

Biodiversity

Assumption	Source	Comments/derived estimate																									
Valuation – clearing of native vegetation	Curtis I A (2004): Valuing ecosystem goods and services: a new approach using a surrogate market and the combination of a multiple criteria analysis and a Delphi panel to assign weights to the attributes. <i>Ecological Economics</i> Volume 50 Issues 3-4, pp.163-194. Value escalated by 2.5% p.a. (as midpoint of RBA long-run inflation target range). 2020 valuation range \$387/ha to \$535/ha (ref. Table 11 [2004:179]). <table><tr><th>PCT</th><th>Total (ha)</th><th>Clearing (ha)</th><th>Fraction</th><th>%</th></tr><tr><td>PCT 1558</td><td>30.23</td><td>0.1</td><td>0.003</td><td>0.3</td></tr><tr><td>PCT 1619</td><td>421.2</td><td>0.1</td><td>0.0002</td><td>0.02</td></tr><tr><td>PCT 1718</td><td>15.77</td><td>0.15</td><td>0.0095</td><td>0.95</td></tr><tr><td>Total</td><td>467.2</td><td>0.35</td><td>0.0007</td><td>0.07</td></tr></table>	PCT	Total (ha)	Clearing (ha)	Fraction	%	PCT 1558	30.23	0.1	0.003	0.3	PCT 1619	421.2	0.1	0.0002	0.02	PCT 1718	15.77	0.15	0.0095	0.95	Total	467.2	0.35	0.0007	0.07	Original study relates to biodiversity assets in the Wet Tropics World Heritage Area [WTWHA] (North Queensland) Appendix D [p.189] (Curtis, 2004) identified wet and dry sclerophyll forest as part of the WTWHA assessed. This is assumed as similar to the EEC PCT 1718. 0.35 ha (PCT 1588, PCT 1619 & PCT 1718). Total valuation range \$136 to \$187 p.a. Upper bound adopted for analysis.
PCT	Total (ha)	Clearing (ha)	Fraction	%																							
PCT 1558	30.23	0.1	0.003	0.3																							
PCT 1619	421.2	0.1	0.0002	0.02																							
PCT 1718	15.77	0.15	0.0095	0.95																							
Total	467.2	0.35	0.0007	0.07																							
Valuation presence of threatened species	Jakobsson K. & Dragun A. (2001) The worth of a possum: valuing species with the contingent valuation method. <i>Environmental and Resource Economics</i> 19, 211-227. Value escalated by 2.5% p.a. (as midpoint of RBA long-run inflation target range). 2020 valuation \$233/household/p.a, preservation of 700 species of flora & fauna (Victoria).	Implied cost of \$0.33 per species; 17 species (6 flora, 11 fauna), \$5.61p.a. Total per year \$153,283. 27,145 households in locality (SA3, ABS Census 2016).																									

Surface water

Assumption	Source			Comments/derived estimate
Valuation	DPE Technical Notes 2018 (Mazur & Bennett) ' <i>Healthy Waterways</i> ' [DPIE]. (Full citation of paper included in references section of this EA) \$0.84 to \$1.10 per household per year for 5 years for each kilometre (2009). Value escalated by 2.5% p.a. (as midpoint of RBA long-run inflation target range).			Estimate is per household per year for 5 years. Applied for 30 years post-commencement (2050) 2020 valuation range: \$1.10 to \$1.44/km household/p.a.; therefore estimated range \$1.76 - \$2.30/household.
Extent of affected waterways	Extracted from Subsidence Report (MSEC 2019:47).			Total length of Schedule 2 stream sections within the Study area based on the 600m boundary is 5.6 kilometres. Area directly under proposed mining area adopted on the basis of assessments of effects on stream reported in subsidence report [Section 5.2.3 <i>Impact assessments for the streams</i>] (MSEC 2019:50-53).
	Stream	Reference	Length of Schedule 2 section directly above the proposed mining area (km)	
	Stony Creek	WC01	0.6	
	Stockyard Creek	WC04	0.1	
	Lords Creek	WC16	-	
	Unnamed watercourse	WC08	0.9	
	Total	-	1.6	
Count of households	ABS 2016 Census data			27,145 households in locality (SA3, ABS Census 2016).

Groundwater

The data and information presented below are the most recently available trading outcomes published by DPIE Water in NSW⁴⁴. These are preferred to the historical data presented in the guidelines and in particular, the technical notes. The project is situated within the Macquarie -Tuggerah Lakes Basin. The catchment area is defined in Figure A4.1

Figure A4.1

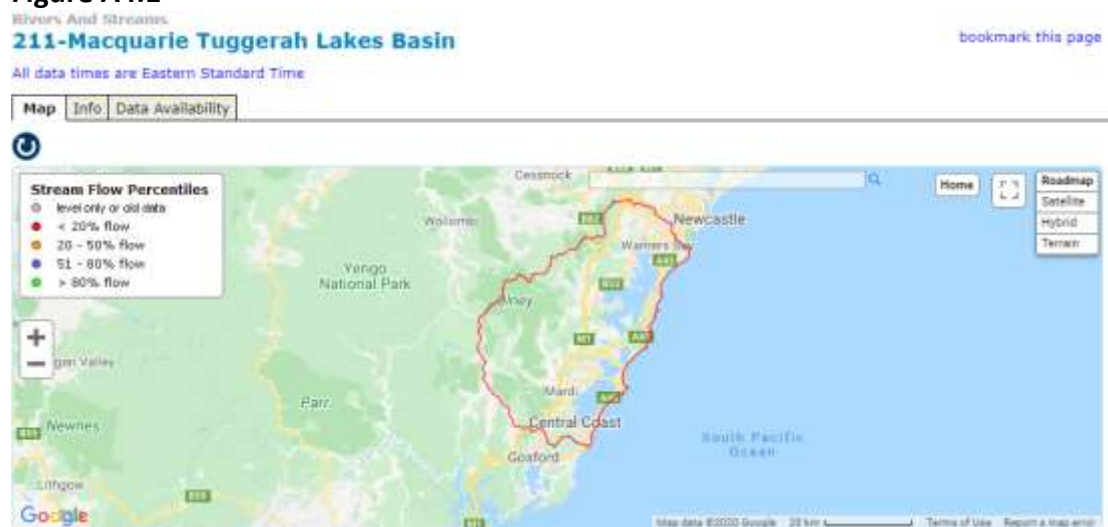


Image source: Water NSW 2020

A description of the basin catchment (DPIE, Water in NSW 2020) is as follows: *‘Most of the rivers and creeks in the Macquarie-Tuggerah Lakes Basin are unregulated, meaning there are no major storages to capture and control flows. Most water users rely on natural flows or small structures, such as weirs for their water supplies. As in most unregulated rivers, flows are most affected during relatively dry times, when water is low and demand high’.*

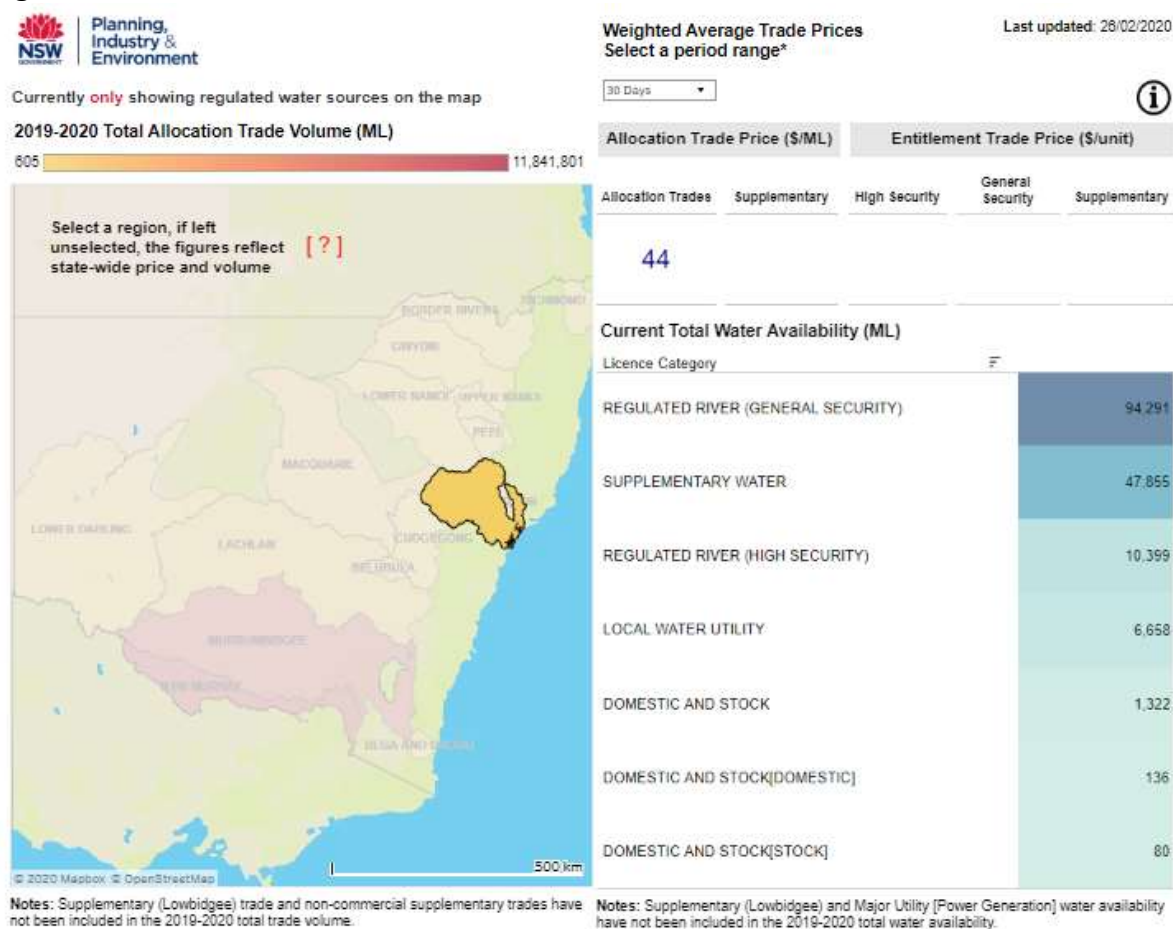
There are no prices provided in relation to unregulated water sources in the data presented in Figures A4.2 and A.4.3. However, given that regulated waterways may be assumed to be of greater use value, values for the allocated water prices are assumed. Supplementary water relates to additional water during events of surplus and is thus not used. High and general security water relates to regulated watercourses, and therefore entitlement values are not adopted, as the basin consists of unregulated water courses, which are presumed to be of lesser significance in terms of competitive uses. Consequently, the allocation trading price for NSW (\$524/ML, Figure A4.3) is adopted as an upper bound for valuation. The Paterson River catchment (Figure A4.3) is the nearest to the basin for which a trading price has been established, and is relatively close to coastal areas, as indicated by Figure A4.3. This is similar to the study and/ or mining area. The most recent trading value for the Paterson River catchment is \$44/ML, which is adopted as the lower-bound pricing assumption.

⁴⁴ The two webpage images show the update at 26 February 2020 (upper right-hand corner of images).

The groundwater and surface water assessments (GHD 2019; 2020) did not identify other licensed users in the study and/or mining areas. As a result, environmental uses/values are the other matter to be considered. Basin environmental values are described as; *‘Marine sediment deposits occur along the major water courses. These deposits include the barrier beach systems found within areas enclosing Tuggerah and Munmorah Lakes and at Swansea, Redhead and The Entrance’* (DPIE, Water in NSW, 2020). No further description is provided. Matters raised in the relevant reports, including the aquatic ecology report, are assumed as identifying relevant considerations in this respect. These do not identify the potential for effects of comparatively major magnitude.

The application of the pricing assumptions identified above is assumed on the basis of being consistent with ‘conjunctive use’ which is described as *‘The situation which may occur when the holder of a Licence pertaining to Regulated Surface Water also holds a Groundwater Licence which services the same property. When the Regulated Surface Water Allocation is less than 100%, under certain circumstances and subject to conditions, the shortfall may be made up from the Groundwater Work’* (Water NSW 2020). The period applied for valuation is advised by GHD (by correspondence)⁴⁵ is to 2034, after which, *‘dewatering of the mine workings ceases at the end of mining and the workings are allowed to flood’*.

Figure A4.2



⁴⁵ Advice received from Ian Gilmore, Water Engineer, GHD, by email of 26 February 2020.



Figure A4.3



Currently **only** showing regulated water sources on the map

2019-2020 Total Allocation Trade Volume (ML)

605 11,841,801



Notes: Supplementary (Lowbidgee) trade and non-commercial supplementary trades have not been included in the 2019-2020 total trade volume.

Weighted Average Trade Prices
Select a period range*

Last updated: 26/02/2020

30 Days



Allocation Trade Price (\$/ML)		Entitlement Trade Price (\$/unit)		
Allocation Trades	Supplementary	High Security	General Security	Supplementary
524	53	9,507	1,909	

Current Total Water Availability (ML)

Licence Category	F
SUPPLEMENTARY WATER	1,181,290
REGULATED RIVER (GENERAL SECURITY)	649,725
REGULATED RIVER (HIGH SECURITY)	102,497
MURRUMBIDGEE IRRIGATION (CONVEYANCE)	83,478
LOCAL WATER UTILITY	62,502
COLEAMBALLY IRRIGATION (CONVEYANCE)	37,139
REGULATED RIVER (CONVEYANCE)	36,919
DOMESTIC AND STOCK	31,213
DOMESTIC AND STOCK[STOCK]	6,800
REGULATED RIVER (GENERAL SECURITY B)	4,314
LOCAL WATER UTILITY[DOMESTIC AND COMMERCIAL]	2,574
DOMESTIC AND STOCK[DOMESTIC]	2,390
REGULATED RIVER (HIGH SECURITY)[ABORIGINAL CULTU..	2,150
EAGLE CREEK TEMPORARY CRITICAL CONVEYANCE [CRI..	800
REGULATED RIVER (HIGH SECURITY)[TOWN WATER SUPP.	673
REGULATED RIVER (GENERAL SECURITY A)	273
REGULATED RIVER (HIGH SECURITY)[RESEARCH]	181
REGULATED RIVER (HIGH SECURITY)[COMMUNITY AND E.	42

Notes: Supplementary (Lowbidgee) and Major Utility [Power Generation] water availability have not been included in the 2019-2020 total water availability.

Annexure 5: Carbon pricing assumptions

European Emissions Exchange (EEX) European Emissions Allowance Futures (EUA) price data⁴⁶ are presented in the figure overleaf for the years 2019 to 2027. The nominal futures price at December 2020 (€25.27) can be assumed as the current or commencing cost. The December 2027 cost is €27.72, as priced by the market. Extrapolating the average annual increment between 2019 and 2027 (€0.33) out to 2035 results in a 2035 price of €30.36. Adopting the long-run Reserve Bank of Australia (RBA) exchange rate of 1 AUD = 0.695 EUR⁴⁷, the market-based price schedule ranges between AUD \$36.36 (2019) and AUD \$43.68 (2031). These are adopted as the upper and lower bounds. The average price is AUD \$40.02. The present value reported initially in Table 2 of the report is based on the average. Sensitivity testing based on DPIE's discount rates is presented in Table A5.2. Bounded Monte Carlo sensitivity testing is presented in Table A5.3.

Table A5.1

Assumption	Source	Comments/derived estimate
Exchange rate AUD:USD	RBA (long term average 2000-2019)	AUD 1 = USD 0.78 (per table A3.1)
Exchange rate AUD:EUR	RBA (long term average 2010-2019)	AUD 1 = EUR 0.695
Carbon price (lower bound) EEX EUA futures @12/2020	European Emissions Exchange futures	EUR 25.27 = AUD 36.36
Carbon price (upper bound) EEX EUA futures estimate to 12/2035	European Emissions Exchange futures	EUR 30.36 = AUD 43.68
Central price	Aigis Group 2020	1,000 iteration bounded Monte Carlo Simulation of NPVs calculated as above (results in Table A5.2)
Carbon equivalent emissions	SLR Consulting 2020	As per Table 4

⁴⁶As noted in the table, the data were recorded on 28 November 2019.

⁴⁷ January 2010 to September 2019. Reserve Bank of Australia (RBA), Exchange Rates (Historical Data) webpage, accessed 17-10-19 <
<https://www.rba.gov.au/statistics/historical-data.html#exchange-rates> >

Table A5.2 Discount rate sensitivity assessments - GHG

	7%	10%	4%
Mean	21,157,138	18,013,609	25,365,312
Low	19,222,227	16,366,188	23,045,546
High	23,092,049	19,661,031	27,685,078

Table A5.3 Monte Carlo Simulation Outputs - GHG

	7%	10%	4%
Simulation Mean	21,117,425	18,107,985	25,464,558
95% Confidence Interval (lower)	21,048,179	18,050,111	25,380,232
95% Confidence Interval (upper)	21,186,671	18,165,859	25,548,884

European Emissions Exchange (EEX) EUA futures at 28 November 2019: (Figure A5.1)

2019-11-28 Month						
Name	Last Price	Last Volume	Settlement Price	Volume Exchange	Volume Trade Registration	Open Interest
Dec/19	25.09	3,000	25.11	354,000	-	350,085
Jan/20	-	-	25.13	-	-	0
Mar/20	24.85	2,000	25.16	4,000	-	9,003
Jun/20	-	-	25.21	-	-	0
Sep/20	-	-	25.24	-	-	0
Dec/20	25.30	5,000	25.27	259,000	-	140,911
Mar/21	-	-	25.38	-	-	2,008
Jun/21	-	-	25.43	-	-	0
Sep/21	-	-	25.48	-	-	0
Dec/21	24.96	8,000	25.52	9,000	-	32,019
Mar/22	-	-	25.59	-	-	0
Jun/22	-	-	25.68	-	-	0
Sep/22	-	-	25.74	-	-	0
Dec/22	-	-	25.85	-	-	9,165
Dec/23	-	-	26.21	-	-	6,388
Dec/24	-	-	26.58	-	-	40
Dec/25	-	-	26.96	-	-	40
Dec/26	-	-	27.34	-	-	0
Dec/27	-	-	27.72	-	-	0

Source: <https://www.eex.com/en/market-data/environmental-markets/derivatives-market/european-emission-allowances-futures>