Appendix 3 – Economic Impact Assessment (AIGIS Group, 2017)

Centennial Coal Company Limited
P O Box 1000
Toronto NSW 2283
www.centennialcoal.com.au

Mandalong Mine
Mandalong Longwall Panels 24 & 24A Modification

Economic Impact Assessment

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AIGIS GROUP

Prepared by

AIGIS GROUP

AIGIS GROUP
MARK SARGENT ENTERPRISES
ABN 41317 992 919
13 DEBS PARADE
DUDLEY NSW 2290
P/F: 02 4944 9292
M: 0423 489 284
E: msemarksargent@dodo.com.au

EXECUTIVE SUMMARY

- This Economic Assessment forms part of the *Statement of Environmental Effects* (SEE) relating to an application by Centennial Mandalong Pty Ltd (Centennial Mandalong) to modify the State Significant Development (SSD) consent SSD-5144 for the Mandalong Southern Extension Project (MSEP), which was granted on 12 October 2015.
- This Economic Assessment has been prepared to comply to the greatest practicable extent with DPE's *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015).
- The objectives of the Mandalong Longwall Panel 24 and 24A Modification are;
  - Extension of Longwall 24 from 1,631 m to 2,570 m. This yields 1,030,813 additional tonnes beyond the 1,766,912 tonnes already approved.
  - Addition of Longwall 24A. Longwall 24A is proposed to be 2,470 m in length which yields an additional 2,679,560 tonnes.
  - Overall additional volume is 3,710,373 tonnes.
- The cost-benefit analysis (CBA) conducted indicates a marginal incremental economic benefit associated with an increase in the recoverable resource as stated. The principal sources of this benefit are an increase in royalty revenue of approximately $19 million, and the labour surplus accruing to the local/regional economy associated with the additional works required to recover the resource, of approximately $9 million.
- These benefits are offset by an increase in the risk of certain environmental effects occurring with associated social considerations. For the purposes of assessing such risk, these are valued at approximately $3.5 million.
- Overall, the Modification is estimated to result in beneficial socioeconomic impacts valued at approximately $24 million. The assessment also identifies a positive Benefit-Cost Ratio (BCR) of 7.9.
- Local Effects Analysis (LEA) indicates that extraction of the additional resource results in a modest change in the socioeconomic effects in the regional and local economies estimated for the overall Project. The relatively short duration of the additional operations contributes to the limited effects that the Modification may entail. Public infrastructure and amenity effects remain similar to those for the SSD-5144 Project as approved, and thus have no discernible cumulative impact.
- The Modification returns positive net present value (NPV) and benefit-cost ratio (BCR) returns across a range of modelled possible economic outcomes, as demonstrated using sensitivity testing based on adjustment of discount rates. Application of alternative

performance data indicates the potential for somewhat lesser or greater magnitude outcomes. Additionally, the application of World Bank price forecasts to the export component of the mine's output provides a further positive assessment, providing further evidence of the beneficial effects.

- In the context of these matters, it is assessed that on balance, the Modification is supportable on the basis of its likely positive socioeconomic contribution.

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ABBREVIATIONS

ABS:	Australian Bureau of Statistics
BAU:	Business as Usual
BCR:	Benefit-Cost Ratio
BSAL:	Biophysical Strategic Agricultural Land
CO_2-e:	Carbon dioxide equivalent
CPI:	Consumer Price Index (ABS)
CBA:	Cost-Benefit Analysis
DPE:	Department of Planning and Environment (NSW)
EIS:	Environmental Impact Statement
EPA:	Environment Protection Authority
EVRI:	Environmental Valuation Reference Inventory
FTE:	Full Time Equivalent (employment)
GHG:	Greenhouse Gas/es
GVA:	Gross Value Added
I/O:	Input/Output
LEA:	Local Effects Analysis
LGA:	Local Government Area
LMCC:	Lake Macquarie City Council
LW:	Longwall
MSEP:	Mandalong Southern Extension Project (The Project)
Mtpa:	Million tonnes per annum
NPV:	Net Present Value
OEH:	Office of Environment and Heritage (NSW Government)
$PM_{2.5}$:	Fine air pollutant particles, less than 2.5 micrometres in diameter
PV:	Present value
ROM:	Run of Mine ('raw' coal)
SA3:	Statistical Area Level 3 (ABS statistical geography division)
SEARs:	Secretary's Environmental Assessment Requirements
SEE:	Statement of Environmental Effects
SLA:	Statistical Local Area
SSD:	State Significant Development
tpa:	Tonnes per Annum
WPI:	Wage Price Index (ABS)

1. ECONOMIC ANALYSIS & IMPACT ASSESSMENT: PURPOSE AND APPROACH

This Economic Assessment forms part of the *Statement of Environmental Effects* (SEE) relating to an application by Centennial Mandalong Pty Ltd (Centennial Mandalong), to modify the State Significant Development (SSD) consent SSD-5144 pursuant to Section 96(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Application seeks consent to permit the extension of the Mandalong Longwall Panel 24, and additional development and extraction of Longwall Panel 24A (the Modification). SSD-5144 was granted on 12 October 2015. SSD-5144 permits mining operations at Mandalong Mine until 31 December 2040.

This Economic Assessment has been prepared to comply to the greatest practicable extent with DPE's *Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015), taking into consideration that Technical Notes supporting the guidelines were not published at the time of preparing this assessment. As a result, some elements of the assessment draw on material most recently presented in May 2015 in relation to the overarching SSD-5144 consent, and guidance extracted from DPE's *draft guidelines for the economic assessment of mining and coal seam gas proposals* (October 2015). Consequently, consistent with the DPE guidelines, the approach to this assessment is to estimate the direct economic benefits and costs of the Modification, as they relate to the State, regional and local communities, employing:

- A Cost-Benefit Analysis (CBA) to assess the impacts of the Modification at State (NSW) level;
- A Local Effects Analysis (LEA) to assess the localised impacts, particularly those relating to certain environmental, social and economic outcomes that may be considered as being concentrated in the local and/or regional community.

The report seeks to address these requirements by providing a 'triple bottom line' reporting focus on the social, economic and environmental outcomes of the Modification, based on both quantitative and qualitative assessments of effects.

2. PROJECT BACKGROUND AND JUSTIFICATION

2.1 Applicant

Centennial Mandalong Pty Ltd is the Applicant for the Modification and operator of Mandalong Mine under development consent SSD-5144. Mandalong Mine is an existing underground longwall coal mining operation producing thermal coal that is supplied to domestic and export markets. It is located approximately 35 kilometres south-west of Newcastle near Morisset in New South Wales. Mandalong Mine is 100 percent owned and operated by Centennial Mandalong, a subsidiary of Centennial Coal Company Limited. Centennial Coal Company Limited is a wholly owned subsidiary of Banpu Public Company Limited, headquartered in Thailand.

2.2 Mine consents and related information

As disclosed in Section 1, the Modification is sought in respect of the development consent SSD-5144 for the Mandalong Southern Extension Project (MSEP), which permits mining within the approved Project Application Area until 31 December 2040. The modification is seeking to undertake the extended development of Maingate 24 and extended secondary extraction of longwall panel 24 in addition to the development of Maingate 24A and extraction of longwall panel 24A within the Project Application Area of SSD-5144.

The reasons for seeking consent are as follows. An igneous sill exists to the west of approved longwall panels 22 to 24. Due to historic uncertainty associated with the extent of the igneous sill, longwall panels 22 to 24 were shortened as a conservative measure to mitigate the sill's impact on the mine's production. Recently, through ongoing geological exploration and the successful extraction of adjacent longwall panels below the igneous sill its extent and condition has become better understood. This has resulted in the proposed extension of longwall panel 24 and the addition of longwall panel 24A within the Project Application Area of SSD-5144. The proposed extension of chain pillars and longwall mining regarding these two panels are detailed in the SEE.

2.3 Description of proposed Modification

As noted in Section 1, the Modification application has been prepared and is submitted pursuant to Section 96(2) of the EP&A Act to seek changes to development consent SSD-5144. The primary components of the Modification are:

- Extension of Longwall 24 from 1,631 m to 2,570 m. This yields 1,030,813 additional tonnes beyond 1,766,912 tonnes already approved.
- Addition of Longwall 24A. Longwall 24A is proposed to be 2,470 m in length which yields an additional 2,679,560 tonnes.

The current approved mine life for the Mandalong Mine is not affected by the proposed Modification. Operations would still terminate in 2040.

3. PROJECT ECONOMIC ANALYSIS – COST BENEFIT ANALYSIS

3.1 Focus of analysis

The CBA component of this analysis presents the State-level implications of the Modification. The LEA addresses the qualitative environmental and social impacts, along with key economic aspects of the project, which are largely concentrated in the western area of Lake Macquarie City Council (LMCC) Local Government Area (LGA). The area for assessment is discussed in Section 3.4.3.

3.2 Discussion of approach to CBA

The Modification proposes an increase of 3,710,373 tonnes of coal extraction over the life of the mine, equating to an additional 4.5 percent of production as approved in the SSD-5144 development consent. As the longwall extension and the additional longwall represent additional output to that approved under the SSD-5144 consent, the incremental economic benefits and costs associated with its extraction are assessed in this report.

It should be noted that, consistent with the approach adopted in respect of the original development consent application for SSD-5144, Centennial Mandalong maintains that the internal financial appraisal process and its outputs in respect of the overall Project and the proposed Modification are highly commercially sensitive. Furthermore, the output of this modelling is of no consequence to consideration of third-party or externalised effects of the Modification, which are the matters of interest in a public exhibition process. As such, this material is considered by Centennial Mandalong as being unsuitable for presentation in a document which is intended for public exhibition. The publication of such information has the potential to jeopardise commercial negotiations and outcomes in which Centennial Mandalong may be involved at the time of publication of this information, particularly in respect of sales to domestic customers, most notably electricity generators. Publication of this information may also impact on relevant Centennial customers. This information is excluded from this economic impact assessment on that basis, but can be made available to the relevant consent authorities as required.

3.3 Discussion of alternatives to the Modification

The project alternatives are limited to:

- continuation of the Project (MSEP) under its present (SSD-5144) consent conditions, and;
- approval of the Modification.

Continuation of the Project as approved equates to the 'do nothing' or 'business as usual' (BAU) base case. The base (MSEP) case was presented in detail and approved in 2015. As noted in Section 2.2, subsequent to grant of that consent, improved geological knowledge of the conditions surrounding the igneous sill have resulted in the potential for extending Longwall panels 22 and 23 (the subject of a prior, separate consent modification application), extension of Longwall Panel 24, and additional development of Longwall Panel 24A.

3.4 Project-related economic evaluation – CBA

The CBA data presented in this section are present values (PV) and net present values (NPV), at an assumed discount rate of seven percent (7%), except as otherwise noted[1].

3.4.1 Estimation of economic benefit

It is advised that the assessments in this report may differ to some extent from those presented in the original MSEP development consent application, reflecting changes relating to application of DPE's current guidelines.

[1] The economic appraisal principles employed herein are consistent with current DPE guidelines (December 2015) and NSW Treasury TPP07-6 Economic Appraisal Principles and Procedures Simplified, to the extent that these documents coincide.

With respect to the Modification, the key economic benefits that would accrue to the local and State communities, as distinct from the proponent corporation, on approval of the Modification are:

- an increase in total recoverable resource, with the attendant increase in royalty and notionally corporate tax returns;
- an increase in the labour surplus calculated to represent the net benefit to the local and/or regional economy of the employment required to mine the additional resource.

It is noted that the panel extensions do not entail a requirement to increase the approval period for the MSEP. However, they do represent additional production and associated economic activity and on-flows.

The DPE guidelines (2015) include provision for reporting of federally-levied corporate income taxes as a component of the economic benefit of projects, which has necessitated a review of method in terms of estimation of assessment of notional tax liability. Tax liability in respect of Centennial Mandalong comprises part of the tax assessments completed by Centennial Coal Pty Ltd at aggregate level for the entire company, and not on the basis of individual operations. Therefore, Centennial Mandalong does 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 (and thus return to government) 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 complexity. 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 would be returned to NSW. Taking these exclusions into consideration, the economic benefit of the Modification and its components are described in Table 1.

Table 1: Estimate of economic benefit: Mandalong Mine LW24/LW24A Modification

Economic Benefit	Estimation assumptions	Modification effects
NSW Government royalties	Assumed royalty rate: 7.2%[2]	Assessed PV ≈$19.0 million
Labour surplus – direct positions	Refer to Appendix 3	Assessed PV ≈ $8.6 million
Other Federal, State and Local government taxes, rates etc.	Refer to Appendix 1	Not quantitatively estimated
Total economic benefit PV		**≈ $27.6 million**

[2] Deep underground coal (+400m) 6.2 per cent; **other underground coal 7.2 per cent**, open cut coal 8.2 per cent.

The Modification would result in an increase in economic benefit of approximately $28 million. The labour surplus estimate represents the residual benefit of Mandalong Mine employee incomes assumed to be largely spent in the local economy, net of alternative employment outcomes (substitute employment or unemployment[3]) and taking into account the wage premium of the mine's employees.

3.4.2 Estimation of economic costs – environmental effects & social/ infrastructure costs

The estimates presented in this section were calculated taking into account certain changed valuation methods which were recommended in the DPE draft guidelines of October 2015. It is assumed that some of these methods will subsequently be promulgated as Technical Notes to the current guidelines (December 2015), however a proportion of the relevant reports that may be subject of revised valuations do not contain data to which draft recommended valuation approaches can be applied. Those for which amendments were possible have been adjusted. Population-based estimates have been adjusted to allow for calculations based on the Lake Macquarie (West) Statistical Area Level 3 (SA3), as mandated in the guidelines as the nominal locality. This is discussed in detail in Section 3.4.3.

It is noted that the DPE guidelines variously suggest qualitative or quantitative analysis of impacts, with quantitative assessments preferred to the extent that these can be validly derived. The valuations presented in this assessment are monetised estimates of these, principally estimated using a 'benefits transfer' method based on specialist assessments of the magnitude of impacts, and relevant valuation methodologies, which are detailed in Table 2.

In relation to these valuations, four key points must be observed:

- Due to the limited scale and duration of the Modification works, Centennial Mandalong, in consultation with DPE, has determined that it is necessary to address the following potential environmental and social effects;
    - Biodiversity;
    - Greenhouse gas (GHG) emissions;
    - Heritage (Aboriginal and historic);
    - Land and Agricultural Resources;
    - Subsidence;
    - Water resources.
- Where possible, valuation methodologies were derived from studies accessed through relevant government bodies and/or recommended in the DPE draft guidelines (October 2015). This may be considered as placing some greater level of reliability on these studies.
- The identified valuation methodologies have been selected to represent similar existing conditions relevant to the Modification as closely as was achievable. However, in some instances the valuation methodologies are either more general, or related to projects of a different nature, but which retain some level of comparability.

[3] Which assumes the individual receiving the Newstart Allowance.

- There remains an unquantified element of social impact, which chiefly relates to more localised effects. This may be described as the 'intrinsic value'[4] of these impacts or effects, as attributed by individual stakeholders. This aspect can be highly individualised and subjective and consequently may not be accurately quantified, as the estimation techniques applied, although based on valid methodologies, may not align with individual stakeholders' values. Although the estimates presented may represent one expression of these values, it must be recognised that there is some likelihood that stakeholders may consider effects to be of higher or lower magnitude.

[4] James Marshall & Co. (2013), Mandalong Southern Extension Project Social Impact Assessment, James Marshall & Co, March 2013.

Table 2: Valuation methods –biophysical and social/infrastructure impacts

Description	Methodology/Source of Valuation mechanism	Valuation measure/unit[5]	Comment on application
Subsidence, land and water	An estimated PV of $50 million for such impacts (Aigis Group 2015) was calculated for the SSD-5144 approval. As the panel extensions involve an increase of 4.5% over total production for one year of mining (2018), this is assumed as the metric, with risk of potential longer term impacts accounted for in the SSD-5144 estimate.	4.5% of total value of impact assessed in SSD-5144 approval.	Applied to assessments for subsidence and water impacts combined. Ordinarily also applied to land/agricultural use, however no BSAL has been identified in the Modification Study Area (SLR 2016 p.23).
Greenhouse gas (GHG)	Australian Energy Market Operator; National Electricity Forecasting Report, June 2016. Proxy emissions abatement cost estimate (2020)[6] http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report	$25 per tonne/$CO_2$-e	Assumes incremental unmitigated Scope 1 & Scope 2 operations-related costs as assessed (64,900 t/CO_2-e in 2018).). Drainage gas and mine ventilation emissions captured in SSD-5144 LOM GHG assessment (BDM 2012). [SLR 2017]
Heritage	1. Allen Consulting Group (2005): "Valuing the Priceless: The Value of Heritage Protection in Australia" – choice modelling/WTP.	$7.62 per capita p.a. for each 1,000 places protected	Assumes Census 2011 population count (Lake Macquarie West, SA3 [70,005]), 1 identified Aboriginal and 1 historic heritage sites (total 2 'places') likely to be affected [RPS 2017a p.40]. Implied cost $0.02 per capita per annum.

[5] All values adjusted by 2.5 per cent per annum post-publication to allow for inflation, with the exception of the unit damage cost metric assumed for air quality and GHG emissions costs as described.

[6] Measure adopted from DPE draft guidelines (2015). Approximates previously adopted measure of $25/ tonne/$CO_2$-e (The Garnaut Review (2011:72) http://www.garnautreview.org.au/update-2011/garnaut-review-2011/garnaut-review-2011.pdf, Australian Government Treasury modelling estimate of $24.60/ tonne/$CO_2$-e (core scenario) (http://carbonpricemodelling.treasury.gov.au/content/chart_table_data/chapter5.asp and social cost of carbon (escalated by average exchange rate) of $25.10/ tonne/$CO_2$-e; https://www.whitehouse.gov/sites/default/files/omb/inforeg/scc-tsd-final-july-2015.pdf .

Description	Methodology/Source of Valuation mechanism	Valuation measure/unit[7]	Comment on application
Biodiversity	Curtis I.A. (2004): "Valuing Ecosystem Goods and Services: A New Approach Using a Surrogate Market and the Combination of Multiple Criteria Analysis and a Delphi Panel to Assign Weights to Attributes". EVRI reference number: 0663 – 1365 (Table 6) <https://www.evri.ca/Global/Splash.aspx >	$1,157 to $1,472/Ha (2017). Upper bound used for estimation.	No native vegetation clearing associated with Project. Applied to area of subsidence-induced ponding (0.38 Ha) [Table 10, p.27, RPS 2017]

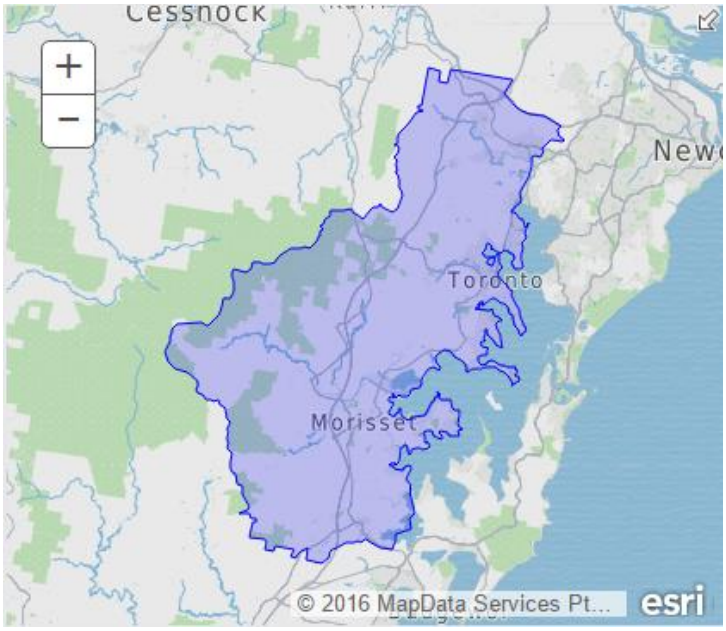
[7] All values adjusted by 2.5 per cent per annum to allow for inflation, with the exception of the unit damage cost metric assumed for air quality.

As the Modification relates to a relatively small increase in LOM operations at Mandalong Mine, there are no assessed increases in demand on public infrastructure, such as public roads, utilities etc. Social impacts are discussed in Section 4.

3.4.3 Physical area applied for estimation of impacts

As is required by the 2015 guidelines, certain impacts assessed in the CBA are necessarily considered in the context of NSW, for example royalties. Furthermore, for the purposes of assessment, the guidelines require the adoption of the relevant ABS Statistical Area Level 3 (SA3) as the locality in which the Project is located. In this instance, the relevant SA3 is the Lake Macquarie – West SA3 (ABS Code 11102), which is illustrated in Figure 1.

Figure 1: Lake Macquarie - West SA3



Source: ABS Census Data (2016).

The LEA guidelines (2015) also provide for the consideration of population groups in assessments, on the following basis; '*for practical reasons of measurement and identification, the analysis should include local effects that accrue to those people ordinarily resident in the locality at the time of the proposal*' (DPE 2015:5). Although the locality in this instance might be interpreted as the SA3, it is apparent that certain impacts may be concentrated among much smaller population groups, such as households situated in close proximity to the mine. These latter impacts remain part of the broader CBA, as they represent the affected part of the NSW community. The assessed impacts are detailed in Table 3.

Section 3.4.4: Valuations – environmental effects

The valuations presented in Table 3 recognise that, notwithstanding the predictions of limited or low level impacts for certain effects, there remains a residual risk that some impacts may occur. A number of the estimates calculated may not be considered as meeting conventional assumptions of financial or economic materiality. However, in the context that these estimates involve impacts on the various communities to which they are

relevant, and may be subject of individuals' perceptions based on the intrinsic values of stakeholders, they may be considered as material to those communities and/or stakeholders, and thus warrant inclusion in the assessment process. This approach is consistent with the DPE guidelines (2015), as previously noted.

Table 3: Estimate of environmental effects: Mandalong Mine LW24/LW24A Modification

	Modification effects
	PV @ 7%
GHG	$1,417,154
Biodiversity	$488
Subsidence; soil, land & water (surface water & groundwater)	$2,116,346
Heritage (Aboriginal and historic)	$1,398
Total PV	$3,535,386
Total (rounded)	**$3.5 million**

The valuations reported in Table 3 relate to the immediate effects of the Modification, and to this extent are incremental to the valuations presented in respect of the SSD-5144 MSEP. However, it is noted that all mining in respect of the Modification is scheduled to occur in 2018. Due to the comparatively limited nature of the Modification, provision for recognition of potential residual costs of the risk of some impacts remaining after avoidance, management and mitigation works and rehabilitation commitments, was presented in the MSEP consent application assessment.

3.4.5 Net economic benefit/cost

Table 4 presents the measures of net economic benefit/cost of the Modification, for the State and regional communities, based on the benefit and cost assessments detailed in Tables 1 and 3.

Table 4: Mandalong Mine LW24/LW24A Modification net benefit/cost

	MSEP with Modification
Economic benefit (PV)	**$27.6 million**
Net economic cost (PV)	**$3.5 million**
Net Present Value (NPV)	**$24.1 million**
Benefit-Cost Ratio (BCR)	**7.9**

The Modification will result in an increase in net benefit of approximately $24 million. The BCR also indicates that a positive economic outcome is likely. The assumptions for the effects of the Modification are conservative. This is particularly relevant with respect to the valuation of environmental impacts, as the conservative approach equates to adopting upper-bound or 'worst-case' estimates based on the methods and data employed. Therefore, the approach values these risks at a relatively high level. As was discussed in

Section 3.4.1, the benefit assessment is also conservative (low), as it excludes provision for corporate income taxes returned to NSW.

3.5 Sensitivity analyses – alternative project options

Sensitivity analyses outcomes are presented in Tables 5 and 6. The testing is predicated on adjustments to interest rates and financial measures (such as royalties and costs).

Table 5: Sensitivity analysis – project options - adjusted discount rates (NPV)

Project option component	Discount Rate 4% $M	Discount Rate 7% $M	Discount Rate 10% $M
Proposed Modification net (unmitigated) environmental impact cost	3.7	**3.5**	3.3
Proposed Modification total State and community benefit	29.2	**27.6**	26.1
Proposed Modification NPV	25.5	**24.1**	22.8

The NPV of the proposed Modification remains positive under these various discount rate assumptions. There may be any number of possible scenarios that vary from the forecast relativities between revenues and costs. The manipulation of the discount rate within NSW Treasury financial appraisal guidelines provides some indication of the range covered by such possible variances and the associated project risk.

A further means of testing the strength of the economic case for the Modification is to adjust certain economic performance assumptions. The test criteria are based on those prescribed in the DPE guidelines (2015:18), to the extent that these can be applied given Centennial's requirements in respect of commercial confidentiality. In respect of the application of each of the recommended tests, the following comments are included to explain application:

- Royalties +/- 25%: - applied as suggested.
- Company income taxes +/- 50%: - company tax is not included in this assessment (refer Appendix 1).
- Environmental cost (high/low per workbooks[8]): - workbooks had not been issued at the time of preparation of this assessment. High and low estimates from discount rate-based sensitivity testing were adopted as upper and lower bounds.
- Net public infrastructure cost +/- 25%: - no public infrastructure costs are associated with the proposed Modification.

It is noted that the guidelines also require that 'where practicable, sensitivity analysis should identify how much output prices would need to fall for a project to have a zero NPV and report on whether such a scenario is either likely or unlikely' (2015:18). This would require disclosure of commercially sensitive information, which Centennial Mandalong has elected

[8] It is anticipated that these will form part of the Technical Notes to the guidelines once promulgated.

not to publish (as noted in Section 3.2). Based on the assumptions and limitations described above, sensitivity testing outcomes are displayed in Table 6.

Table 6: Sensitivity analyses - adjusted performance assumptions (NPV)[9]

Evaluation Element	LW24-LW24A Panel Extensions $M
NPV as assessed	**24.1**
Royalties: Δ 25%	28.8
Royalties: - 25%	20.3
Environmental cost: (maximum range)	23.9
Environmental cost: (minimum range)	24.3

Sensitivity testing based on these performance indicators indicates that a positive outcome is predicted in each of these circumstances. Also, an additional form of sensitivity analysis is provided in Appendix 2. This compares the revenue-based assessment (royalty) element reported in this section with outcomes based on World Bank price forecasts current at January 2017, applied to the minority export volume assumptions for the Modification. These broadly-based data also do not anticipate a reduction of the magnitude required to result in a notionally negative outcome.

Although this analysis examines a limited range of feasible outcomes from among a much broader range of potentialities, the social and economic outcomes are likely to be positive in most foreseeable eventualities.

4. LOCAL EFFECTS ANALYSIS (LEA)

4.1 Approach

As is the case with the CBA component of this assessment, the matters discussed in this LEA are based on the assessments presented in Section 3. This entails the assumption that due to the limited duration of the Modification works, effects will be experienced over that time. Provision for residual impacts forms part of the parent SSD-5144 MSEP economic assessment, as previously noted.

4.2 Regional context

Centennial's operations in the west Lake Macquarie area provide significant employment and other economic stimuli in the LMCC LGA and the broader Lower Hunter regional

[9] At 7% discount rate.

economy. For the purposes of analysis, the DPE guidelines require consideration of the impacts at the ABS SA3 level. As previously identified, the Lake Macquarie (West) SA3 forms part of the Lake Macquarie LGA, and the Newcastle and Lake Macquarie SA4 (ABS Code 111). Table 7 provides a snapshot of relevant population comparators.

Table 7: Regional population data

	Count	SLA3 %	Land area (Ha)
Lake Macquarie (West) SA3[10] population	75,613	100	50,701
Lake Macquarie LGA population	202,676	37	64,799
Newcastle & Lake Macquarie SA4 population	342,605	22	86,999

The population data demonstrate that the population is more concentrated in other areas of the Lake Macquarie LGA. The SA3 comprises around two-fifths of the LGA population and one-fifth of the regional population. Population density is lower for the SA3 and Mandalong Mine's operational sites are at some distance from populated areas. This provides some level of mitigation in respect of some impacts, by reducing the number of impacted receptors.

ABS data also indicate that mining accounts for a much higher proportion of employment in the Lake Macquarie West SA3 than is the case for the broader region. This is also the case when compared against the state and nation. Relevant comparisons are displayed in Table 8.

Table 8: Regional employment data[11]

Area	Mining employment	All industries employment	Mining as share of employment (%)
SA3	1,237	16,521	7.5
LGA	1,283	52,058	2.5
SA4	1,641	140,571	1.2

The data demonstrate that mining industry employment in the Newcastle and Lake Macquarie SA4 is heavily concentrated in the SA3 in which Mandalong Mine is located. It is noted that there are also several other operations in the area (some also operated by Centennial Coal), which contribute to that concentration. The data emphasise the relative importance of mining in the locality (as defined by DPE). This supports a conclusion that a significant proportion of employees' economic, community and social activities are likely to take place in the locality, and thus provide stimuli to the community and the economy. These data and observations are consistent with the findings of internal research presented in the SSD-5144 MSEP consent application.

[10] All estimates are ABS Estimated Regional Population statistics for 2014.
[11] ABS 2011 Census data.

4.3 Discussion of localised environmental impacts

Assessments of environmental effects were described and presented in Tables 2 and 3. The quantified assessments of these impacts form part of the overall CBA for the project. Importantly, however, some of these environmental impacts will principally affect the regional and/or local communities, as distinct from broader, less contiguous community groups, such as those resident in other parts of NSW. Recognition of these effects emphasises both financial and experienced materiality in dealing with these impacts, in order to appropriately address stakeholder interests.

The likelihood of local effects is mitigated by the brief duration of operations associated with the Modification. Furthermore, as the Modification is consistent with operations permitted under SSD-5144, the effects may not be distinguishable or discernible to those from ongoing operations.

Among the limited range of effects quantified in this report, the potential for subsidence effects would have the greatest localised impact, should such effects eventuate. This issue was identified in the MSEP consent application. However, Seedsman Geotechnics (2017) reported that '*The mine layout is designed so that this [strong conglomerate layer in the overburden] can span across the longwall extraction panel and deform elastically. This has resulted in vertical subsidence of less than 1 m (compared to a maximum subsidence of 2.98 m in the original consent) and has protected surface and subsurface features from significant impact. The mine layout has been successfully employed for 21 panels to date and the same approach to mine design has been adopted for LW24 and LW24A…. The similar geology and mine layout will result in a continuation of the range of impacts and consequences experienced to date'* (Seedsman Geotechnics 2017:1).

The relatively limited extent of other impacts, and the likelihood that subsidence-related impacts will not be severe, indicates that the effects of the Modification are likely to be consistent with those for previous operations at Mandalong Mine, which are subject of continuing consultation with the local stakeholders.

4.4 Discussion of regional economic effects

A number of the economic impacts assessed in the CBA are also differentially distributed across local/regional and broader communities. The impacts of royalties and taxes are broadly distributed across the State, whereas the direct and indirect effects of wages earned by workers in a specific region may be more concentrated in that region, as was identified in Section 4.2.

4.5 Community consultation

As was disclosed in relation to the original MSEP development consent application, Centennial Mandalong has conducted an extensive consultation program in relation to Mandalong Mine's continuing operations. The program commenced in 2009, with the aim of

obtaining relevant access permissions and providing information to landholders in relation to the MSEP SSD-5144 exploration and mining approval processes.

Ongoing monitoring and management of the approved MSEP and the proposed Modification incorporates community stakeholder input. This is achieved principally through continuing engagement with the Mandalong Mine Community Consultative Committee. This program of engagement constitutes an important element of Centennial Mandalong's endeavours in understanding and addressing the effects on households and land users in close proximity to the mine, and takes into consideration the effects of the proposed Modification.

4.6 Social impacts

The Social Impact Assessment[12] in relation to MSEP emphasised a limited number of positive and negative aspects of concern to stakeholders, determined through the consultation process. These included landholder concerns regarding subsidence, and contributions to the regional economy, particularly those associated with the ongoing employment of up to 420 FTE employees. The Modification would not materially change the likelihood or magnitude of such effects. Furthermore, the Modification would not produce any material additional demand on public and/or private services and infrastructure in the locality.

4.7 Extended economic impacts

As has been established in these analyses, the labour surplus estimated in relation to employee salaries at Mandalong Mine is material, particularly in the context that a proportion of this residual element of employee income is likely to be captured in the regional and SA3 economy through the consumption activity of employee households. Furthermore, the contribution of mining to the LGA economy is recognised by LMCC (as presented in the MSEP SSD-5144 consent application).

Any increase in operations also necessitates a concomitant increase in transactions with other businesses supplying goods and services to the mine. Once again, given the duration of the Modification works, any such increase would be of limited magnitude and is not quantitatively assessed in this report.

The Modification is likely to stimulate further indirect, downstream economic effects, as the initial transactions with labour and suppliers induce procurement of additional goods and services along the value chain. The nature of these effects would be consistent with those identified in relation to the MSEP approval.

4.8 Ecologically sustainable development reporting: quantitative and qualitative assessment of social, economic and environmental impacts

The legislation governing this proposed Modification requires consideration of the principles of ecologically sustainable development in the design and implementation of such a project (refer to Section 1), including the avoidance, mitigation and management of relevant

[12] (James Marshall & Co 2013)

impacts. This report adopts a 'triple bottom line' approach to assessing and reporting these impacts. The approach is intended to provide an integrated assessment of the social, economic and environmental impacts of the Modification, with the interdependencies between each of these aspects taken into consideration. Table 9 provides a summary of the socioeconomic and environmental matters addressed in this assessment.

TABLE 9: QUALITATIVE AND QUANTITATIVE ASSESSMENT OF ENVIRONMENTAL AND ECONOMIC IMPACTS, LW24 & LW24A PANEL MODIFICATION

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
Mandalong Mine LW24 – LW24A operations: 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 production (2018): PV ≈ $19.0 million • Labour surplus – direct positions PV ≈$8.6 million • Additional federal/state/local government taxes, rates & charges: Not quantitatively analysed (Refer to Appendix 1). • Economic contribution of mining and associated employment in local economy recognised by LMCC.	Net economic benefit estimated. Valuations for individual impacts provided in relevant sections of this table.	Nil required
Subsidence Consultant: Seedsman Geotechnics Pty Ltd	The mine layout has been successfully employed for 21 panels mined to date and the same approach to mine design has been adopted for LW24 and LW24A. The similar geology and mine layout will result in a continuation of the range of impacts and consequences experienced to date. Deformation applied to dwellings will be within the safe, serviceable and repairable range. There will be no tensile cracking of the soil or any exposed rock. There may be some minor compression humps detected on sealed roads. The movements likely to imposed on TransGrid towers are very low with less than 3mm/m tilt and 1mm/m strain. Given the gentle topography above LW24 and LW24A and the low subsidence deformations, no rock falls or cliff instability is predicted. The spanning of the massive conglomerate ensures that there is no hydrogeological connection between the surface and the underground workings.	Detailed consultation with landholders in the area has been undertaken. As a result of this engagement, the proposed mine plan is designed to minimise subsidence impacts.	Notional cost to community: PV: ≈ $2,116,316 (includes estimate for land resources and water resources impacts) as per combined estimation methodology described in Table 3.	Mine layout designed to reduce impacts by incorporating favourable geological features/ conditions.

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
Biophysical Strategic Agricultural Land & Soil and Land Resources Assessments **Consultant: SLR Consulting Australia**	Agricultural Suitability ranges from moderately low to very low. Negligible soil and land resource impacts are associated with the proposed Project. The Study Area for this BSAL Assessment is the LW24 – LW24A footprint, plus a 100 metre buffer, totalling 251 hectares. The Study Area is partially mapped as BSAL according to the NSW Government (DP&I, 2012). Three Soil Units that were identified and mapped with the Study Area were verified as non-BSAL due their failure of Interim Protocol Criteria 9 (poor soil drainage) and/or Criteria 10 (pH). There was 113 hectares of land verified as non-BSAL within the Study Area based on the soil survey results. Additionally, there was 138 hectares excluded as BSAL due to greater than 10% slope, or being less than 20 hectares contiguous area. Therefore the total Study Area has been mapped as non-BSAL. It can be concluded that there is no qualifying BSAL within the Study Area.	No land impacts assessed, therefore no qualitative or quantitative assessment reported. Assessed benefits of the Modification exceed estimated costs to agricultural resources.	Negligible land impacts assessed, therefore no quantitative assessment calculated. Precautionary assessment on impacted agricultural resources, of $251 per annum (possible residual impacts provided for in MSEP SSD-5144 consent application)	Refer to Section 6 (p.41), Disturbance Management, Soil and Land Resources Assessment (SLR 2017b)

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
Water Resources **Groundwater Consultant: GHD Pty Ltd** **Surface water Consultant: GHD Pty Ltd**	GROUNDWATER: Predicted impacts on groundwater levels are expected to be less than the Level 1 minimal impact considerations from the NSW Aquifer Interference Policy and are therefore considered to be acceptable. It is not expected that Project would reduce the beneficial use category of alluvial groundwater or fractured and porous rock groundwater in the vicinity of longwalls 24 and 24A. Changes in flooding regimes and increased potential remnant ponding areas were predicted to be isolated to the zone of predicted subsidence. Given the nature of channels within the study area, the resilience to subsidence as a result of the Project is high. SURFACE WATER: Localised changes to water quality, including elevated levels of total suspended solids and turbidity, may occur due to the mobilisation of sediments caused by changes to the surface as a result of subsidence. However, these changes are expected to be negligible (not measurable) and temporary. It is expected that the environmental value of the surface water will be maintained. Adverse impacts to downstream water users are unlikely to occur as a result of the Project due to the low risk of potential impacts and the ephemeral nature of waterways.	Nil assessed	Notional cost to the community included in estimate reported in subsidence section (above), as per combined estimation methodology in Table 3.	Mandalong Mine EMS Refer to Water Resources Impact Assessment, Section 7, pp 107-108 (GHD 2017).

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
Biodiversity Consultant: RPS Australia East Pty Ltd	The minor subsidence impacts are expected to have a minor or temporary effect on ponding within the local watercourses and are not likely to significantly affect riparian vegetation, Endangered Ecological Communities (EECs), threatened species or their habitats. The Project has the potential for indirect impacts on surrounding retained areas (i.e. edge effects). No areas of native vegetation cover would be cleared for the Project. The Project is only predicted to have subsidence related impacts, which are defined as negligible under Section 2.3.1.2 (c) of the FBA. Subsidence related impacts are not required to be assessed (i.e. no clearing of native vegetation or associated habitat). Native vegetation cover located outside ponding areas will be treated as having no change in site value score as no ponding, surface cracking or adverse impacts on areas of cliff line, caves or similar structures are expected within these areas (Umwelt 2016, Seedsman Geotechnics Pty Ltd 2016).	Cost estimate is conservative (high) as impacts are not expected to be significant and upper bound of impact evaluation range applied for estimation.	Notional cost to community: PV: ≈ $488 (2018)	Mandalong Mine EMS It is considered impractical to implement any meaningful impact avoidance measures given the small predicted total area of increased ponding within areas mapped as native vegetation (i.e. estimated to be 0.38 ha) and its scattered distribution throughout the impact area. No impact avoidance measures have been considered in this assessment (RPS 2017, pp 27-28). Refer to Biodiversity Assessment Report (RPS 2017) Section 4.5, pp28-29

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
Heritage Consultant: RPS Australia East Pty Ltd	ABORIGINAL Based on the areas surveyed, one newly recorded scarred tree site was identified in the Study Area and is reference as AHIMS #45-3-3678 (RPS Mand 2016_1). HISTORIC One unlisted heritage item (General Cemetery ML-01) was identified in Lot 198 (DP727714). Lot 198 was gazetted as a cemetery in 1884 but subsequently re-gazetted for different land use in the 1900s. There was no record to confirm that the land was used for human burials and no visible evidence was identified during the field investigation. Expected subsidence at Lot 198 (DP727714) would be unlikely to cause adverse impact to the land.		Notional cost to community (Lake Macquarie [West] SLA3, 2018 PV: ≈$1,910 per annum.	Monitoring, management and offset recommendations detailed in Sections 11 p.40, Heritage Impact Assessment (RPS 2016a).

Impact	Environmental Assessment Commentary	Benefits	Costs	Mitigation/treatment
GHG Consultant: SLR Consulting Australia	There will be no change to the estimated total LOM drainage gas and ventilation gas emissions, however a portion of these emissions can be attributed to the coal extracted under the Modification and these emissions have been calculated for transparency. Diesel consumption is linked to production. Electricity consumption at Centennial Mandalong is primarily associated with the operation of conveyors and to meet current ventilation requirements, as well as bath house operations etc. Maximum total Scope 1 & Scope 2 emissions (as described above) relating to the Modification are 64,900 t/CO_2-e[13] (2018). Estimates are the maximum GHG emissions for the Modification. These emissions will be reduced through abatement or avoidance activities. Total Project emissions ≈0.001% of total NSW and ≈0.0003% of total Australian GHG production.	Centennial recognises that climate change response is an important aspect of its business that presents both challenges and opportunities. Centennial believes GHGs can be reduced, mitigated and/or offset. Centennial Mandalong is hosting a trial of 'VAM-RAB' technology and the use of gas engines for cogeneration as an effective means of reducing fugitive emissions from the Project.	Assumed cost of \$25/tonne CO_2-e. Notional cost of operations-induced Scope 1 & Scope 2 emissions (2018): PV: ≈ \$1.4 million	Mandalong Mine EMS Abatement & Avoidance recommendations consistent with those detailed in MSEP GHG Report Section 10, (BDM, 2012).

[13] Drainage gas and mine ventilation emissions are not additional LOM emissions, but quantified to give an estimate due to Mod. 5. (SLR 2017).

4.9 Summary

The Modification entails an increase in total production of the mine of approximately 3.7 million tonnes of ROM coal. Although this additional production will be conducted within the approved MSEP approval (Life of Mine), this volume will generate additional royalty revenue and employment benefits for the state and regional economies. The Modification will also result in the likelihood of some increased environmental impacts over the brief period in which the relevant operations will take place. The analysis in this economic assessment suggests that the Modification would have a positive effect on the quantum of economic benefits accruing to NSW, and the regional economies, already associated with the SSD-5144 Project.

5. ADDITIONAL REQUIREMENTS

5.1 Cumulative impacts

It is anticipated that there will be no additional cumulative impacts associated with the Modification, given the limited scale of the panel extensions and the comparatively brief period of mining. The limited scale and duration of the Modification works are not expected to materially increase demand on publicly or privately provided services and infrastructure. Therefore, the risk of cumulative impacts remains the same as assessed for the SSD-5144 MSEP.

5.2 Intragenerational and intergenerational equity

Due to its limited scale and duration the Modification will not materially affect intragenerational and intergenerational equity outcomes beyond the effects discussed in relation to the SSD-5144 MSEP application.

6. CONCLUSION

The Modification will yield the assessed benefits of the additional production in terms of royalties, with associated positive socioeconomic outcomes for NSW. There is also likely to be an unquantified income tax effect that would notionally accrue to the State. The additional period of employment generated by the increased production within the existing approved LOM will also support a modest increase in economic activity chiefly concentrated in the local/regional areas during the brief duration of the Modification works, as quantified by the assessed labour surplus.

The effects of the Modification have been tested using a variety of measures and alternative scenarios. In each instance, such testing has resulted in positive economic assessments for the proposal. The further positive qualitative socioeconomic effects of the Modification have been discussed, with these contributing to the overall benefit Mandalong Mine provides in the relevant communities and economies.

The MSEP SSD-5144 received its required approvals on 12 October 2015, at which point the grant of consent recognises the positive contribution of MSEP. The effect of the Modification is likely to be a marginal increase in benefit of the MSEP, thus maintaining its suitability for approval.

REFERENCE LIST[14]

Australian Bureau of Statistics [ABS] (2017a): Census website.
<http://www.abs.gov.au/websitedbs/censushome.nsf/home/census?opendocument&navpos=10 >

ABS (2017b): Data by Region
< http://stat.abs.gov.au/itt/r.jsp?databyregion >

ABS (2017c): 6202.0 Labour Force, Australia Mar 2017
< http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6202.0Mar%202017?OpenDocument >

Aigis Group (2013-2015): Mandalong Mine Southern Extension Project Economic Impact Assessment.

Australian Government (2015): Department of Human Services website
<http://www.humanservices.gov.au/customer/services/centrelink/newstart-allowance >

Australian Government (2015): JobSearch website. Job Outlook
<http://joboutlook.gov.au/alpha.aspx?letter=M#M >

GHD (2017): Mandalong Longwall Panel 24 to 24A Modification Water Resources Impact Assessment.

NSW Department of Planning and Environment (2015): Guidelines for the economic assessment of mining and coal seam gas proposals – draft for consultation (October 2015).

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Reserve Bank of Australia website 2017 – Historical data
<http://www.rba.gov.au/statistics/historical-data.html >

RPS (2017a): Biodiversity Assessment Report Mandalong Mine Longwalls 24 & 24A, Centennial Mandalong.

RPS (2017b): Mandalong Mine Heritage Impact Assessment LW24 & 24A Modification.

Seedsman Geotechnics (2017): Prediction of Subsidence Impacts for LW24 – LW24A.

SLR Consulting Australia (2017a): Biophysical Strategic Agricultural Land Assessment Mandalong Mine LW24-LW24A Modification.

[14] In the interests of brevity, references to the SSD-5144 consent application have been withheld from this report.

SLR Consulting Australia (2017b): Soil and Land Resource Assessment, Mandalong Mine LW24-LW24A Modification.

SLR Consulting Australia (2017c): SSD-5144 MOD 5 Longwall Panel 24-24A Extension Modification (Mod 5) Greenhouse Gas Assessment.

World Bank (2017): Commodity Markets Outlook, January 2017
< http://pubdocs.worldbank.org/en/926111485188873241/CMO-January-2017-Forecasts.pdf >

APPENDIX 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 DPE guidelines (December 2015). 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.

A1.1 Corporate taxes (Federal)

The DPE guidelines (2015) include provision for reporting of federally-levied corporate income taxes as a component of the economic benefit of projects[15], which has necessitated a review of method in terms of estimation of assessment of notional tax liability. Tax liability in respect of Centennial Mandalong comprises part of tax assessment by Centennial Coal Pty Ltd at aggregate level for the entire company, and not on the basis of individual operations. Therefore, Centennial Mandalong does 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 would be returned to NSW.

A1.2 NSW State Government taxes and Local Government rates, local authority charges etc.

The treatment of State-levied taxes varies. The DPE guideline (2015) notes '*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 a consequence, payroll taxes are interpreted as equating to new mining employment. As such they are excluded from the analysis. Other state taxes and local government rates and charges were based on an aggregated (bundled) basis for the MSEP economic assessment, as provided by Centennial Mandalong. As these are of a relatively minor magnitude, they have been excluded from the analyses in this report.

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

[15] Calculated as a population-based proportional return to NSW.

APPENDIX 2: ADDITIONAL PRICE-BASED SENSITIVITY COMPARISON

As is noted in Section 3.5, the sensitivity analysis requirements of the DPE guidelines provide for; 'where practicable, sensitivity analysis should identify how much output prices would need to fall for a project to have a zero NPV and report on whether such a scenario is either likely or unlikely' (2015:18). As is discussed in Section 3.5 and Appendix 1, such an assessment is not provided in this report. The exclusion of commercially confidential information from the report renders the calculation and reporting of such an analysis impracticable.

However, as also indicated in Section 3.5, to provide some further level of validation in respect of the conclusions of this analysis, a comparative assessment of the estimates in this report and estimates based on most recently available World Bank price data (July 2016) is presented below in Tables A4.1 and A4.2. It should be noted that the World Bank pricing is applied only to the export component of Mandalong Mine's output, which is consistent with the nature of the Bank's data. Given the contractual basis of Centennial Mandalong's supply to domestic customers, it was considered appropriate to value that element at the relevant prices advised by Centennial Mandalong.

Table A2.1: World Bank thermal coal price forecasts at July 1 2016: - 2017-2025[16]

Thermal coal (Australia)	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
USD/mt[17] (nominal)	70.0	60.0	55.0	54.4	55.9	56.3	56.8	57.2	57.7
AUD/mt	54.02	46.30	42.44	42.75	43.14	43.45	43.83	44.14	44.53

Table A2.2 Comparison of estimates of NPV: Internal and World Bank (2017) price assumptions

	Modification 2017 $M	Modification WB 2017 $M
PV Royalties $M	**19.0**	18.4
PV Total Benefit $M	**27.6**	27.0
PV Cost $M	**3.5**	3.5
NPV $M	**24.1**	23.5

Discussion

Comparison with World Bank forecasts provides some further validation of the likelihood of positive economic effects arising from the MSEP and the Modification. This would indicate that the likelihood of the scale required to make the Modification not viable from the State's perspective is relatively low.

[16] Data released 24 January 2017. Conversion to AUD based on exchange rate on 24-1-17 of AUD: USD $0.7717:1 (RBA 2017).
[17] Metric tonne.

A further source of mitigation of this risk is that a proportion of Centennial Mandalong's output is committed to stable domestic contracts. This limits the company's exposure to market price variations to some extent, and this consideration is factored into the assessments reported in Table A2.2.

APPENDIX 3: EXAMPLE LABOUR SURPLUS ESTIMATION METHOD USING RESERVATION WAGE

Internal employee survey material on the residential status of the Mandalong Mine workforce is discussed in **Section 4.2.1**. This indicates that the workforce is largely resident in the immediate region. As a result, mobility in terms of alternative employment may be somewhat constrained, as transaction costs associated with relocation may be a barrier (e.g. Coulson and Fisher 2009). This being the case, attempts to apply more generalised assumptions to a regional area in relation to which alternative employment is not geographically convenient are problematic and may not effectively capture the effects of these factors. Despite this, it is necessary to assess the extent to which employees of Mandalong Mine might find alternative employment if the consent is not approved and mining subsequently ceased. The approach taken is to adopt a 'reservation wage' and compare this to the assumed wage level for ongoing employment. 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 JobSearch website was referenced to obtain information to inform an assumption on this probability. Findings for relevant occupations for the five-year period 2015 to 2025 are included in Table A3.

Table A3.1: Job outlook information – mining industry

Occupation	Unemployment level (%)[18]	Employment growth	Job openings
Drillers, Miners & Shot Firers	average	declining	average
Mine Deputies[19]	above average	slight growth	average
Mining Engineers	average	relatively steady	low
Other Construction and Mining Labourers	above average	moderate growth	below average
Geologists & Geophysicists	average	declining	low
Production Managers	below average	relatively steady	above average

As the majority of the workforce at Mandalong Mine would fall into the first category (miners) this group is used as a basis for assessing probability of unemployment. As unemployment is assessed as average, the unemployment rate for NSW may be considered as reflecting the likelihood of a displaced employee being unable to find work. At March

[18] At November 2015

[19] Included in the occupational group 'Other Building and Engineering Technicians'.

2017, the unemployment rate for NSW was 5.2 percent. Adopting this rate can be considered as conservative, as it does not allow for the constraints on employee mobility discussed above. It also does not recognise the inherently low labour mobility in the black coal industry reported by the Productivity Commission (1998), which found that voluntary labour turnover rates were less than half the average for all industries, thus indicating scarcity of alternative employment positions.

AW = assumed alternate wage. In this instance the alternate wage is assumed as the median wage for the mining sector (August, 2014) as determined by ABS (2014), which was $2,270 per week (all earnings). This equates to $118,040 annualised.
B = Newstart Allowance. The benefit is assumed at partnered level, $483.60 per fortnight (each)[20] annualised ($24,825). Therefore the reservation wage would be:

$$(0.948 \times \$118,040) + (0.052 \times \$25,147) \quad \therefore$$

$$\$111,902 + \$1,308 = \mathbf{\$113,210}$$

The assumed wage rate at the time of preparation of the economic impact assessment was the average wage (including overtime, shift allowances and bonuses) for a tradesman technician at the mine, which was **$138,661**, therefore the difference, and the labour surplus value assumed for estimation of the employment effects in the LMCC LGA is **$25,451**.

[20] Australian Government Department of Human Services website (rate as at 20 March 2017)