APPENDIX D – Consideration of Matters of National Environmental Significance

The Bulga Coal Complex operates under two *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act) approvals issued by the Commonwealth Minister for the Environment, being 2002/773 for the underground operations and 2012/6637 for the open cut operations.

On 17 December 2018, a delegate of the Commonwealth Minister for the Environment determined the proposed Modification 3 to the open cut operations (SSD 4960 Modification 3) to be a 'controlled action' under section 75 of the EPBC Act (see EPBC Act Referral 2018/8300), due to the proposal being likely to have a significant impact on "matters of national environmental significance" (MNES).

In accordance with the bilateral agreement between the Commonwealth and the NSW Governments, the Department provides the following additional information, required by the Commonwealth Minister, in deciding whether or not to approve a proposal under the EPBC Act. The Department's assessment has been prepared on the assessment contained in the original Bulga Optimisation Project Environmental Impact Statement (EIS), the Statement of Environmental Effects (SEE) accompanying the porposed modification, Bulga Coal's Submissions Report and supplementary information provided during the assessment process. The Department has also carefully considered issues raised in public submissions and advice provided by the Biodiversity Conservation Division (BCD, formerly the NSW Office of Environment and Heritage), other NSW agencies and the Commonwealth's *Independent Expert Scientific Committee on Coal Seam Gas and Large Mining Development* (IESC).

This Appendix is supplementary to, and should be read in conjunction with, the main volume of the Department's assessment which includes the Department's consideration of impacts to listed threatened species and communities, impacts to water resources and avoidance, mitigation and offset measures for threatened species, including for MNES.

D1. IMPACTS TO LISTED THREATENED SPECIES AND COMMUNITIES

As outlined in **Section 3.3** of this report, the modification was determined by DoEE (now the Department of Agriculture, Water and Environment) as being likely have a significant impact on one vegetation community and two threatened species listed under the EPBC Act.

The proposed action involves the disturbance of 19.2 ha of native vegetation, 1 ha of disturbed land and approximately 200 ha of mine site rehabilitation. Of the native vegetation proposed to be cleared, 16.4 ha is commensurate with *Central Hunter Valley Eucalypt Forest and Woodland* critically endangered ecological community (CEEC), listed under the EPBC Act. Some areas of native vegetation proposed to be cleared are also considered to provide (or have the potential to provide) habitat and foraging resources for two critically endangered bird species listed under the EPBC Act, being the Regent Honeyeater and Swift Parrot. A summary of the likely impacts of the proposed action on these Matters of National Environmental Significance (MNES) is provided in **Table D1**:

Table D1: Summary of likely impacts on CEEC's and threatened species listed under the EPBC Act

Matters of National Environmental Significance	EPBC Act Status	Impact Area (ha)	Nature of Impact
Central Hunter Valley Eucalypt Forest and Woodland	Critically Endangered	16.4	Direct clearing of vegetation community
Regent Honeyeater (Anthochaera phrygia)	Critically Endangered	16.4	Clearing of potential foraging habitat
Swift Parrot (Lathamus discolour)	Critically Endangered	16.4	Clearing of potential foraging habitat

The Applicant, Bulga Coal Management (BCM), has provided biodiversity assessment reports[1] that identify that the proposal would clear potential and/or known habitat for threatened species which could, in the absence of appropriate management measures, result in significant impacts in MNES.

D2. DEMONSTRATION OF "AVOID, MITIGATE, OFFSET' FOR MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

The SEE and Submissions Report (see **Appendix A** and **Appendix C**) note that whilst direct impacts upon threatened flora species cannot reasonably be avoided, some measures and refinements have been made to reduce the potential additional disturbance of threatened species, ecological communities and fauna habitat outside of the approved and proposed disturbance areas. Additionally, BCM has committed to an extensive range of mitigation measures to manage unavoidable direct impacts upon threatened ecological communities and fauna habitat and species. This is discussed further in **Section 5.1** of this report.

There are no direct impacts proposed outside of the proposed disturbance boundaries. The Department's recommended conditions require BCM to clearly identify the proposed disturbance boundaries prior to the commencement of work and ensure there is no clearing of native vegetation outside of the proposed disturbance boundary. For impacts within the proposed disturbance boundary, where avoidance is not practicable, BCM has proposed a range of targeted mitigation measures, including undertaking pre-clearance surveys, tree-felling supervision, relocation of displaced fauna, landform establishment, habitat augmentation, fencing and signposting. Where the proposal is considered likely to have indirect impacts on MNES (ie from light, noise, dust, erosion, weeds and feral animals), BCM has proposed to undertake mitigation or management actions in accordance with approved management plans to reduce the extent of these impacts (see **Section 5.1** of this report).

To account for any residual impacts that cannot be addressed through the proposed avoidance and mitigation measures, BCM has provided a comprehensive and targeted Biodiversity Offset Strategy (BOS). This strategy includes the establishment of an off-site Biodiversity Stewardship Offset Site, which will provide like-for-like offsets for the area of *Central Hunter Valley Eucalypt Forest and Woodland* CEEC impacted by the proposed disturbance (see **Table D2**).

BCD and the Department consider that the proposed BOS satisfies the offsetting requirements for MNES. Further detailed consideration and assessment of the likely impacts for individual fauna species and the adequacy of the proposed offsets package is provided in **Section 5.1** of this report.

Table D1: Summary of impact and offset areas for MNES

MNES	Impact Area (ha)	Offset Area (ha)	Offset ratio
Central Hunter Valley Eucalypt Forest and Woodland ecological community	16.4 (known habitat)	81.1 (current equivalent) 33.8 (to be restored)	7:1
Regent Honeyeater (Anthochaera phrygia)	16.4 (potential habitat)	81.1 (current equivalent) 33.8 (to be restored)	7:1
Swift Parrot (Lathamus discolour)	16.4 (potential habitat)	81.1 (current equivalent) 33.8 (to be restored)	7:1

[1] Including BCM's biodiversity assessment in Appendix A of the SEE and supplementary biodiversity assessment in Appendix C of the Submissions Report.

D3. REQUIREMENTS FOR DECISIONS ABOUT THREATENED SPECIES AND ENDANGERED ECOLOGICAL COMMUNITIES

In accordance with Section 136 of the EPBC Act, in deciding whether or not to approve the taking of an action and what conditions to attach to an approval the Minister must consider matters relevant to any matter protected by a provision of Part 3 that the Minister has decided is a controlling provision for the action. These matters are addressed in **Section 5.1** of this report.

In accordance with Section 139 of the EPBC Act, in deciding whether or not to approve, for the purposes of a subsection of either Section 18 or Section 18A of the Act, the taking of an action and what conditions to attach to such an approval, the Commonwealth Minister must not act inconsistently with certain international environmental obligations, Recovery Plans, or Threat Abatement Plans. The Commonwealth Minister must also have regard to relevant approved Conservation Advices.

D.3.1 Australia's International Obligations

Australia's obligations under the *Convention on Biological Diversity* (Biodiversity Convention) include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.

The recommendations of BCM's biodiversity assessment reports and this report are not inconsistent with the Biodiversity Convention, which promotes environmental impact assessment (such as this process) to avoid and minimise adverse impacts on biological diversity. Accordingly, the recommended conditions require avoidance, mitigation and management measures for listed threatened species and communities and all information related to the proposed action is required to be publicly available to ensure equitable sharing of information and improved knowledge relating to biodiversity.

Australia's obligations under the *Convention on Conservation of Nature in the South Pacific* (Apia Convention) include encouraging the creation of protected areas which together with existing protected areas would safeguard representative samples of the natural ecosystems occurring therein (particular attention being given to endangered species), as well as superlative scenery, striking geological formations and regions. Additional obligations include using their best endeavours to protect such fauna and flora (special attention being given to migratory species) so as to safeguard them from unwise exploitation and other threats that may lead to their extinction. The Apia Convention was suspended on 13 September 2006. Nonetheless, Australia's obligations under the Convention have been taken into consideration. The recommended approval of Modification 3 is not inconsistent with the Convention which has the same general aims of conservation of biodiversity.

The *Convention on International Trade in Endangered Species of Wild Flora and Fauna* (CITES) is an international agreement between governments which seeks to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The recommendations are not inconsistent with CITES as the proposed action does not involve international trade in specimens of wild animals and plants.

D.3.2 Recovery Plans and Approved Conservation Advice

The Department's assessment report provides a detailed and comprehensive assessment of the potential impacts of the proposed action on listed threatened species and communities under the BC Act and the EPBC Act (see **Section 5.1**). In accordance with the bilateral assessment process, the

Department has taken into consideration approved Conservation Advices and Recovery Plans for the species and communities which would be impacted by the proposed action.

BCM has also considered these Recovery Plans, Threat Abatement Plans and Approved Conservation Advices' in the assessment of significance contained within its SEE biodiversity assessment report. The Department has considered and reflected this advice in its assessment.

- Approved Conservation Advice for the Central Hunter Valley Eucalypt Forest and Woodland

In April 2015, the Commonwealth Minister approved the Conservation Advice for the *Central Hunter Valley Eucalypt Forest and Woodland CEEC*. The Conservation Advice identifies vegetation clearance and landscape fragmentation as a key threat affecting this CEEC. Other key threats include invasive flora species, pests, infrastructure development and removal of fallen timber and trees.

The Conservation Advice identifies and prioritises conservation actions that could be implemented to assist the recovery of the ecological community. The CEEC does not have an approved National Recovery Plan or Threat Abatement Plan however, a number of existing strategies, plans and guides are relevant to management and/or recovery of the ecological community, or its component species.

While the *Central Hunter Valley Eucalypt Forest and Woodland* ecological community is fragmented, it is a critically endangered ecological community (CEEC) and any incremental clearing of moderate to good condition vegetation would decrease the extent of this CEEC and adversely affect habitat. The Conservation Advice for *Central Hunter Valley Eucalypt Forest and Woodland* CEEC aims to mitigate the risk of extinction of the community and help recover its biodiversity and function.

While the proposed action would clear 16.4 ha of this CEEC, BCM has proposed a substantial land-based off-site biodiversity offset package that is aligned to assist in the recovery of this ecological community. The Department considers that the proposed offsets package is consistent with the conservation objectives of reducing the risk of extinction. The Department therefore considers that the proposed action would not be inconsistent with the Conservation Advice for the CEEC subject to the timely and successful implementation of the proposed offset strategy.

- National Recovery Plan and Approved Conservation Advice for the Regent Honeyeater (Anthochaera phrygia)

The National Recovery Plan considers the conservation requirements of the Regent Honeyeater across its known range and identifies actions to ensure its long term viability. The Recovery Plan provides information on habitat requirements, ecology, distribution, conservation status, key threats, management issues, research and monitoring, captive breeding and translocation, and community education. The Hunter Valley is identified in the recovery plan as a known breeding area of the Regent Honeyeater, where the species is regularly recorded.

The Conservation Advice for the Regent Honeyeater was approved by the Commonwealth Minister on 25 June 2015 and identifies the main threat as the clearing, fragmentation and degradation of its habitat. The Conservation Advice identifies local and regional priority actions that could be implemented to support recovery of the species.

The objectives of both documents are to:

- reverse the long-term population trend of decline and increase the numbers of Regent Honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years; and

- maintain key Regent Honeyeater habitat in a condition that maximises survival and reproductive success and provides refugia during periods of extreme environmental fluctuation.

The Regent Honeyeater was not recorded despite targeted surveys being undertaken. However, the Regent Honeyeater is known to occur in the broader region and the proposed action would result in the clearing of approximately 16.4 ha of vegetation which is considered potential foraging habitat for the Regent Honeyeater. Surveys undertaken to inform the BAR indicate that this 16.4 ha of potential foraging habitat contains a localised occurrence of around 0.1 ha of low abundance, young Spotted Gum (*Corymbia maculata*) which is a key foraging tree species

To address these potential impacts, BCM's Biodiversity Offset Strategy includes a direct land-based offset that would provide foraging habitat for the Regent Honeyeater. The proposed Glencore owned offset site of 153.7 ha in size and is located approximately 1.5km south of the proposed disturbance area. It would provide 81.1 ha of extant *Central Hunter Valley Eucalypt Forest and Woodland CEEC* and a further 33.8 ha of this community to be restored over time, which would provide suitable foraging habitat for the Regent Honeyeater within the Central Hunter Valley Subregion in the immediate and long term and is considered appropriate to compensate for the proposed impact of 16.4 ha of potential foraging habitat and 0.1 ha of young key foraging tree species.

The Department considers that the proposed offset package is consistent with the primary objectives of the Recovery Plan through a management action to improve the extent and quality of Regent Honeyeater habitat. The Department therefore considers that the proposal would not be inconsistent with the approved Conservation Advice or Recovery Plan for the Regent Honeyeater, subject to the timely and successful implementation of BCM's BOS. Therefore, the Department has recommended conditions to formalise these measures (refer to conditions 29-35 of Schedule 3 to SSD 4960, as modified and shown in **Appendix F**). Key actions of the Recovery Plan including monitoring would also be implemented as part of the Biodiversity Management Plan for the site and offset areas.

- National Recovery Plan and Approved Conservation Advice for the Swift Parrot (*Lathamus discolor*)

The National Recovery Plan considers the conservation requirements of the Swift Parrot across its known range and identifies actions to ensure its long-term viability. The Recovery Plan provides information on known habitat requirements, ecology, distribution, conservation status, key threats, management issues, research and monitoring, captive breeding and translocation, and community education. The Hunter Valley is identified in the Recovery Plan as the winter foraging area for the Swift Parrot where the species is regularly recorded.

The Conservation Advice for the Swift Parrot was approved by the Commonwealth Minister on 5 May 2016 and identifies the main threats as predation from Sugar Gliders and loss/alteration of its habitat. The Conservation Advice identifies local and regional priority actions that could be implemented to support the recovery of the species.

The objectives of both documents are to:

- prevent further decline of the Swift parrot population; and
- achieve a demonstratable sustained improvement in the quality and quantity of Swift parrot habitat to increase carrying capacity.

The Swift Parrot was not recorded despite targeted surveys being undertaken. However, the Swift Parrot is known to occur in the broader region and the proposed action would result in the clearing of approximately 16.4 ha of vegetation which is considered potential foraging habitat for the Swift Parrot.

Surveys undertaken to inform the BAR indicate that this 16.4 ha of potential foraging habitat contains a localised occurrence of around 0.1 ha of low abundance, young Spotted Gum (*Corymbia maculata*) which is a key foraging tree species

To address these potential impacts, BCM's Biodiversity Offset Strategy includes direct land-based offsets that would provide foraging habitat for the Swift Parrot. The proposed Glencore owned offset site of 153.7 ha in size and is located approximately 1.5km south of the proposed disturbance area. It would provide 81.1 ha of extant *Central Hunter Valley Eucalypt Forest and Woodland CEEC* and a further 33.8 ha of this community to be restored over time, which would provide suitable foraging habitat for the Swift Parrot within the Central Hunter Valley Subregion, in the immediate and long term and is considered appropriate to compensate for the proposed impact of 16.4 ha and 0.1 ha of young key foraging tree species.

The Department considers that the proposed offset package is consistent with the primary objectives of the Recovery Plan through a management action to improve the quality and quantity of Swift Parrot foraging habitat, within the Hunter Valley region. The Department therefore considers that the proposal would not be inconsistent with the approved Conservation Advice or Recovery Plan for the Swift Parrot, subject to the timely and successful implementation of BCM's BOS. Therefore, the Department has recommended conditions to formalise these measures (refer to conditions 29-35 of Schedule 3 to SSD 4960, as modified and shown in **Appendix F**). Key actions of the Recovery Plan including monitoring would also be implemented as part of the Biodiversity Management Plan for the site and offset areas.

D3.3 Threat Abatement Plans (TAPs)

The Department has considered the approved Threat Abatement Plans (TAPs) under the EPBC Act, available at http://www.environment.gov.au/biodiversity/threatened/threat-abatement-plans/approved, along with any current draft revisions to these plans. The relevant TAPs are set out below. The Department notes that there are no TAPs identified as being relevant for the *Central Hunter Valley Eucalypt and Woodland CEEC*.

Regent Honeyeater

- *Threat abatement plan for competition and land degradation by rabbits (DoEE 2016)*

Rabbits have direct impacts on native flora and fauna, including from grazing on native vegetation, preventing regeneration and competing with native fauna for habitat and food. Rabbits can also have indirect and secondary effects on the predation of native fauna, for instance by supporting populations of introduced predators or by denuding vegetation and thereby exposing fauna species to increased predation. The ecology of rabbits, including digging and browsing habitats, leads to a loss of vegetation cover and consequent slope instability and soil erosion, which further degrades fauna habitat.

In relation to the threat abatement plans for competition and land degradation by rabbits, there is a possibility that the proposed action may marginally increase the amount of disturbed and modified habitats which rabbits tend to colonise, and lead to an increase in rabbit populations.

The Department's recommended conditions require BCM to consider the TAPs in the development of an updated Biodiversity Management Plan for the site and include detailed strategies for the control of feral animals. The Department notes that these measures are already in place for the existing approved project (SSD 4960 and Cwth EPBC Act reference 2012/6637) and would simply need to be extended to the additional area to be disturbed under the proposed action, which represents an approximately 0.5% increase in the 3,786 ha existing approved disturbance area. With these updated measures in

place, the Department considers that the proposed action would not be inconsistent with the TAPs for competition and land degradation by rabbits.

Swift Parrot (and also relevant to Regent Honeyeater)

- *Threat abatement plan for predation by feral cats (DoEE 2015)*

Feral cats are a serious pest in Australia and can have severe impacts on native fauna through predation, competition and disease transmission. The Threat Abatement Plan for this species focuses on reducing recruitment of domestic/stray cats near human habitation to the feral cat population and to manage negative impacts of feral cats.

As the proposed surface disturbance area are limited to within the currently approved project boundary and close to active mining activities, the risk of facilitating the spread or abundance of feral cats is considered to be very low. BCM has proposed that feral animal control management and control would be continued through the implementation of the site's Biodiversity Management Plan, which would be updated to reflect the proposed modification. With these measures in place, the Department is satisfied that the action would not be inconsistent with the threat abatement plan for predation by feral cats.

D4. A WATER RESOURCE, IN RELATION TO COAL SEAM GAS DEVELOPMNET AND LARGE COAL MINING DEVELOPMENT SECTIONS 24D AND 24E OF THE EPBC ACT

For reasons set out in **Section 5.3** of the assessment report, the Department concludes that the impacts of the action on water resources are acceptable, subject to the avoidance and mitigation measures described in the BCM's Complex wide Water Management Plan, the SEE, Submissions Report, BCM's responses to DPIE Water and NRAR advice (March 2020) and to the IESC's advice (April 2020).

The Department has also provided further specific consideration for each matter raised in the IESC's advice in **Table D3** below.

The Department notes that the conditions of the existing development consent (SSD 4960) already include a number of controls for the management of water resources and has recommended further amendments to these conditions for Modification 3 (see **Appendix E**).

The Department believes that conditions 24-28 of Schedule 3 to SSD 4960, as recommended to be modified and shown in **Appendix F**, provide a suitable regulatory framework to manage the risk of impacts to water resources from the modification. These conditions require BCM to monitor surface and groundwater flows and potential impacts to groundwater dependent ecosystems and private water users, and implement appropriate trigger action response plans in the event of adverse impacts.

Accordingly the Department recommends the Commonwealth Minister require BCM to implement conditions 24, 24A, 26, 27 and 28 of Schedule 3 of the consolidate consent for SSD 4960 at **Appendix F** (as proposed to be amended by the Notice of Modifications, see **Appendix E**), where they relate to the management of potential impacts of water under the EPBC Act.

IESC Advice	Consideration
The assessment documentation generally provides adequate mapping and delineation of water resources within the project area. Some additional work is required to increase understanding of potential impacts and includes:	
a) mapping of the current groundwater levels and flow directions;	Addressed in BCM's response to IESC advice (Figure 2 of Appendix A)
b) improved spatial resolution of the extent of the alluvium in areas of current uncertainty such as Loders Creek, Nine Mile Creek and the Beltana Reach of Wollombi Brook;	BCM's response to IESC advice includes hydrographs and conceptual cross sections for bores located within and adjacent to Wollombi Brook to demonstrate its understanding of the extent of alluvium in this system. While additional verification of the alluvium in Loders Creek and Nine Mile Creek was not provided, BCM noted that the Nine Mile Creek/ Loders Creek catchments are already significantly impacted by approved mining operations. BCM has advised the Department that it has installed two additional piezometers in Loders Creek (LC1 and LC2) to further confirm the spatial extent of the alluvium. In addition, if monitoring indicates that impacts are outside the range of predictions, further works will be undertaken to redefine alluvial zones. The Department notes that the groundwater assessment predicts minimal changes to groundwater drawdown in these aquifers due to the modification.
c) improved characterisation of areas where the alluvium occurs and could be in hydraulic connection with Permian aquifers and the time scales of these connections;	BCM provided a series of hydrographs using monitoring data from 2000 to 2019 (Figures 5 to Figure 10, Appendix A), which demonstrates the poor hydrogeological connection between the Permian and alluvial aquifers. The hydrographs demonstrate that historical drawdown in the Permian aquifer has not affected the water levels in the alluvium which are primarily affected by rainfall and streamflow. BCM proposes to update the water management plan to include

IESC Advice	Consideration
	additional monitoring and hydrogeological ground truthing of the alluvium, which would be enforced through amended conditions of the development consent. The Department is satisfied that there is adequate understanding of the connectivity between the aquifers to assess the potential impacts of the proposed modification on the groundwater systems.
d) identification of stream reaches where the Permian aquifers are connected, and potentially providing baseflow to, the surface water systems, either directly or via alluvial aquifers;	Addressed in response to 1 c) above.
e) mapping of the occurrence of potential GDEs, including stygofauna and riparian vegetation;	The SEE and BCM's response to the IESC advice indicate the location of GDEs align with riparian vegetation along the creeks and tributaries. The SEE concluded that drawdowns caused by the proposed modification would be within levels previously assessed as not being significant as part of the approved project and extraction of coal in areas potentially impacting these systems would already have occurred. BCM noted that stygofauna and hyporheic fauna may be present in alluvium but not in Permian aquifer systems, which is consistent with other studies in the Hunter Valley.
f) identification of the source of groundwater potentially used by the EPBC-Act listed Warkworth Sands Woodland and whether it is connected to any other groundwater or surface water sources; and	Addressed in response to 1 c) above.
g) groundwater quality data for potential contaminants (other than salinity) particularly in the Wollombi Brook alluvium.	The Department notes the current monitoring at the project is carried out in accordance with the existing Environment Protection Licence (EPL), BCM has committed to monitor for metals, nutrients and ions in an updated monitoring program. The Department's assessment has found that the predicted impacts due to the proposed modification are unlikely to materially change

IESC Advice	Consideration
	compared with the approved project.
In addition to the above, specific details of the changes in the proposed depth of mining and what coal seams will be mined as a result of the proposed deepening of the open cut pit are needed so the extent of the project is clear.	Information provided by BCM to indicate the change in the depth of mining and targeting of the Bayswater Coal Seam.
The large uncertainties in the groundwater model have not been considered when the proponent assessed the predicted surface water impacts for Wollombi Brook and Loders Creek.	BCM's assessment predicts a small incremental impact on the surface water baseflows within Wollombi Brook and Loders Creek due to the proposed modification compared with the approved project. BCM contends that the relative uncertainties in the groundwater modelling are minor compared with flows in the Wollombi Brook and the level of uncertainty does not warrant further detailed analysis. The Department notes the peer reviewer considered the model fit for purpose and the majority of streamflow losses caused by the modification are associated with catchment changes rather than groundwater drawdown impacts.
The surface water assessment modelling concluded that the impacts on baseflows were negligible as they represent a reduction in flows of less than 1%. However, reporting baseflow decreases as a volumetric proportion of the average fails to recognise the potential impacts on ecologically important aspects of the flow regime (e.g. impacts on the frequency, duration and timing of low- and zero-flow periods). Analysis of the groundwater drawdown impacts indicates that baseflow decreases of 1.38 ML/day will increase the number of zero-flow days by around 50%. The timing and duration of these impacts is illustrated in Figure 1 (Attachment A of this advice), where it is seen that the nature of these impacts on the flow regime are of material concern. For example, longer periods of zero- and low-flows will affect the completion of life cycles by aquatic stages of stream biota and maintenance of refugial pools. Evapo-concentration due to reduced flows may further increase salinity.	The Department notes that the change in streamflow or dry days due to the modification are predicted to be negligible compared with the approved project, particularly in Nine Mile Creek and Loders Creek catchment which are already subject to disturbance from approved mining operations.
The proponent presented flood modelling which suggests that there will be lower peak flows and reduced flood levels in Loders Creek due to the landform modifications over the	The Department has considered the incremental changes to the catchment due to the proposed modification (associated with the proposed 0.5% increase in approved disturbance areas) and is satisfied

IESC Advice	Consideration
life of the project (Engeny 2019, p. 36). The modelling is based on an approach and assumptions sometimes adopted for urban environments but which are not consistent with national flood guidance provided for rural catchments (Hill and Thomson, 2019). No attempt was made to relate flood estimates to nearby gauged catchments or other regional information. It is noted that the 1% Annual Exceedance Probability (AEP) flood estimate is around half the magnitude of the flood estimate based on regional flood information and only slightly higher than the corresponding lower 5% confidence limit (http://rffe.arr-software.org/). While the use of ARR87 procedures is reasonable for the purposes of assessing impacts relative to previously provided estimates, it does not provide a suitable basis for assessing current flood risks.	that they would not be substantial enough to warrant analysing the flood risk estimates to this level of detail.
The sensitivity of flood impacts to climate change was assessed by reference to the difference between 0.5% and 0.2% AEP flood events, although the rationale and nature of the inferences to be drawn from this assessment are not explained. No consideration was given to assessing the impacts of climate change on rainfall intensity as discussed in national flood guidelines (Bates et al. 2019).	BCM's response to the IESC Advice noted that the assessment included the adopted NSW approach to assess climate variability.
The flood modelling also did not consider potential impacts on the downstream environment from spills from the Northern and Surge Dams during high rainfall events (HEC 2019, Figures 31-33, p. 39). The IESC recommends a sensitivity analysis should be undertaken to assess the likely impacts of a range of rainfall events (including extreme events), and the potential for spillage post-mining by considering climate change. The influence of climate change on expected storage levels in these dams could be informed through the use of the Climate Futures Framework and Tools (Whetton et al. 2012) (https://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures- tool/projections/) which allows for various climate regimes to be simulated.	BCM's response to the IESC Advice justified not conducting a sensitivity analysis because the dams constructed for the approved project operate as pumped storages, have a limited catchment area and always maintain enough freeboard to contain a 1% AEP storm event. The Department notes that the proposed modification does not include changes to the water management system of the approved project which includes ongoing monitoring to ensure adequate freeboard for flood events.
The site water balance modelling was based on the use of a well-accepted rainfall-runoff model (AWBM), and a reasonable level of agreement was obtained between model simulations and monitored storage levels. The site water balance considered three scenarios relating to underground operations: existing approved underground operations,	BCM's response to the IESC Advice indicates that the predicted maximum variability in supply reliability for key water demands of the mining operations is up to 2.8% during the modelled climate change scenarios. This demonstrates that the potential variations due to climate

IESC Advice	Consideration
delaying restart of underground operations until 2029 and no further underground operations. These scenarios considered climate variability through the use of 121 "climate realisations" which were based on 20-year periods that were successively shifted forward one year at a time over the full historic period. This approach to investigating the impacts of climate variability does not allow for projected changes in rainfall and temperature associated with climate change (Whetton et al. 2012).	change are minimal and do not affect overall water supply reliability for the modified project.
9) The proponent states that discharges from the Northern Dam and Surge Dam into the Hunter River may occur in accordance with their existing environment protection licence (EPL). However, the modelling predicts zero median discharge volumes until well after the end of tailings relocation, with up to approximately 2,000 ML/year median discharge in the last eight years of the proposed project (HEC 2019, p. 43). The proponent has stated that licensed discharges via the Hunter River Salinity Trading Scheme (HRSTS) may be required at times of higher rainfall to mitigate spill risk and control high water inventories. The IESC notes that the downstream impacts on aquatic and riparian ecosystems and impacts on water quality and flow as a consequence of the increase in discharge have not been fully considered by the proponent (discussed further in Paragraphs 10, 12 and 15). 10) The IESC considers that the proponent has not fully assessed the additive effects of altered water quality (caused by sporadic and uncontrolled discharges) and increased water take on aquatic, riparian and floodplain biota and ecological processes downstream. A comprehensive risk assessment of these impacts (including cumulative ones) is needed, along with reliable baseline data against which to judge the effectiveness of proposed mitigation and management plans.	BCM has assessed the discharges from the Northern Dam and Surge Dam to be negligible compared with regional Hunter River flows. The Department's assessment concluded that the proposed modification would not change the Northern Dam, Surge Dam or their catchments or the design measures adopted for their operation. Water quality discharges from the project are regulated by the EPL and the Hunter River Salinity Trading Scheme (HRSTS), which would continue to apply to the modified project.
The proponent has not adequately modelled potential impacts of the final void in the rehabilitated landscape, including worse-case impacts on surface water. These include long-term impacts on surface water and groundwater quality (particularly salinity). More detail is needed on the range of possible rates of water level recovery (cf. KCB 2019, Figure 4-12, p. 71) to improve assessment of legacy impacts. Further information on the salt balance of the site and salt sources and stores within the final landform should be provided by the proponent (discussed further in Paragraphs 16 and 25).	The SEE includes a salt and water balance for the final void and the Department considers the predicted freeboard of approximately 120 m below spill level would ensure the risks of overtopping are negligible during extreme events. The Department also notes the development consent includes provisions for ensuring the final void and final landform is designed to minimize long term impacts on groundwater and surface water quality.

IESC Advice	Consideration
The proponent considers that the changes to flow regimes associated with the proposed project will be negligible in Wollombi Brook as well as at a regional scale in relation to flows from Wollombi Brook and Loders Creek into the Hunter River (Engeny 2019, p. 36). As noted in Paragraph 3, the proponent has not considered changes to ecologically important flow components, and thus it is not possible to fully assess the potential impact of this on GDEs and aquatic biota and ecological processes in Wollombi Brook, Loders Creek and Nine Mile Creek. In particular, the proponent has highlighted potential changes to baseflow and reduced saline Permian groundwater leakage into the alluvium in Wollombi Brook. Further analysis is needed as to how changes in surface water regimes and groundwater availability could affect the presence of the following EPBC Act-listed communities: Coastal Swamp Oak (Casuarina glauca) Forest (endangered), White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) and the Central Hunter Valley Eucalypt Forest and Woodland (critically endangered).	The assessment has demonstrated that the proposed modification would result in minimal incremental change compared with the approved project, which suggests that this impact would be negligible.
The proponent has presented monitoring data for pH, EC (electrical conductivity) and TSS (total suspended solids) which are monitored under their EPL. Future monitoring should include a broader suite of analytes such as sulfate, metals and metalloids for all current surface water monitoring sites, and should include new sites in Loders Creek, downstream from licenced discharge points. Discharges are likely to contain a number of metals and metalloids which have the potential to adversely affect biota. The proponent should also provide water quality data for water used in dust suppression.	BCM has committed to monitor for the additional analytes (including metals and metalloids) on a 6 monthly basis as part of the revised water quality management plan.
The proponent has stated that there is the potential for mining to be disrupted over time due to excessive volumes of water stored in the open cut voids (HEC 2019, p. 37). Consequently, the proponent has outlined a site water storage strategy which includes discharging excess water to underground goafs and the Hunter River through the HRSTS. Limited information has been provided on the volumes, quality and timing of releases of this excess water. Further information on the quality of the water and potential for interactions with the goaf material should be provided. Monitoring of the water quality of all water subject to controlled discharge should occur prior to discharge.	The storage of water in the goafs is permitted under the approved project and discharge of water from the project would continue to be regulated by the EPL and HRSTS.
The proponent has highlighted that, under the new water management system, there will be discharges from the Northern Dam and Surge Dam (HEC 2019, pp. 12-14). As noted in Paragraph 7, the potential impacts from controlled and uncontrolled discharges (spills from	The assessment has demonstrated that the proposed modification would result in minimal incremental change compared with the approved project, which suggests that this impact would be negligible.

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dams overtopping during high rainfall events) are not discussed. Any impacts from discharge into the Hunter River will be cumulative with existing impacts from agriculture and mining, and these potential impacts should be assessed in the context of current and future monitoring. The IESC notes that the HRSTS is intended to manage impacts from salinity but not other contaminants. The proponent should provide a detailed assessment of all potential impacts from discharges, including from metal contaminants and cumulative impacts. This assessment should include expected quantity, quality, frequency and timing of discharges, together with assessment of the likely impacts and any proposed mitigation measures (such as water treatment). As discharges may present an ongoing local erosion risk, the potential impacts of this on downstream water quality also require consideration.	Therefore, the modified project is unlikely to result in changes to downstream erosion potential. Water quality discharges from the project are regulated by the EPL and the HRSTS, which would continue to apply to the modified project BCM has committed to monitor for the additional analytes (including metals and metalloids) on a 6 monthly basis as part of the revised water quality management plan.
The proponent needs to include analysis of the evolution of salinity and water level in the final void. This information is key for understanding the potential risks posed by the void should it spill or leach. The analysis should use relevant predictions from the project's surface water and groundwater modelling.	The SEE includes a final water level assessment (Appendix 11) and a final void salinity analysis (Appendix 10).
Confidence in the predictions of potential impacts on groundwater resources relies entirely on the adequacy of the groundwater model design, history-matching and uncertainty quantification. The paragraphs below describe the IESC's concern about the groundwater model and outlines work that should be undertaken to improve confidence in the predictions of potential impacts.	N/A
The proponent notes that currently the alluvium is not represented in detail in the groundwater model because the model is intended to predict impacts on Permian aquifers (KCB 2019, p. 68). The IESC considers this to be a significant limitation severely reducing confidence in the predicted impacts of groundwater drawdown within the alluvial aquifers. The history-matching hydrographs provided for Layer 1 of the groundwater model, which include the alluvial aquifers, indicate bias as the modelled hydrographs are unable to replicate the observed variability and systematically under-predict groundwater levels. As a result, the current groundwater model has limited application for predicting impacts to the alluvial aquifer, GDEs and baseflow changes. The groundwater model requires further work including improved representation of the alluvial aquifer and should be history- matched with field data to provide confidence in predicted impacts.	The Department is satisfied that the groundwater and surface water assessments demonstrate that the potential impacts are unlikely to materially change due to the proposed modification.
The history-matched hydrographs provided by the proponent highlight that in many layers	BCM's response to the IESC Advice included information to compare

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simulated and observed heads vary considerably (sometimes by greater than 50 m). Discussion of the history-matching results was limited and focused primarily on the improvement between model versions rather than providing an analysis of potential causes for the observed mismatches. Additionally it was stated that there were limited data available for history-matching (KCB 2019, p. 53) though this was not explained. It also appears that not all available data were used for history-matching, for example, groundwater inflows to the mine do not appear to have been used as a direct history-matching target in the groundwater model. The proponent compared predicted mine inflows from the current model with those calculated in a previous version of the groundwater model (KCB 2019, p. 54) rather than providing a comparison to measured inflows. Further discussion and analysis is required of the data used for history-matching and how groundwater model predictions compare to observations to provide confidence in the ability of the groundwater model to predict impacts to important environmental assets such as the Wollombi Brook alluvium, surface waterways and GDEs. Further monitoring of the groundwater levels in the alluvium is recommended to provide more relevant data for history-matching.	modelling predictions with observed monitoring data and noted that the anomalies due to the timing of the groundwater observations relate to the Permian aquifer and the impacts on predictions for the alluvium are insignificant. The Department also notes the groundwater model was subject to peer review which considered the model fit for purpose.
The IESC considers confidence in impact predictions could be further increased by undertaking additional sensitivity and uncertainty analyses (Middlemis and Peeters 2018). The reported sensitivity analysis only varied specific yield. It is unclear which parameters were varied in the uncertainty analysis, whether the model used in the uncertainty analysis was constrained by history-matching (noting it was not the current model) and what prior parameter distributions were used. The additional analyses should be used to identify which parameters have the greatest influence on impact predictions under a range of plausible parameterisations and rainfall scenarios. These analyses are needed to assist understanding of how the groundwater model limitations affect impact predictions. Once the likely range of potential impacts is established, the proponent should undertake further work to identify any additional management measures required to address the range of impacts.	The groundwater assessment included uncertainty analysis in accordance with the explanatory note provided by the IESC (Middlemis and Peeters 2018). The Department notes that the groundwater peer review concluded that the model is fit for purpose for the assessment of the proposed modification. BCM has also committed to additional groundwater monitoring during operations to update the model.
The proponent has identified that there are no privately owned registered bores located within the predicted 2-m drawdown contour. The IESC notes that the range of uncertainty in drawdown has not been clearly presented in the assessment documentation. The results of the uncertainty analysis should be presented as drawdown contours at a range of likelihoods (Middlemis and Peeters 2018) so that decisionmakers can have confidence that	BCM's response to the IESC Advice includes further information on the uncertainty analysis which indicates the drawdown would be minimal and within the predictions for the approved project.

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no privately owned bores are likely to be impacted by the project.	
The proponent notes that the groundwater model is intended primarily for impact prediction in the Permian aquifers, and that the alluvium is not included in detail in the groundwater model (KCB 2019, p. 68). Consistent with this, the IESC notes that the shallow groundwater level dynamics were not represented well within the model, which has implications for the reliability of predictions and long-term drawdown impacts on the shallow alluvium. This reduces confidence in predictions of flux to surface waters including the Hunter River, Monkey Place Creek, Wollombi Brook and their associated alluvial aquifers (and GDEs). While some uncertainty analysis has been provided to aid understanding of how the project may change flux to surface waters, further comprehensive uncertainty analysis and presentation of the results incorporating likelihoods are needed (Middlemis and Peeters 2018). These should include a description of the prior parameter distributions used in the uncertainty analysis. Given the known high connectivity between some surface waters and the groundwater, the potential for changes to groundwater levels, flux and quality to impact GDEs and aquatic biota, plus the dependence of agriculture on surface water and alluvial groundwater, it is important to understand variability in flux under a range of plausible hydraulic parameterisations and different climate and rainfall scenarios.	Refer to the Department's responses in comments 1c, 1d and 18.
To investigate how changes in flux may impact water-dependent ecosystems, the proponent should provide ecohydrological conceptual models. These models should include potential changes to flow regimes (e.g. frequency, duration and timing of low- and zero-flow periods) and how this could impact biota, including through changes in refugial pool persistence. At a minimum, ecohydrological conceptual models should be developed for: a. the potential impacts to ephemeral streams and Wollombi Brook; and, b. the Warkworth Sands Woodland CEEC to show how the perched aquifer and associated GDEs may be affected by the project.	The Department notes that the incremental drawdown impacts due to the proposed modification (compared with the approved project) are negligible. Therefore, the Department considers the use of an ecohydrological model is not essential to understand the relationship between drawdown in the Permian and alluvium. Nothwithstanding, BCM proposes to include ecohydrological monitoring in its updated Water Management Plan. Similarly, the effects of the modification on the Warkworth Sands Woodland EEC are predicted to be negligible compared with the approved project. The Department also notes that BCM proposes to review its monitoring program to incorporate additional monitoring of the alluvium if

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	required.
24) The proponent has not explicitly modelled changes to the catchment salt balances. This is presumably because they are generally predicting small changes in groundwater discharge to surface waters which are expected to result in no changes to water quality. Planned discharges to surface water are managed under the HRSTS and, as such, are unlikely to have a considerable impact on the catchment salt balance. 25) If the additional uncertainty analyses recommended in the response to this question suggest that fluxes to surface waters may be likely to be large enough to impact water quality, then the catchment salt balance should be calculated and discussed to inform potential management.	Salt balance modelling is included in the Site Water Balance in the SEE which notes the discharges and salt balance will be comparable with the approved project. The Department also notes the discharges from the project are regulated under the HRSTS.
26) From the groundwater impact assessment, it is unclear what the likelihood is that groundwater levels will recover to a point at which saturation of the TSF occurs and, if so, how this could impact both groundwater and surface water quality. While the proponent has identified that most discharge from the TSF will ultimately drain to the void lake, they suggest that local flow paths could possibly develop. Information on where these flow paths could discharge is needed to understand and manage the potential impacts on receiving environments. 28) The nature of connectivity between the underground workings and the final void post-mining requires further investigation. It is unclear from the hydrogeological conceptualisation whether this water, which could be contaminated depending on the geochemistry of the target coal seams, will also flow toward the final void lake. Site-specific data should be used to justify the parameter functions applied in the model for hydraulic conductivity and specific storage, particularly between the longwall panels and the open cut pit.	BCM's response to the IESC Advice includes further discussion about the groundwater characteristics as they relate to the potential transporting of contaminants from the final tailings storage. BCM notes that the groundwater contours towards the final void would ensure offsite migration of contaminants is minimized. The Department also notes that the proposed modification does not include changes to the approved location of the main in-pit tailings storage. The Department considers the proposed relocation of the final void is unlikely to substantially change the connectivity between underground workings and the void or interaction with remnant coal seam/s to influence the approved water quality impacts.
Groundwater quality data are required that includes monitoring for a range of potential contaminants other than salinity, particularly for the Wollombi Brook Alluvium. This information is needed to understand the current condition of the water resources and for comparison with monitoring data collected during and postmining to identify whether impacts are occurring. The effectiveness of mitigation strategies can also be assessed using this information.	BCM has committed to monitor for the additional analytes (including metals and metalloids) on a 6 monthly basis as part of the revised water quality management plan. BCM has sampled water in standpipe piezometers since 2008, which are analysed for ions, metals and selected metalloids. Monitoring has not indicated any identifiable impact on alluvial aquifer water quality that

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	has been attributable to mining induced impacts.
The proponent currently predicts that no impacts will occur to the Warkworth Sands Woodland CEEC. This is based on the assumption that the CEEC accesses groundwater from perched aquifers disconnected from the underlying Permian aquifers and that drawdown of the water table will not extend to the Warkworth Sands Woodland. Confidence in this impact prediction is limited. The measures suggested by the consultants (KCB 2019, pp. 86-87) should be implemented to address and manage the limited confidence. The IESC also suggests the following: a. undertaking concurrent ecological monitoring of the Warkworth Sands Woodland CEEC, including species recruitment and persistence, to identify potential impacts; b. instigating a groundwater monitoring program (using nested monitoring bores) which would continue during and after operations to identify potential water table drawdown at the Warkworth Sands Woodland CEEC; c. undertaking an uncertainty analysis to determine the likelihood and magnitude of water table drawdown in the area of the Warkworth Sands Woodland; and, developing a management plan if the additional measures identify the potential for impact to the Warkworth Sands Woodland CEEC. This plan should utilise the ecohydrological conceptual modelling discussed in Paragraph 23.	The Department is satisfied that sufficient information is available to adequately understand the Permian and Alluvial aquifers are hydraulically disconnected. BCM proposes to monitor the ecology and the groundwater of the Warkworth Sands Woodland CEEC in accordance with the BOMP for the Wollombi Brook Voluntary Conservation Area and has committed to install additional piezometers to further define the perched nature of the Warkworth Sands Woodland CEEC.
The justification in the report (KCB 2019) for the input data used in the model is limited for some parameters and scenarios. Furthermore, there are significant data gaps. Some of the model design assumptions and selected parameterisations do not appear credible as evidenced by the poor history-matching (for example, in many instances the anomalies between simulated and observed heads exceed 50 m). Currently, the modelling does not consider worse-case situations and the uncertainty analysis provided is not consistent with the most recent iteration of the groundwater model (KCB 2019, p. 73). Future uncertainty analyses should use a groundwater model incorporating the current mine plan.	KCB undertook further assessment and calibration of the model parameters beyond the previous assessments in response to the IESC Advice. KCB concluded that while a wide range of values were assessed for many parameters, the calibrated values closely align with those used to support the previous approvals.
Given the long history of mining at the site, the IESC would expect the proponent to present more data for history-matching, representing the potential impacts of	Refer to the Department's response to comment 19.

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deepening the open cut and for in- pit tailings placement. History-matching targets are not available for all model layers. Where targets are available, history matching fits are sometimes poor and importantly when simulating impacts on surface waters and existing bores, do not represent the dynamics (or even the median response) of the aquifer within the shallow layers. Uncertainty analysis testing a range of plausible parameterisations is needed to understand how these limitations may affect impact predictions. Reporting of any uncertainty analysis should include a description of the parameters varied and their prior and posterior probability distributions (Middlemis and Peeters 2018).	
Additional limitations of the groundwater model noted by the proponent include the boundary conditions influencing the prediction of creek discharge and that local impacts such as groundwater extraction for irrigation and high rainfall events are not incorporated into the model (KCB 2019, p. 68). These limitations should be considered in the updated version of the model and uncertainty analyses suggested in Paragraphs 20 and 22, and during future model updates.	Sensitivity analysis has included relevant parameters for the likely impacts of the proposed modification compared with the approved project. The Department notes that groundwater take is regulated under the NSW *Water Management Act 2000* which includes a cap on licenced take from alluvial systems. The NSW Aquifer Interference Policy includes further assessment considerations around groundwater take. The Proposed Modification is also considered to satisfy the Minimal Impact Considerations under the Aquifer Interference Policy. The Department's assessment notes that BCM holds sufficient licences entitlements for the modified project and could adjust the scale of its operations if needed to match available supply. These requirements are reinforced by the development consent.
The current groundwater model is used as the basis for assessing cumulative impacts. However, the groundwater model has a number of limitations as outlined in Paragraphs 18-20. In addition, while the current groundwater modelling provides predictions of cumulative impacts the presentation of these predictions makes it difficult to clearly identify the changes in groundwater levels from current conditions and to determine the contribution of the proposed project to cumulative impacts. These limitations need to be	Note the Department's response to items 18-20. The Department also notes the groundwater peer review considers the model is fit for purpose.

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addressed so that the incremental changes of the project and the total cumulative impacts to groundwater can be clearly identified and assessed.	
It is noted by the proponent that irrigation impacts are not incorporated into the groundwater model (KCB 2019, p. 68). Incorporating irrigation water use into groundwater models can be complicated as pumping volumes may not be known and timing is often not at the temporal scale of the modelling. Further discussion of irrigation water extraction and return flows should be provided and incorporated into future groundwater model updates, and their impacts should be considered on alluvial aquifers and their dependent ecosystems along Wollombi Brook.	The Department notes that groundwater take is regulated under the NSW *Water Management Act 2000* which includes a cap on licenced take from alluvial systems. The NSW Aquifer Interference Policy includes further assessment considerations around groundwater take. The Proposed Modification is also considered to satisfy the Minimal Impact Considerations under the Aquifer Interference Policy. BCM argues that because changes in groundwater conditions (as a result of the proposed modification) are far smaller than changes in groundwater conditions due to surface flows and irrigation, the effects of irrigation may override those of the proposed modification. BCM proposes to review and update the groundwater model against the measured data progressively through mining operations.
The proponent identifies that flows of approximately 100 m^3/day may occur from the TSF to Mount Thorley, the adjacent mine site (KCB 2019, p. 80). This potential cumulative impact is not fully considered in the groundwater impact assessment. Further information and analysis are needed of where these flows discharge. If they enter the final void of the Mount Thorley Mine (which is likely), consideration is needed of whether these discharges change the predicted water levels in the Mount Thorley final void, increase the chance of spills from the final void and/or change the void's water quality.	The Department notes that the Main Pit TSF forms part of the approved project and as noted in BCM's response to the IESC Advice, a tailings facility is approved adjacent to the Bulga Main Pit TSF as part of the Mount Thorley operations.
Potential impacts to surface and groundwater resources are discussed in response to Questions 1 to 6 above. Where information is considered inadequate, this is highlighted below.	N/A
Information on riparian and groundwater-dependent vegetation is limited. In particular: a. McVicar et al. (2016) mapped GDEs in the Hunter sub-region, where KCB (2019, p. 40)	BCM's response to the IESC Advice includes information demonstrating the aquifer in which the riparian and Warkworth Sands Woodland

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acknowledges that riparian zones may be groundwater-dependent. Loss of riparian and groundwater- dependent vegetation has the potential to impact semi-aquatic and terrestrial biota, especially species heavily reliant on remnant woodlands and streamside trees. Baseline information, including verification of groundwater-dependence, is required to predict, monitor and manage potential impacts of the proposal. Doody et al. (2019) provide useful guidance on approaches to assess groundwater dependency and to survey and manage GDEs. b. the critically endangered Warkworth Sands Woodland is approximately 3.5 km from the project (KCB 2019, p. 40). It is unclear to what spatial and temporal extent this CEEC may utilise groundwater, especially during periods of low rainfall. If drawdown occurs in the Warkworth Sands aquifer, then persistence and recruitment of vegetation in the Warkworth Sands Woodland may be impacted. Confirmation of the groundwater source for this community is required (see Paragraph 29), along with its vulnerability to drawdown due to individual or cumulative impacts associated with the project.	vegetation is located is perched and disconnected from the underlying Permian aquifer. Information gained from groundwater monitoring and modelling indicates that the Permian aquifer systems are currently depressurised below the Warkworth Sands adjacent to the existing operations. Vegetation monitoring indicates no observable impacts on community composition or health in this community based on the drawdown caused by mining operations to date. The Department notes that the predicted impacts due to the modification are negligible compared with approved project.
While targeted surveys of EPBC Act-listed fauna were undertaken, limited aquatic ecology surveys of the project site and downstream environments have been conducted. The IESC notes that frog surveys targeted only the Green and Golden Bell Frog (*Litoria aurea*) (Umwelt 2019a, p. 29), and were limited to the areas that are proposed to be cleared. However, previous surveys (e.g. targeted Green and Golden Bell Frog surveys and searches for tracks of nocturnal reptiles and amphibians) were undertaken outside of the proposed project area. a. The survey dates and effort of previous fauna assessment sites noted in Umwelt (2019a, Figure 2.5, p. 38) are unclear. It is therefore not possible to determine their completeness, and their relevance to assessing potential impacts of the current project on water-dependent biota. b. Although surveys did not detect the Green and Golden Bell Frog (Umwelt 2019a, p. 59), if the proposed project is approved, targeted surveys for the Green and Golden Bell Frog (and other amphibian species) should be undertaken over adequate timeframes to verify their absence from the site and potentially affected areas.	BCM currently undertakes annual surveys for the green and golden bell frog and its response to the IESC Advice clarified survey dates of the previous fauna assessments.
As rates of carbon processing in hyporheic and alluvial sediments of ephemeral streams like Loders and Monkey Place Creeks can be high (e.g. Burrows et al. 2017), it is possible that groundwater drawdown in the alluvial sediments will affect this crucial ecological process. This risk is not addressed by the proponent, nor are the	See the Department's response in Paragraph 4.

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implications for similar ecological processes that may be affected by drawdown in the sediments of Wollombi Creek.	
There has been no sampling of stygofauna, an obligate GDE, that has been recorded in other assessments of the alluvial sediments of Wollombi Brook and tributaries of the Hunter River (Eco Logical 2015, p 20; AGE 2016, p.55). As drawdown and/or altered groundwater water quality associated with the project may impact upon this GDE, stygofauna should be sampled and monitored using appropriate methods, potentially including the use of environmental DNA (Doody et al. 2019). Sampling should include, where possible, multiple reference sites upstream of the proposed project and in alluvial aquifers where no drawdown is predicted. These data will provide crucial baseline information for comparison with samples from areas where groundwater drawdown or changes to groundwater quality occur as a result of the project.	Refer to the Department's previous comments to item 1 e).
Cumulative impacts to water-dependent ecological communities and species have not been adequately assessed. The proponent should discuss the project's likely impacts by providing a summary of historical and current impacts to these ecological receptors and an assessment of how the project would add to the existing cumulative impacts. This work should consider the Hunter sub-region Bioregional Assessment which identified that changes to the hydrological regime from further resource development may result in increases of low-flow days of 3 to 80 days across the 5th to 95th percentile range which was considered potentially likely to impact a number of identified GDEs (Herron et al. 2018).	BCM has provided additional information to compare the groundwater assessment against the Bioregional Assessment which demonstrates that the detailed assessments for the project are more accurate than the Bioregional Assessment based on the availability of local data.
Additional monitoring of the Warkworth Sands Woodland CEEC is needed as outlined in Paragraph 29. This would allow potential impacts to be detected and adaptively managed through a trigger-action response plan (TARP). The IESC considers that 'like-for-like' offsetting measures for this CEEC are not feasible because of the extreme rarity of this community and its unique association with perched groundwater and aeolian sands.	BCM proposes to consider additional measures to monitor impacts on the Warkworth Sands Woodland including hydrogeological ground-truthing and additional monitoring locations if considered necessary based on the ongoing monitoring of this area.
Additional monitoring of the groundwater in the alluvium is needed to better understand how impacts in the Permian aquifer propagate to the alluvial aquifer and influence surface water flows.	BCM's response to the IESC Advice indicated the current extent of monitoring in the alluvium (Figure 33 of Appendix A in the BCM response), with a commitment to undertake additional monitoring where considered necessary.

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Baseline ecological surveys targeting aquatic biota, stygofauna and riparian vegetation that may be impacted by the project (for example in the Beltana Reach of Wollombi Brook where drawdown may exceed 2 m) should be undertaken and reported. Aquatic biota should be sampled opportunistically when streams are flowing and from refugial pools. Currently, the only monitoring for "stream health" focuses solely on the riparian zone, using the "Rapid Appraisal of Riparian Conditions" described by Jansen et al. (2005). Jansen et al. (2005) caution that this method is designed for rivers and creeks with "relatively permanent" water. Baseline data of aquatic biota, stygofauna and riparian vegetation are needed to understand the current condition of the systems and to compare with monitoring data obtained during operations to determine if impacts have occurred.	The Department notes that the proposed modification involves a continued mining of coal seams to the south of the current approved extent of open cut mining operations. BCM has carried out ecological and stream health monitoring to determine the effects of existing operations on these systems. The relevant assessments demonstrate that the incremental impacts of the proposed modification compared with approved operations would be within the extent of approved operations.
The proponent has identified that there is the potential for local flow paths to form around the TSF and that monitoring of groundwater could be useful (KCB 2019, p. 83). The IESC agrees that additional groundwater monitoring (including sampling for metals and metalloids) should occur in this area and be targeted at detecting localised flow paths from the TSF, especially where discharge to alluvium and/or surface water could occur.	BCM has committed to monitoring final void water quality and surrounding groundwater quality on a six-monthly basis.
The proponent has not clearly identified expected discharge quality (particularly in relation to metal contaminants). This means that the appropriateness of the proposed mitigation or monitoring cannot be fully evaluated.	The Department notes that the current discharge water quality is regulated by the EPL and under the HRSTS, and no changes to current management or regulatory requirements are proposed.
The proponent has not considered the potential for groundwater seepage from the altered TSF to influence groundwater quality in the Permian aquifers and impact aquatic biota. The IESC notes that the proponent's modelling indicates that most of the seepage from the TSF will go into the final void lake, with some leakage to Mount Thorley (Paragraph 33). The proponent should provide further information on the extent and depth of he TSF and assess if seepage could impact aquatic biota.	The Department notes that, with the exception of minor flows north towards Mount Thorley, the groundwater gradient will primarily flow toward the final void which will permanently act as a groundwater sink. This will ensure potential seepage from the TSF would not impact aquatic biota in aquifers surrounding the project.
The IESC notes that monitoring of the water management dams on site does not include any monitoring of metals and metalloids. Metals (both total and dissolved) and metalloids should be monitored especially in the Northern Dam and Surge Dam as this water can be discharged to the Hunter River.	Refer to the Department's response to comment 45. BCM proposes to expand the existing surface water monitoring program to include monitoring of a broader suite of analytes such as metals and

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	metalloids. The annual program will include monitoring of on-site dams.
The IESC recommends the proponent develop a Receiving Environment Management Plan (REMP) that specifies actions to ensure that the downstream environment is not adversely affected by discharges or storage overflows from the proposed mine. The REMP should: a. include a program of regular and event-based water quality monitoring of discharge water, and of surface water upstream and immediately downstream of the mine or licenced discharge points; b. provide a TARP, in line with ANZG (2018) guidelines, which uses site-specific data from reference sites; c. include site-specific guidelines that have been derived from reference sites as outlined in Huynh and Hobbs (2019); d. integrate with the existing Surface Water Management Plan (SWMP) so that the mitigation and management measures will adequately protect environmental values within and downstream of the project area; e. include ecohydrological conceptual models that illustrate potential pathways and mechanisms of the effects of altered surface flows on groundwater and alluvial recharge, instream water quality, and surface and groundwater ecosystems. These conceptual models would help the proponent justify strategies proposed to mitigate and manage potential impacts; and, f. include a mechanism for evaluating the effectiveness of selected mitigation and management measures and adopting new approaches if the current approaches are found ineffective.	Refer to the Department's comments on item 23.
No water-dependent ecosystem-specific triggers appear to be proposed. Should amphibians be detected as part of monitoring proposed in Paragraph 38b, a TARP will be required to mitigate and manage potential impacts to these species.	BCM's response to the IESC Advice notes that it currently carries out diurnal and nocturnal searches for the green and golden bell frog. Should any amphibian species detected as part of this monitoring a TARP will be prepared to mitigate and manage potential impacts to these species.

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If the proposed project will be included in the water management plan for the existing mine, all triggers should include timeframes for proposed responses. In addition, measures should be adopted to minimise impacts to aquatic biota and ecological processes. Currently, the approved water management plan for the existing mine includes triggers along Nine Mile Creek, Loders Creek and Wollombi Brook for negligible change in (Glencore 2017, pp. 55-56 and 65-66): a. ecosystem functionality of the riparian vegetation: a floristic change that can be correlated with a hydrological change; and, b. frog diversity and abundance: a 30% decline in species assemblage or abundance of frogs utilising riparian vegetation.	BCM's response to the IESC's Advice notes that the water management plan would be updated to incorporate the proposed modification if approved. BCM has also committed to update the WMP to include response timeframes for TARPs.
Based on the data from sampling stygofauna and aquatic biota (Paragraph 44), triggers should be developed that encompass declines in taxa richness or abundance of, for example, aquatic or groundwater invertebrates in response to changes in hydrology, water quality or groundwater regime due to the project.	Refer to the Department's consideration in item 44.

D5. ADDITIONAL EPBC ACT CONSIDERATIONS

In addition to the key matters discussed above, **Table D3** contains the additional mandatory considerations, factors to be taken into account and factors to have regard to under the EPBC Act, which the Commonwealth Minister must consider in determining the proposed action.

Table D3 | Additional Considerations for the Commonwealth Minister under the EPBC Act

EPBC Act section	Consideration	Conclusion
Mandatory considerations		
136(1)(b)	Social and economic matters are discussed in the SEE, the Submissions Report and throughout this assessment report, particularly in **Section 5.8**.	The Department considers that the proposed action would result in a range of benefits for the local and regional economies and is of public benefit. It would also provide benefit to the State of NSW through the payment of royalties and taxes. Negative social impacts, particularly on the local community have been considered in the assessment of the development. A range of management measures have been proposed by BCM to manage potential adverse social impacts, including through the provision of an increased quantum to the existing Planning Agreement with Singleton Council.
Factors to be taken into account		
136(2)(a)	Principles of ecologically sustainable development (ESD), including the precautionary principle, have been taken into account, in particular in: • long and short-term economic, environmental, social and equity considerations relevant to this decision; • conditions that restrict environmental impacts, impose monitoring and adaptive management requirements and reduce uncertainty concerning the potential impacts of the proposal; • conditions requiring the proposal to be operated in a sustainable way that protects the environment for future generations and conserves MNES; • advice provided within this report which reflects the importance of conserving biological diversity and ecological integrity in relation to the controlling provisions for the proposed action; and • mitigation measures to be implemented which reflect improved valuation, pricing and incentive mechanisms that promote a financial cost to the Proponent to	The Department considers that, subject to the conditions in **Appendix F** (as proposed to be modified by **Appendix E**), the proposed action could be undertaken in a manner that is consistent with the principles of ESD.

	mitigate the environmental impacts of the proposed action.	
136(2)(e)	Other information on the relevant impacts of the action.	The Department considers that all information relevant to the impacts of the proposal has been taken into account in this recommendation. The Department is not aware of any relevant information not addressed in this assessment report.
136(2)(f)	Advice was sought from the IESC	The Department has reviewed the advice and recommendations of the IESC and considered BCM's response to these matters. The Department considers that its assessment and recommendations have appropriately taken the IESC's advice into account.
Factors to have regard to		
176(5)	Bioregional plans. Bioregional data and assessment matters are discussed in the SEE, the Submissions Report and **Section 5.3** of this assessment report.	The Commonwealth Government released its bioregional assessment package for the Northern Sydney Basin – Hunter Subregion in May 2018. The Department notes that the bioregional assessment includes predictions of drawdown covering the Bulga Complex Project area. The bioregional assessments are undertaken at a regional scale and the results are used to inform more detailed local scale assessment, using finer scale modelling and local data. This local scale assessment has already been undertaken for the proposed action and should therefore continue to be relied on over the larger-scale bioregional assessment. The bioregional assessment of the area is available at https://www.bioregionalassessments.gov.au/assessments/hunter-subregion
Considerations on deciding conditions		
134(4)	Must consider: • information provided by the person proposing to undertake the action or by the designated applicant of the action; and • desirability of ensuring as far as practicable that the condition is a cost-effective means for the Commonwealth and the person taking the action to achieve the object of the condition.	Documentation provided by BCM is provided at **Appendix A** and **Appendix C** of this report. These documents are available on the Department's website at http://majorprojects.planning.nsw.gov.au/ The Department considers that the recommended conditions of consent (see **Appendix F**, as modified by **Appendix E**) are a practicable and cost-effective means to achieve their purposes. The conditions have been prepared following careful consideration of material provided by BCM and following consultation with DoEE, DPIE Water Group, EPA, BCD and other agencies.

D6. CONCLUSIONS ON CONTROLLING PROVISIONS

Threatened Species and Communities (sections 18 and 18A of the EPBC Act)

For the reasons set out above and in **Section 5.1**, the Department considers that the impacts of the action on threatened species and communities are acceptable, subject to implementation of the avoidance and mitigation measures described in the SEE and supplementary Submissions Report, and compliance with the recommended conditions of approval.

The Department considers that the following conditions of the modified development approval (see **Appendix F**, as modified by **Appendix E**) provide a suitable regulatory framework to avoid and minimise and manage impacts to listed threatened species and communities, and water resources:

Category	Recommended Conditions of SSD 4960
Water Supply	condition 24 & 24A of Schedule 3
Water Discharges	condition 26 of Schedule 3
Water Management Performance Measures	condition 27 of Schedule 3
Water Management Plan	condition 28 of Schedule 3
Biodiversity Offset Strategy	condition 29 of Schedule 3
Habitat for Threatened Fauna Species	condition 30 of Schedule 3
Hunter Ironbark Research Program	condition 31 of Schedule 3
Regent Honeyeater Recovery Plan Contribution	condition 32 of Schedule 3
Long Term Security of Offsets	conditions 33 & 33A of Schedule 3
Rehabilitation Offsets	condition 33B of Schedule 3
Biodiversity Management Plan	conditions 34 & 34 A of Schedule 3
Progressive Rehabilitation	condition 54 of Schedule 3
Rehabilitation Strategy	condition 56 of Schedule 3
Environmental Management Strategy	condition 1 of Schedule 5
Adaptive Management	condition 2 of Schedule 5
Management Plan Requirements	condition 3 of Schedule 5
Revision of Strategies, Plans and Programs	condition 5 of Schedule 5
Incident Notification	condition 7 of Schedule 5
Annual Review	condition 4 of Schedule 5
Independent Environmental Audit	conditions 9 & 10 of Schedule 5
Monitoring and Environmental Audits	conditions 10A & 10B of Schedule 5
Access to Information	condition 11 of Schedule 5

Accordingly, the Department recommends that the Commonwealth Minister require BCM to implement the above conditions of the modified development approval (as shown in **Appendix F**), where they relate to the management of potential impacts on listed MNES under the EPBC Act.

In addition, the Department recommends that the Commonwealth Minister consider implementing a supplementary condition requiring BCM to demonstrate that the 81.1 ha of existing and 33.8 ha of restored *Central Hunter Valley Eucalypt Forest and Woodland CEEC* within the Vere Offset site

conforms to the Commonwealth's EPBC Act listing definition for this ecological community and that the offset provides suitable habitat for the Regent Honeyeater and Swift Parrot.

D7. OTHER PROTECTED MATTERS

The Commonwealth DoEE determined that other matters under the EPBC Act are not controlling provisions with respect to the proposed action. These include listed migratory species, Ramsar Wetlands, World Heritage properties, National Heritage places, Commonwealth marine environment, whether the referring party is a Commonwealth agency or undertaken on Commonwealth land, nuclear action, Great Barrier Marine Park or Commonwealth Heritage places overseas.

D8. CONCLUSIONS

The Department considers that the recommended conditions would provide suitable protection for MNES under the EPBC Act. The Department notes that, if approved, the proposal would be referred to the Commonwealth Minister for the Environment for determination under the EPBC Act.