Threatened Flora

Table 22 lists the eleven candidate threatened flora species which were considered to have potential associated habitat within the MOD 8 Survey Area and as such, were subject to targeted surveys.

Table 22
Threatened Flora Species Considered for Assessment

Flora Species	BC Act Status*	EPBC Act Status*	Native Vegetation Type(s)	Species recorded during targeted surveys
Cyperus conicus	Endangered	Not Listed	PCT 88 and PCT 1313	No
Dichanthium setosum (Bluegrass)	Vulnerable	Vulnerable	PCT 599, PCT 1313 and PCT 1383	No
Digitaria porrecta	Endangered	Not Listed	PCT 599 and PCT 1383	No
Lepidium aschersonii (Spiny Peppercress)	Vulnerable	Vulnerable	PCT 88	No
Pomaderris queenslandica (Scant Pomaderris)	Endangered	Not Listed	PCT 599 and PCT 1313	No
Swainsona murrayana (Slender Darling Pea)	Vulnerable	Vulnerable	PCT 1383	No
Thesium austral (Austral Toadflax)	Vulnerable	Vulnerable	PCT 599 and PCT 1383	No
Tylophora linearis	Vulnerable	Endangered	PCT 88, PCT 599, PCT 1313 and PCT 1383	**Yes**
Androcalva procumbens	Vulnerable	Vulnerable	PCT 88, PCT 1313 and PCT 1383.	No
Diuris tricolor (Pine Donkey Orchid)	Vulnerable	Not Listed	PCT 88 and PCT 1313.	No
Lepidium monoplocoides (Winged Peppercress)	Endangered	Endangered	PCT 88.	No

Tylophora linearis, which is listed as a Vulnerable flora species under the BC Act and Endangered under the EPBC Act was recorded within the MOD 8 Survey Area. Surveys conducted for MOD 8 identified seven *Tylophora linearis* individuals as occurring within the MOD 8 Survey Area (**Figure 15**). No individuals of *Tylophora linearis* were identified within the MOD 8 Disturbance Footprint. As such, the species will not be directly impacted by MOD 8.

Targeted surveys completed on the remaining ten threatened flora species likely to occur within the area did not record any specimens. Accordingly, these threatened flora species are not considered to be affected by MOD 8.

Threatened Fauna Species

A total of 74 species of fauna have been recorded during field surveys conducted within and adjacent to the MOD 8 Survey Area. Of these 74 species, six are threatened fauna species which all have a Vulnerable status under the BC Act. The threatened fauna recorded during field surveys conducted for MOD 8 and other historical recordings are shown in **Figure 15** and include:

- Brown Treecreeper (BC Act – Vulnerable);
- Dusky Woodswallow (BC Act – Vulnerable);
- Little Lorikeet (BC Act – Vulnerable);
- Speckled Warbler (BC Act – Vulnerable);
- Turquoise Parrot (BC Act – Vulnerable); and
- Varied Sittella (BC Act – Vulnerable).

Nineteen EPBC Act listed threatened fauna species are known to occur within the locality of the MOD 8 Survey Area, of which nine are considered to have a moderate or higher likelihood of occurring within this area. A total of 10 EPBC Act listed migratory species are known or predicted to occur within the locality of the MOD 8 Survey Area based on the results of database searches completed. No threatened or migratory fauna species listed under the EPBC Act were recorded in the MOD 8 Survey Area during targeted surveys.

Table 23 lists the threatened fauna species that were identified by the searches of the BAM Credit Calculator and database searches, which includes 32 ecosystem credit species. **Table 23** also includes the two fauna species which are listed as migratory species under the EPBC Act. The BAM Credit Calculator identified nine candidate threatened fauna species credit species which were considered to have potential associated habitat within the MOD 8 Survey Area and as such, were subject to targeted surveys. No candidate threatened fauna species were recorded during the targeted surveys completed for MOD 8.

Table 23
Threatened Fauna Species

Threatened Species	Scientific Name	Species Present	BC Act Status	EPBC Act Status
Ecosystem Credit fauna species				
Barking Owl	*Ninox connivens*	No	Vulnerable	Not listed
Black-breasted Buzzard	*Hamirostra melanosternon*	No	Vulnerable	Not listed
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	No	Vulnerable	Not listed
Black Falcon	*Falco subniger*	No	Vulnerable	Not listed
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Yes	Vulnerable	Not listed
Diamond Firetail	*Stagonopleura guttata*	No	Vulnerable	Not listed

Threatened Species	Scientific Name	Species Present	BC Act Status	EPBC Act Status
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Yes	Vulnerable	Not listed
Flame Robin	*Petroica phoenicea*	No	Vulnerable	Not listed
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	No	Vulnerable	Not listed
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	No	Vulnerable	Not listed
Hooded Robin (south-eastern subspecies)	*Melanodryas cucullata cucullata*	No	Vulnerable	Not listed
Little Eagle	*Hieraaetus morphnoides*	No	Vulnerable	Not listed
Little Lorikeet	*Glossopsitta pusilla*	Yes	Vulnerable	Not listed
Masked Owl	*Tyto novaehollandiae*	No	Vulnerable	Not listed
Painted Honeyeater	*Grantiella picta*	No	Vulnerable	Vulnerable
Pied Honeyeater	*Certhionyx variegatus*	No	Vulnerable	Not listed
Powerful Owl	*Ninox strenua*	No	Vulnerable	Not listed
Regent Honeyeater	*Anthochaera phrygia*	No	Critically Endangered	Critically Endangered
Scarlet Robin	*Petroica boodang*	No	Vulnerable	Not listed
Speckled Warbler	*Chthonicola sagittata*	Yes	Vulnerable	Not listed
Spotted Harrier	*Circus assimilis*	No	Vulnerable	Not listed
Square-tailed Kite	*Lophoictinia isura*	No	Vulnerable	Not listed
Superb Parrot	*Polytelis swainsonii*	No	Vulnerable	Vulnerable
Swift Parrot	*Lathamus discolor*	No	Endangered	Critically Endangered
Turquoise Parrot	*Neophema pulchella*	Yes	Vulnerable	Not listed
Varied Sittella	*Daphoenositta chrysoptera*	Yes	Vulnerable	Not listed
Corben's Long-eared Bat	*Nyctophilus corbeni*	No	Vulnerable	Vulnerable
Koala	*Phascolarctos cinereus*	No	Vulnerable	Vulnerable
Large Bent-wing Bat	*Miniopterus orianae oceanensis*	No	Vulnerable	Not listed
Little Pied Bat	*Chalinolobus picatus*	No	Vulnerable	Not listed
Spotted-tailed Quoll	*Dasyurus maculatus*	No	Vulnerable	Endangered
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	No	Vulnerable	Not listed
Species Credit Fauna Species				
Barking Owl (breeding)	*Ninox connivens*	No (targeted survey)	Vulnerable	Not listed
Glossy-Black Cockatoo (breeding)	*Calyptorhynchus lathami*	No (targeted survey)	Vulnerable	Not listed
Little Eagle (breeding)	*Hieraaetus morphnoides*	No (targeted survey)	Vulnerable	Not listed
Masked Owl (breeding)	*Tyto novaehollandiae*	No	Vulnerable	Not listed

Threatened Species	Scientific Name	Species Present	BC Act Status	EPBC Act Status
		(targeted survey)		
Powerful Owl (breeding)	*Ninox strenua*	No (targeted survey)	Vulnerable	Not listed
Square-tailed Kite (breeding)	*Lophoictinia isura*	No (targeted survey)	Vulnerable	Not listed
Koala	*Phascolarctos cinereus*	Assumed Present	Vulnerable	Vulnerable
Squirrel Glider	*Petaurus norfolcensis*	Assumed Present	Vulnerable	Not listed
Pale Headed Snake	*Hoplocephalus bitorquatus*	Assumed Present	Vulnerable	Not listed
Migratory Fauna Species				
Fork-tailed Swift	*Apus pacificus*	No	Not Listed	Migratory
White-throated needletail	*Hirundapus caudacutus*	No	Not Listed	Migratory; Vulnerable

*Blue shading illustrates species whose potential habitat is included MOD 8 Disturbance Footprint (PCT 88)

Three candidate fauna species have been assumed to be present based on the associated suitable habitat, survey seasonality constraints and historical threatened species records from within Leard State Forest and surveys completed for the BCM. These species include:

- Koala;
- Squirrel Glider; and
- Pale-headed Snake.

The Koala is listed as a Vulnerable species under both the BC Act and the EPBC Act. No koala activity was recorded during the surveys for MOD 8. However, based on the previous ecological studies and records, the species is known to occur within the locality and has previously been observed (in 2011) to frequent the MOD 8 Disturbance Footprint (see **Figure 15**).

The Squirrel Glider is listed as Vulnerable under the BC Act. The targeted surveys completed for MOD 8 did not record this species within the MOD 8 Survey Area. However, based on the presence of foraging habitat, the abundance of large old trees with hollows for breeding and nesting and the general cryptic nature of the species, it is considered that the MOD 8 Survey Area would form part of the species home range and thus likely be utilised by the species.

The Pale-headed Snake is listed as a Vulnerable species under the BC Act. Targeted surveys completed for MOD 8 did not record this species within the MOD 8 Survey Area. However, the species has previously been recorded immediately adjacent to the MOD 8 Survey Area during clearing operations in 2015 as part of the existing ROM haul road (see **Figure 15**).

Assessments of significance have been prepared for the EPBC Act listed species in accordance with the Matters of National Environmental Significance – Significant Impact Guidelines 1.1 (DoE 2013) for impacts on threatened species (see **Appendix P**). These assessments concluded that MOD 8 is not likely to have a significant impact on these MNES.

Groundwater Dependent Ecosystems

The GDE Atlas mapping identifies various areas of vegetation within and immediately surrounding the BCM as having a low potential to be a GDE (national assessment) (BoM, 2021). This includes the following PCTs, which have been classified to be vadophytic vegetation, with no apparent dependence upon groundwater:

- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion;
- PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion; and
- PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion.

The field validated mapping completed as part of the MOD 8 BDAR and the desktop assessment of the Government's regional vegetation mapping (OEH, 2016) identified six PCT's and one exotic community within the Nagero Creek Study Area, where the predicted incremental drawdown as a result of MOD 8 is predicted to occur. The dependence (or interaction of these vegetation communities was determined by aligning them with hydrological ecosystem types (Eamus *et al*, 2006). One PCT is considered to have potential to be at least partially reliant on access to groundwater (phreatophytic vegetation) in the Nagero Creek Study Area, PCT 101 Poplar Box – Yellow Box – Western Grey Box grassy woodland. In the absence of field surveys to verify the condition of this PCT, the GDE assessment has conservatively assumed that this PCT conforms to listed CEECs under the EPBC Act.

PCT 101 occurs on the lower lying floodplain within the upper reaches of Nagero Creek. Groundwater modelling predicts that the water table in this area is at least 7 m below the surface. Kath *et al*. (2014) identified that *Eucalyptus populnea* (Poplar Box) has a deep extensive taproot system which was recorded to be at a maximum of 25 m below the surface and was accessing groundwater for its water requirements. Kath *et al*. (2014) also recorded that the preferred access to groundwater for *Eucalyptus populnea* (Poplar Box) is between 12 m and 25 m below the surface. Whilst *Eucalyptus populnea* (Poplar Box) would access soil water and perched aquifers, due to their potential for extensive tap roots, they are likely to proportionally use groundwater to fulfil their requirements. Therefore, the PCT 101 has been assessed to be a potential GDE due to it proportional dependence on groundwater.

For many terrestrial plants, groundwater forms only part of their overall water balance. Vegetation will extract water from sources where the combination of soil moisture content, root density and hydraulic connectivity requires the least amount of energy (Stygoecologica, 2013). Accordingly, vegetation will use shallow soil water first before seeking groundwater.

Where soil water is insufficient to meet plant water requirements, plants that can access groundwater will become increasingly dependent on that water source as soil water is depleted (Howe *et al.*, 2007).

GDE's that solely rely on groundwater are particularly at risk from water level fluctuations due to roots being distributed just above the water table in the vadose zone (i.e. the unsaturated zone above the water table). The viability of these GDEs is likely influenced by groundwater regime parameters, such as alteration of water level and pressure regimes (Stygoecologica, 2013). *Eucalyptus* spp. have a dual (dimorphic) roost system, with lateral roots that are close to the surface, and a taproot that penetrates deep in the soil (Holloway, Biggs, Marshall, & McGregor, 2013). Therefore, these species can source water from multiple sources (i.e. surface water, soil moisture after rainfall or flooding, and groundwater). Their reliance and use of groundwater are therefore potentially facultative (optional).

Whilst the maximum rooting depths of many species is largely unknown, a review of literature of rooting ranging depths by Stygoecologica (2013), found that deeper rooting depths down to 30 m or greater for larger tree species are an exception, with most deep-rooted woody species only extending down approximately 10 m. In a study by Kath *et al.* (2014), *Eucalyptus populnea* (Poplar Box) was observed to have a tree condition to groundwater depth threshold between 12.6 m and 26.7 m before the canopy showed signs of dieback, suggesting that the species has extensive tap roots capable of accessing alluvial groundwater.

Patches of PCT 101 have been mapped within the Nagero Creek Study Area where groundwater levels are generally less than 10 mbgl. Therefore, PCT 101's reliance on groundwater in the Nagero Creek Study Area cannot be discounted and this community has the potential to be impacted by groundwater drawdown. However, as a maximum incremental groundwater drawdown from MOD 8 of 0.8 m could eventuate in at least part of the community's mapped locations in the Nagero Creek study area, it is not likely that this potential GDE would be substantially impacted by the modelled groundwater drawdown in the alluvium for MOD 8 alone.

An Assessment of Significance for PCT 101 which potentially conforms to a CEEC listed under the EPBC Act has been undertaken as part of the GDE assessment. This Assessment of Significance concluded that MOD 8 will not result in a significant impact on this CEEC.

Within the Regional Study Area, the GDE Atlas mapped high potential GDEs as occurring along Back Creek, Namoi River, Barber's Lagoon, Maules Creek, Goonbri Creek and its unnamed tributaries as well as the upper reaches of Bollol Creek. Based on the desktop assessment and vegetation classification of GDE types, five PCTs were considered to have potential to be at least partially reliant on access to groundwater and one aquatic system (i.e. the Namoi River). The predicted cumulative groundwater drawdown impacts beneath these potential high priority GDEs, includes:

- less than 0.5 m cumulative drawdown in terrestrial GDEs adjacent to small parts of Goonbri Creek and Bollol Creek;

- up to 40 m cumulative drawdown in the watertable in GDEs adjacent to Back Creek; and
- up to 5 m of cumulative drawdown in the watertable in the upper reaches of Goonbri Creek.

Further assessment of the potential impacts of MOD 8 on GDEs is provided in **Appendix Q**.

7.10.4 Mitigation and Management

BCOPL currently manages the potential impacts to ecological values as a result of its operations at BCM through its implementation of the following environmental management plans:

- Biodiversity Management Plan;
- Biodiversity Offsets Strategy;
- Offset Management Plan; and
- Rehabilitation Management Plan.

As previously discussed, the fauna movement crossing will be constructed largely within the approved disturbance areas at BCM. However, to blend the vegetated landform of the fauna movement crossing into the natural landform to the west of the BCM approved disturbance areas, up to 1.21 ha of additional disturbance is anticipated within the MOD 8 Disturbance Footprint. The location of this 1.21 ha of disturbance within the MOD 8 Disturbance Footprint will be determined following the detailed engineering design for this infrastructure, which will take place following the approval of MOD 8.

The Biodiversity Management Plan details several specific control measures which are integral to the mitigation of the potential impacts to biodiversity values during the construction of the fauna movement crossing. These include:

- Tree clearing and habitat removal resulting from the additional disturbance will be undertaken in accordance with the Clearing and Fauna Management Procedure as detailed in Appendix B of the Biodiversity Management Plan. This includes:
    - Detailed design to consider the avoidance of unnecessary impacts to any key biodiversity attributes (such as hollow bearing trees) and to minimise disturbance to the greatest extent possible;
    - Identification and salvage of key habitat features/resources (such as, fallen timber, hollow logs, bush rocks, etc) for relocation into rehabilitation areas or other areas identified for retention;
    - Scheduling the proposed disturbance activities in periods where the works avoid critical life cycle events such as breeding or nursing;

  - Follow the approved clearing protocols, such as clearly marking out disturbance areas with high visibility fencing (or similar), presence of a trained ecologist/wildlife handler during clearing to relocate any displaced fauna, planning compounds, carparking, and/or storage areas within currently disturbed areas.

- Implementation of hygiene protocols (in accordance with the approved Weed and Pest Management Strategy as per Appendix C of the Biodiversity Management Plan) to prevent the spread of weeds or pathogens between infected areas and uninfected areas;
- Environmental training and inductions for all staff associated with the construction of the fauna movement crossing to be aware of relevant obligations; and
- Engineering design will consider measures to minimise impacts to neighbouring fauna, including lighting, water management/erosion and sediment control designs, exclusion perimeter fencing of the haul road to control animal and vehicle interactions.

The Biodiversity Management Plan will be reviewed and updated (if required) to ensure that the biodiversity impacts arising from MOD 8 are appropriately managed.

Offsetting Strategy

As previously discussed, whilst up to 1.21 ha of new disturbance is proposed within the MOD 8 Disturbance Footprint, overall there will be a net decrease in total native vegetation disturbance of 2.06 ha at BCM as a result of MOD 8. This is the result of the surrendering of the existing approval to utilise a dragline in mining operations at BCM (and the 3.27 ha of disturbance assessed for the dragline erection pad and walk road) which was originally approved under SSD 09_0182.

Table 24 provides a comparison of impacts associated with MOD 8 against the disturbance previously approved for the dragline erection pad and walk road which is being surrendered.

A residual impact of 0.25 ha is proposed to PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, which is the only community to be disturbed by MOD 8. This vegetation community does not conform to any threatened ecological community listed under the BC Act or the EPBC Act.

The primary reductions in total disturbance are proposed to occur to PCTs 599, 1313 and 1383. PCTs 599 and 1383 have both been assessed to conform to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community which is listed as a CEEC under the BC Act and the EPBC Act.

Accordingly, the residual impacts of MOD 8 to PCT 88 (i.e. 0.25 ha of additional disturbance) are anticipated to be appropriately compensated for by the total reduction in disturbance to other native vegetation communities (including 1.38 ha of vegetation conforming to Box Gum Woodland) which has previously been approved for disturbance and subject to compensation under the BCM Biodiversity Offset Strategy.

Table 24
Impact of Surrendering Dragline Infrastructure

Vegetation Community	Dragline Erection Pad and Walk Road[1] (Ha)	Surrendered Dragline Disturbance[2] (Ha)	MOD 8 Estimated Final Disturbance Area (Ha)	Biodiversity Gain[3] (Ha)
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	0.98	0.96	1.21	-0.25
PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion*	2.52	1.28	-	1.28
PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	0.48	0.48	-	0.48
PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion*	0.1	0.1	-	0.1
Highly disturbed areas with no or limited native vegetation	0.36	0.3	-	0.3
Total	**4.78**	**3.27**	**1.21**	**2.06**

** Vegetation community conforms to White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland which is listed as a CEEC under the BC Act and EPBC Act.*
(1) Dragline Infrastructure (construction pad and walk road) approved under the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff (2010a))
(2) Surrendered Dragline Infrastructure (construction pad and walk road) less impacts associated with Modification 7, which intersected the construction pad in the south west.
(3) The net biodiversity gain achieved with MOD 8 if the approved Dragline Infrastructure is surrendered. Importantly, biodiversity offsets were provided for impacts associated with the Dragline Infrastructure for the comprehensive Biodiversity Offset Strategy and Revised Biodiversity Offset Strategy (WSP, 2018c).

GDE Field Verification & Monitoring

The GDE assessment for MOD 8 has been undertaken via desktop analysis using the raft of information previously collected within the BCM Project Boundary and biodiversity offset areas and other State Government vegetation mapping information. BCOPL proposes to conduct further field assessment and verification surveys within the Nagero Creek Study Area to confirm the following:

- Refine the vegetation mapping in line with contemporary vegetation mapping conventions and to determine whether the vegetation conforms to CEEC's listed under the EPBC Act (as conservatively assumed within the GDE assessment); and
- Complete an investigative work program to verify the rooting depths of vegetation within the Nagero Creek Study Area in relation to the groundwater levels.

In accordance with the requirements of SSD 09_0182, BCOPL's approved Water Management Plan, Groundwater Management Plan and the BTM Complex Water Management Strategy currently outline the program to monitor and assess potential impacts of operations on terrestrial GDEs (including stygofauna) and stream and riparian vegetation health. The existing monitoring program entails the sampling of the following locations:

- Stream and riparian health monitoring program, including five permanent monitoring locations situated along Nagero Creek and the Namoi River;
- Terrestrial vegetation health and composition monitoring program, including 11 permanent monitoring locations which comprises five stream and riparian heath monitoring sites situated along the Namoi River floodplain within PCT 101 and PCT 78; and
- Stygofauna bore monitoring (GDE bore monitoring locations situated along the Namoi River floodplain).

It is noted that only one of the above vegetation monitoring locations is located within the Nagero Creek Study Area. In light of the assessed impacts of MOD 8 to potentially groundwater dependent vegetation communities within the Nagero Creek Study Area, BCOPL will expand the existing GDE monitoring program above to include the following additional monitoring (as further detailed in **Appendix Q**):

- Location 1 – located along Nagero Creek south of BCM entrance access road;
- Location 2 – located along Nagero Creek within PCT 101 west of Leard Forest Road somewhere within Victoria Park property; and
- Location 3 – stygofauna bore hole monitoring within GW020432 (or newly constructed bore in a similar location).

The purpose of these additionally proposed monitoring locations is to gather further baseline condition data as well as to monitor the potential impacts of the increased depth of mining at BCM to evaluate the success or failure of the mitigation measures implemented to reduce possible terrestrial GDE impacts associated with MOD 8. Existing vegetation monitoring locations outside of the Nagero Creek Study Area will continue to be utilised as reference sites in relation to the new monitoring locations.

The monitoring program will specifically target canopy condition (i.e. noting observations of any canopy dieback or water stress if evident taking into consideration seasonal conditions e.g. drought stress) to assist in detecting any changes in terrestrial GDE health overtime in response to groundwater drawdown impacts from BCM, including MOD 8.

The approved Water Management Plan and Groundwater Management Plan will be reviewed and updated to reflect the proposed changes to the GDE monitoring program described above.

7.11 ABORIGINAL AND CULTURAL HERITAGE

7.11.1 Background

An Aboriginal Archaeological Due Diligence Assessment (Due Diligence Report) was undertaken by Insite Heritage Pty Ltd (Insite Heritage) to assess any impact to Aboriginal sites that would be encountered during construction of the fauna movement crossing associated with MOD 8.

A copy of this report provided within **Appendix R** with a summary in the following sections.

7.11.2 Methodology

The MOD 8 Survey Area is located within the Project Boundary which was originally subject to the Aboriginal Cultural Heritage Impact Assessment (Insite Heritage, 2010) supporting the Boggabri EA. Accordingly, the objectives of the Due Diligence Report were to review the known Aboriginal cultural sites within the 110 ha MOD 8 Survey Area and to identify any previously unrecorded sites exposed in the time interval since the area was previously inspected.

The Due Diligence Report was prepared in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (NSW Office of Environment & Heritage 2010).

BCOPL engaged with the BCM RAPs throughout the assessment process, including various meetings and providing the opportunity for RAPs to participate in the field assessment.

Desktop Review

A search of the Aboriginal Heritage Information Management System (AHIMS) database was undertaken to check the distribution of recorded sites within the area proximate to the MOD 8 Survey Area. A total of 37 sites were recorded as valid. However, Insite Heritage identified that four registered sites had previously been salvaged within the MOD 8 Survey Area. Insite Heritage is working with AHIMS to have the database updated.

No registered Aboriginal Heritage sites were identified within the MOD 8 Disturbance Footprint.

Field Survey Planning

Insite Heritage prepared a field survey and assessment methodology providing the findings of the above desktop searches and the key focus areas for the field survey. The draft assessment methodology was distributed to the BCM RAPs for review and comment prior to the commencement of the field surveys.

Field Inspection

Field surveys were conducted on the 28 and 29 September 2020 over the MOD 8 Survey Area. The field inspection covered the entirety or the MOD 8 Survey Area with particular focus on the 3.3 ha MOD 8 Disturbance Footprint.

Consultation

Consultation with the Aboriginal community was undertaken in accordance with the approved CHMP. Consultation with the Aboriginal community involved the following:

- Distribution of a draft assessment methodology to the BCM RAPs for comment, with a review period of more than 28 days;
- An ASCF meeting was held with the RAPs on 10 September 2020 where specific information was presented regarding MOD 8 and the proposed assessment methodology which was supported by the RAPs present;
- Four RAPs were in attendance during the field surveys;
- The draft Due Diligence Report was distributed to the BCM RAPs for a 28 day review period throughout November and December 2020; and
- An ASCF meeting was held with BCM RAPs on 3 December 2020 to discuss the content of the Draft Due Diligence Report. Written comments were received from two RAPs during this meeting. These comments have been considered by Insite Heritage within their final Due Diligence Report.

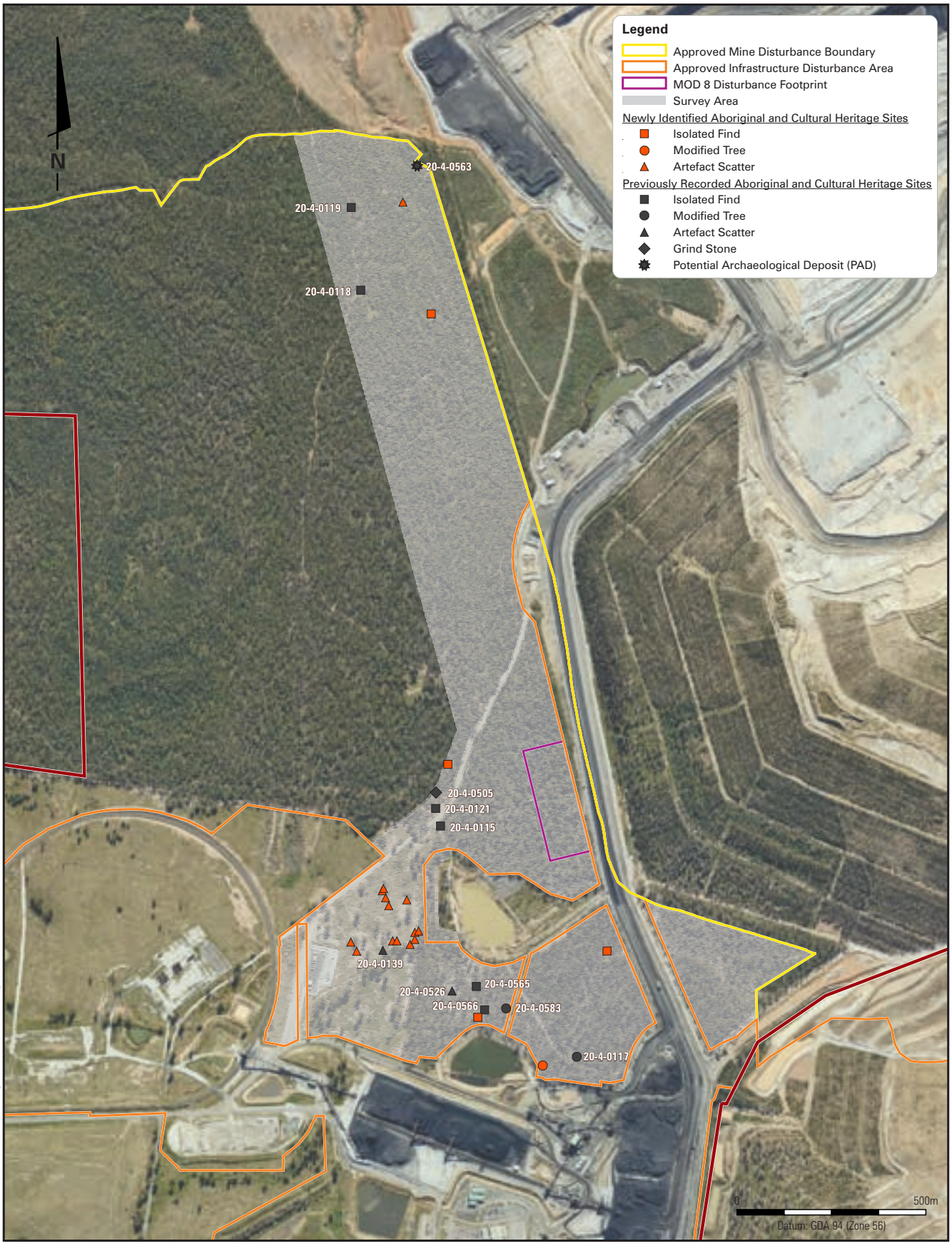
Further details of the consultation with RAPs is contained in **Appendix R**.

7.11.3 Impact Assessment

The AHIMS database search identified a total of 12 Archaeological sites within the MOD 8 Survey Area. **Figure 16** provides the locations of these sites. Further to this, the AHIMS database identifies four previously known sites within the MOD 8 Survey Area which Insite Heritage identified had previously been salvaged.

The field surveys of the MOD 8 Survey Area identified six new Archaeological sites, including four isolated finds, an artefact scatter, and a modified tree.

Further to this, the field survey identified a further 28 artefacts at 15 locations over the area of a registered AHIMS site (20-4-0139). This registered AHIMS site was partially salvaged in 2013 to allow for BCM activities.



HB BOGGABRI MOD8 1824 Fx Aboriginal and Cultural Heritage Sites 24 03 2021

BOGGABRI COAL MINE

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

IDEMITSU
BOGGABRI COAL

Aboriginal and Cultural Heritage Sites

FIGURE 16

The desktop reviews and the field surveys did not identify any Aboriginal heritage items within the MOD 8 Disturbance Footprint. Further the field assessments confirmed that land within the MOD 8 Disturbance Footprint was not archaeologically sensitive and there was some evidence of partial disturbance. There are no cultural heritage constraints associated with the MOD 8 Disturbance Footprint. Further detail on the Due Diligence Report is provided in **Appendix R**.

7.11.4 Mitigation and Management

BCM currently operates under the BCM CHMP prepared in consultation with the BCM RAPs. The CHMP will be reviewed and updated (if required) to address any requirements of MOD 8.

Any disturbance activities related to MOD 8 will be conducted in accordance with procedures outlined within the BCM CHMP. If any Aboriginal objects are identified during earthworks, any work would immediately cease in the area and an archaeologist and RAPs notified to ascertain the significance of the object. The protocols outlined within the approved CHMP will then be implemented to identify the appropriate course of action.

7.12 HISTORIC HERITAGE

A Heritage Impact Assessment was undertaken by Insite Heritage to assess any impact to historic heritage sites, both known and previously unrecorded, that would be encountered during construction of infrastructure associated with MOD 8.

The Heritage Impact Assessment report is provided within **Appendix S**, with a summary in the following sections.

7.12.1 Methodology

Desktop Review

A search of the Narrabri LEP and NSW Heritage Office Heritage Inventory of items of State and Local significance was conducted to identify potential historic heritage items.

The Narrabri LEP lists four sites within the vicinity of the BCM. The NSW Heritage Inventory also identified three out of these four sites. No registered historic heritage sites were identified within the BCM Project Boundary and/or within the MOD 8 Disturbance Footprint.

Field Inspection

The MOD 8 Survey Area was inspected by Insite Heritage in conjunction with the Aboriginal cultural heritage surveys on the 28 and 29 September 2020.

7.12.2 Impact Assessment

No items of local or State heritage significance were identified within the MOD 8 Survey Area during the desktop reviews. Further the field inspection of the MOD 8 Survey Area did not identify any items of historic heritage significance.

No historical archaeological constraints were identified within the MOD 8 Disturbance Footprint and accordingly, there are no constraints for the construction of the fauna movement crossing.

7.12.3 Mitigation and Management

Historic heritage will continue to be managed in accordance with the approved CHMP during the activities proposed by MOD 8.

7.13 SOCIAL

7.13.1 Background

A Social Impact Assessment (SIA) was undertaken for MOD 8 by Hansen Bailey and is provided in **Appendix T**.

The SIA identifies the potential socio-economic benefits and impacts associated with MOD 8. It also identifies appropriate strategies to avoid, mitigate or manage the negative impacts and to enhance the positive opportunities.

7.13.2 Methodology

The SIA is subject to the following regulatory requirements and guidelines:

- SSD 09_0182 in relation to the BCM, which MOD 8 is seeking to vary by way of an application submitted under Section 4.55 of the EP&A Act; and
- The NSW SIA Guideline (DPIE, 2017b) (SIA Guideline).

The SIA also considers the Draft NSW *Social Impact Assessment Guideline State Significant Projects* (Draft NSW SIA Guideline) (DPIE, 2020).

The methodology for the SIA included the following key components:

- Identification of the social area of influence for MOD 8;
- Profiling the socio-economic environment of the social area of influence based on a review of existing information/ data and consultation with relevant stakeholders;
- Stakeholder engagement to inform the social baseline, the potential impacts and opportunities of MOD 8 and to devise the development of appropriate mitigation and management measures;
- Identification of potential direct, indirect and cumulative social impacts and opportunities of MOD 8 for the social area of influence;
- An assessment of the likely impacts and benefits, and their significance for each stage of MOD 8 (i.e. construction of the fauna movement crossing, mining operations and post-mining); and
- Development strategies to avoid and/or mitigate social impacts, and actions which will enhance social benefits.

SIA Social Area of Influence

The Social Area of Influence for MOD 8 consists of the:

- Regional Study Area - Defined as the New England North West (NENW) Area, particularly the Narrabri LGA and the Gunnedah LGA; and
- Local Study Area - Comprising Boggabri State Suburb (SS) and those neighbours who are most at risk of experiencing impacts as a result of MOD 8.

These areas are illustrated on **Figure 17**.

Socio-economic Profile

Local Area

Boggabri is the closest town to BCM, being located approximately 15 km to the south-west. The town of Boggabri had a population of approximately 1,130 people in 2016 (ABS, 2017). Boggabri is a small rural township that was historically a grazing area. Boggabri boasts a heritage-listed railway station established in 1882 that originally serviced the surrounding region. The history and character of Boggabri remain largely that of a small rural community, despite the influence of the mining industry over the past few decades.

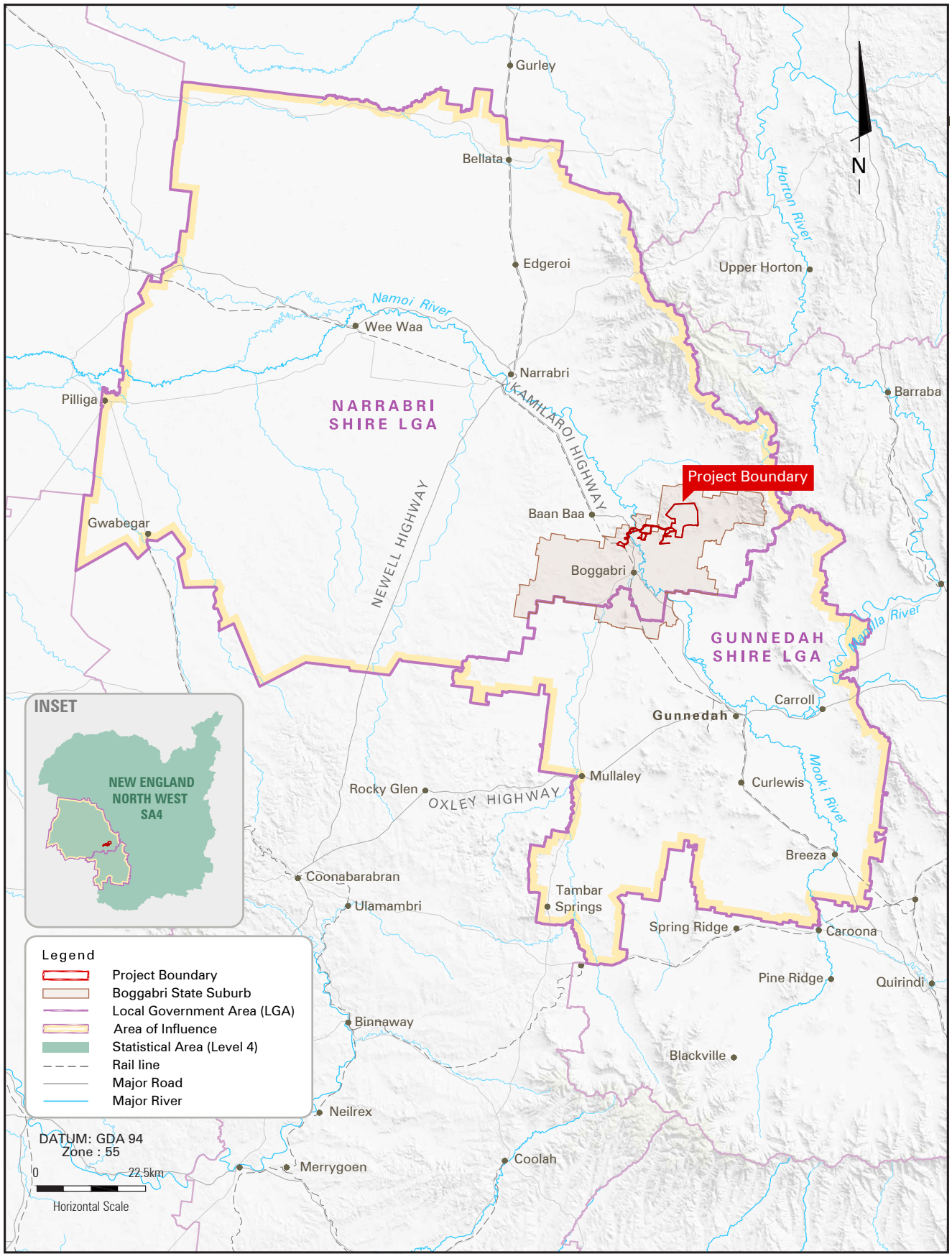
The Boggabri SS exhibits the following key demographic characteristics:

- Population growth rate of 5.1% between 2006 and 2016, compared the NSW average of 12% (ABS, 2017);
- Indigenous population equivalent to 11%, significantly higher than the NSW average of 2.9% (ABS, 2017);
- Median age of 41, slightly higher than the NSW median age of 38 (ABS, 2017);
- Household structure has a significantly higher proportion of lone person households than all other areas of interest as well as a larger proportion of group households; and
- Higher proportion of couples with no children (27.4%) compared to NSW (25.8%) as well as higher proportion of one parent families (16.1%) compared to NSW (11.4%) (ABS, 2017).

The Boggabri SS has experienced a trend of significantly increasing median rent from 2006 to 2016 (150%). This can be partly attributed to the expansion of operations at BCM during the early 2010's, the construction and now operational Maules Creek Mine and the popularity of Boggabri as a locality for mine employees and their families more generally.

Regional Study Area

The NENW Region has a diverse economy and is responsible for a fifth of NSW's agricultural produce (DPIE, 2017c). The NENW Region includes the LGAs of Armidale, Glen Innes, Severn, Gunnedah, Gwydir, Inverell, Liverpool Plains, Moree Plains, Narrabri, Tamworth, Tenterfield, Uralla, and Walcha. In 2016, the NENW Region had a population of 181,555 people (ABS, 2017).



1974_Boggabri SIA F02 Area of Influence.ai

BOGGABRI COAL MINE

Area of Influence

Hansen Bailey
ENVIRONMENTAL CONSULTANTS

IDEMITSU
BOGGABRI COAL

FIGURE 17

BCM is located wholly within the Narrabri LGA. The BCM is in close proximity to the Narrabri and Gunnedah LGA administrative boundaries. Gunnedah Township is the main mining industry service centre of the Gunnedah Basin. The regional study area is therefore defined as the combined area of the Narrabri and Gunnedah LGAs.

The Narrabri and Gunnedah LGAs form part of the larger NENW Region, which is defined by the boundaries of the New England North West Statistical Area Level 4.

The town of Narrabri is the key regional centre for the Narrabri LGA and is located approximately 70 km north-west of BCM. In 2016, Narrabri LGA comprised 13,015 km^2 with a population of approximately 13,084 people (ABS, 2017).

Gunnedah township is the regional centre for the Gunnedah LGA and is located approximately 57 km south from BCM. The town provides district level services. Gunnedah had an estimated resident population of 12,215 people (ABS, 2017) and comprised an area of 4,987 km^2.

The coal mining industry has expanded in both LGAs over several decades. BCM is one of six mines located in the regional study area.

In 2020, both the Narrabri Gas Project and the Vickery Extension Project were approved. Both projects are located within the regional study area and are in proximity to the BCM.

The Narrabri and Gunnedah LGAs exhibit the following key demographic characteristics:

- Population decrease of 0.2% between 2006 and 2016 for Narrabri LGA while Gunnedah LGA experienced an increase of 5.7%, compared to the NSW 12% growth rate (ABS, 2017);
- Indigenous population equivalent to 12% and 13% for the Narrabri and Gunnedah LGAs respectively, significantly higher than the NSW proportion of 2.9% (ABS, 2017);
- Median age of 40, for both LGAs slightly higher than the NSW median age of 38 (ABS, 2017);
- Household structure has a relatively higher proportion of family households (69%) for both LGAs; and
- Higher proportion of couples with no children (28.7% and 28.2%) for the Narrabri and Gunnedah LGAs respectively, compared to NSW (25.8%) (ABS, 2017).

Within Narrabri and Boggabri there are also accommodation villages operated by CIVEO (CIVEO Villages). The CIVEO Narrabri Village provides 500 ensuite rooms, and the CIVEO Boggabri Village has 600 ensuite rooms (CIVEO, 2021). The CIVEO Villages both provide meals, laundry amenities and fitness and recreation facilities (CIVEO, 2021).

Consultation findings suggest that the CIVEO Villages are largely used by contractor groups who work within the mines. During SIA consultation, several accommodation providers and real estate providers suggested that the use of short-term accommodation in the Narrabri and Gunnedah regions, outside of the CIVEO Villages, has declined over time because of the construction of these Villages.

Stakeholder Engagement

Community engagement has been a key component throughout the preparation of this Modification Report and the various specialist assessments. Through the preparation of the SIA, stakeholders have been engaged through a wide variety of mechanisms including the use of newsletters, regulatory authority briefings, website updates, surveys and community group meetings (refer to **Section 5.1**).

SIA consultation allowed stakeholder inputs on social baseline characteristics, experienced impacts, and perceptions of potential social impacts and benefits. Stakeholder groups who participated in the SIA consultation program are as follows:

- Local Government representatives e.g. NSC and GSC;
- Peak community organisations;
- CCC members;
- Local and regional service/ facility providers, including health and emergency services;
- Housing providers e.g. community housing and real estate;
- Business owners and operators; and
- Local and regional community members.

In addition to the engagement completed by BCOPL, Hansen Bailey undertook an SIA engagement program for MOD 8 in January and February 2021 over a course of four weeks. SIA engagement entailed 13 telephone interviews/surveys with a total of 19 participants.

7.13.3 Impact Assessment

Table 25 provides the potential perceived benefits and impacts of MOD 8 as identified by stakeholder groups through the SIA consultation.

Table 25
Perceived MOD 8 Benefits and Impacts

Perceived Benefit/Impact	Stakeholder Group
Benefits	
Creation of direct and indirect employment opportunities within the Narrabri and Gunnedah LGAs during the construction phase and the operations phase	Residents of the local and regional study area
Creation of additional supply arrangements for local businesses and enhancement of existing supply arrangements	Residents of the local and regional study area Local and regional businesses/contract suppliers
Ongoing voluntary contributions from BCOPL to the surrounding local and regional study area through sponsorship and donations, and the VPA with NSC	Local Government

Perceived Benefit/Impact	Stakeholder Group
Opportunity for greater communication to exist between BCM and the local community, including local businesses	Residents of the local and regional study area Local and regional businesses/contract suppliers
Impacts	
Changes in property values for proximate landholders, due to adverse changes in residential amenity i.e. the potential for noise and dust impacts of the project	Proximate landholders and residents.
Conflict between different industry sectors, namely between agriculture and mining, due to water demands and availability	Residents of the local and regional study area
Local businesses may miss the opportunity to capitalise on continued supply chain contracts and/or new contract packages of work associated with MOD 8 due to small business status and/or ability to tender for work	Residents of the local and regional study area Local and regional business representatives
Impacts to groundwater quality and availability if the project results in changes to the water table and surrounding landowners' bores from increasing the mining depth	Residents of the local and regional study area
Concerns in relation final landform i.e. voids	Local government
Impact of construction activities on existing flora and fauna may result in temporary decrease of wildlife/biodiversity in neighbouring Leard State Forest	Residents of the local and regional study area
Perceived increased flooding due to mining	Residents of the local and regional study area Key organisations
Potential cumulative impact upon groundwater and water availability due to several approved projects and other industries requiring large amounts of water/increased water access licenses	Residents of the local and regional study area Key organisations
Potential adverse changes in residential amenity for any neighbouring landowners due to continued operations	Residents of the local and regional study area
Increased demand for health services in the local area due to increased mine workforce	Health service providers
Cumulative changes in amenity e.g. visual, air quality, noise, resulting from mining operations in the local and regional study areas	Residents of the local and regional study area Health service providers
Continued operations may sustain negative perceptions of mining in community, creating conflict between community members	Residents of the local and regional study area
Continued operations may contribute to cumulative impacts from the resource industry on climate change	Local government
Impacts to flora and fauna associated with the land disturbance required for the construction of the fauna movement crossing	Local government Residents of the local and regional study area
Potential short-term construction related traffic impacts on local road network due to the nature of construction activities/required construction workforce	Proximate landholders and residents Local government
Construction activities may increase temporary demand upon emergency services	Proximate landholders and residents Emergency service representatives

Each of the identified impacts have been assessed in detail in **Appendix T**. To prioritise the identified social impacts, a risk-based framework was adopted. The social risk matrix considers both the consequences of the potential social impact (minimal, minor, moderate, major and extreme) and the likelihood of the impact occurring (very unlikely, unlikely, possible, likely and almost certain) and is then used to determine an overall risk assessment of the social impact as 'low', 'moderate', 'high' or 'very high'. The assessment of impact significance was undertaken utilising a methodology adapted from that described in the Draft NSW SIA Guideline (DPIE, 2020). This assessment is largely considered to be a fair analysis of positive and negative impacts. The evaluation of significance is complex, balancing the subjectivity, scale and sensitivity of impacts and benefits.

Appendix T describes the potential incremental social impacts and opportunities for MOD 8 using the risk framework, including management / enhancement measures.

7.13.4 Mitigation and Management

Socio-economic impacts are generally associated with environmental impacts, including increased noise and dust emissions, changes in visual amenity and the potential impacts on available water. Socio-economic benefits of MOD 8 include increased employment opportunities for the construction and operational workforce, opportunities for local businesses during the additional six years of operations and additional contributions to the NSC through the existing VPA.

MOD 8 has been assessed to have low to moderate social impacts, noting that there would be:

- Minimal impact for MOD 8 changes to surrounding amenity, apart from operations for an additional six years;
- No predicted notable change to the social and economic profile of the community except for the potential for continued employment; and
- Low to moderate cumulative changes in amenity, infrastructure (including housing), and the economic profile of the region in conjunction with the commencement of other projects in proximity to the BCM.

The social impacts of MOD 8 will be managed, and opportunities enhanced principally through the implementation of the SIMP. Should MOD 8 be approved, the SIMP would be reviewed and updated to reflect the outcomes of the SIA for MOD 8 and any relevant approval conditions.

7.14 ECONOMICS

7.14.1 Background

An Economic Impact Assessment (EIA) of MOD 8 has been prepared by Gillespie Economics. A summary of the EIA is presented below with a copy of the report provided in **Appendix U**.

7.14.2 Methodology

The EIA for MOD 8 was prepared in accordance with the requirements of the in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Economic Guidelines) released by the NSW Government in December 2015. The EIA entailed a cost benefit analysis (CBA) and a local effects analysis (LEA). Further to this, a supplementary LEA was completed using Input-Output (IO) Analysis to assess flow-on impacts of local employment and expenditure to the local economy.

The Economic Guidelines also require an estimate of the potential costs generated by MOD 8. Accordingly, an estimate of the environmental, social and transport related costs has been completed in accordance with the *Technical Notes supporting the guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.

Cost Benefit Analysis

CBA is the recommended method used to consider the economic efficiency of proposals by providing a comparison of the present value of aggregate benefits to society, as a result of the proposed change(s), with the present value of the aggregate costs (i.e. the net benefit).

Provided the present value of aggregate benefits to society exceed the present value of aggregate costs (i.e. a net present value of greater than zero), a proposal (MOD 8) is considered to improve the well-being of society and hence is desirable from an economic efficiency perspective.

The Economic Guidelines set out the CBA framework to measure the net benefits of a proposal (MOD 8) to the NSW community. **Table 26** provides a summary of how these net benefits have been measured for MOD 8. Consistent with the Economic Guidelines, the CBA was undertaken in 2021 real values, with discounting at 7 percent (%). Sensitivity testing was also completed at 4% and 10%.

The CBA analysis period is 22 years, coinciding with the proposed life of MOD 8 (i.e. 2022 to 2039) plus one year pre-approval and three years for rehabilitation and closure. Any impacts that occur after this period are included in the final year of the analysis as a terminal value.

An estimate of environmental, cultural and social impacts has also been undertaken using market data and benefit transfer which have been incorporated them into an estimate of the net social benefit of MOD 8.

Local Effects Analysis

The LEA uses a similar framework to the CBA. However, the LEA is focussed on the net economic impacts to the local community (rather than to the State of NSW). The local area is defined as the Narrabri and Gunnedah LGA's, within which MOD 8 is located. This region is considered likely to be the main source of labour and non-labour inputs for MOD 8.

The LEA method specified by the Economic Guidelines adjusts the incremental employment (i.e. difference between the base case and MOD 8 case) by only considering those that already live in the region, which was assumed at 57% based on current employment data.

Table 26
Cost Benefit Analysis Framework

Direct Benefits	Indirect Benefits	Indirect Costs
The net benefits that accrue to NSW from the direct operations of MOD 8. This includes: • Net producer surplus attributable to NSW; • Royalties payable; and • Company tax attributable to NSW.	The net benefits that are generated for parties that economically interact with MOD 8. This includes: • Net economic benefits to landowners; • Net economic benefits to NSW employees; and • Net economic benefits to NSW suppliers.	Social costs generated by MOD 8, borne by the NSW community. This includes: • Net environmental, social and transport related costs; • Net public infrastructure costs; and • Loss of surplus to other industries.

The LEA method then further adjusts incremental employment by calculating the incremental net income for those already living in the region (i.e. the difference between after tax (net) mining wage and average after tax (net) wage in the region) and calculating the net FTE jobs to local residents by dividing this increase in net income by the average net mining wage.

7.14.3 Impact Assessment

Cost Benefit Analysis

The CBA prepared for MOD 8 is provided in **Appendix U**. MOD 8 was assessed against the potential incremental economic benefits and costs illustrated in **Table 27**. The main potential economic benefit is producer surplus (net production benefits) generated by the changes sought to the mine plan by MOD 8. The main potential economic costs relate to any environmental, social and cultural costs resulting from any additional impacts from MOD 8 beyond those currently approved for BCM.

The CBA demonstrated that the MOD 8 will have a global net production benefit of $513 Million (present value), with a minimum of $294 Million (present value) of these net production benefits accruing to Australia and $241 Million (present value) accruing to NSW. These net production benefits of MOD 8 to Australia and NSW are predicted in the form of:

- Additional company tax to the Commonwealth government ($78 Million present value) which is subsequently used to fund provision of government infrastructure and services across Australia, including NSW (estimated at $25 Million present value); and
- Additional royalties to the NSW government as a result of recovering the MOD 8 coal resource ($216 Million present value) which are subsequently used to fund provision of government infrastructure and services across the State, including the local area.

Table 27
MOD 8 Potential Incremental Economic Costs and Benefits

Category	Costs	Benefits
Production	• Opportunity cost of land after final rehabilitation commencing in 2034; • Opportunity cost of capital (2034); • Development costs; • Operating costs, including administration, mining, ore processing, transportation, mitigation measures and offsets (but excluding royalties); and • Decommissioning and rehabilitation costs at cessation of MOD 8.	• Delayed decommissioning and rehabilitation costs; • Sale value of coal; and • Residual value of capital and land at the cessation of MOD 8.
Indirect Impacts	• GHG generation; • Operational noise impacts; • Road transport impacts; • Air quality impacts; • Groundwater impacts; • Surface water impacts; • Biodiversity impacts; • Aboriginal heritage impacts; • Historic heritage impacts; • Visual impacts; • Net public infrastructure costs; and • Loss of surplus to other industries.	• Wage benefits to employment; • Economic benefits to existing landholders; and • Economic benefits to suppliers.

Indirect Costs and Benefits

The EIA quantified (and where not possible to quantify, qualitatively described) the main environmental, cultural and social impacts of MOD 8 to Australia and NSW for comparison to the net production benefits.

Many of the environmental and social costs are internalised into the production costs of MOD 8. However, other costs not already included in the production cost are associated with opportunity costs of the existing WALs held by BCOPL (~$0.6 Million present value) and the additional GHG costs resulting from MOD 8 (~$0.1 Million present value).

Social Costs and Benefits

The main decision criterion for assessing the economic desirability of a project to society is its net present value (NPV). NPV is the present value of benefits less the present value of costs. A positive NPV indicates that it would be desirable from an economic perspective for society to allocate resources to the project, because the community as a whole would obtain net benefits from the project. Overall, with consideration of the above indirect costs, MOD 8 is estimated to have net social benefits to both Australia and NSW of $293 Million (present value) and $240 Million (present value) respectively.

Sensitivity Analysis

The sensitivity analysis indicated that the CBA results are not highly sensitive to changes in capital costs, or environmental costs that have not already been internalised into production costs, such as GHG, groundwater and surface water costs. Since mitigation, offset and compensation costs are a small component of the capital and operating costs of MOD 8, it is unlikely that large changes in these cost levels would have any significant impact on the CBA results.

Under all scenarios examined (i.e. with 4%, 7% and 10% discount rates), MOD 8 is predicted to result in net social benefits to NSW. Given the similar net social benefits of MOD 8, relative to the economic base case, the same results would apply.

Local Effects Analysis

MOD 8 will provide increased direct economic activity, including jobs, to the local economy, and indirect economic activity to the local area (Narrabri and Gunnedah LGAs) via both wage and non-wage expenditure. A summary of the local economic effects of BCM, including MOD 8 as well as the incremental effects is provided in **Table 28**.

The expenditure by employees, who reside in the region, and non-labour expenditure that is captured by the local area, provides flow-on economic activity to the local economy. Recognised methods for assessing second round and flow-on effects include IO analysis. The results of the supplementary IO analysis are also included in **Table 28**.

The IO analysis determined that MOD 8 is likely to provide the following ongoing total annual direct and indirect effects to the local economy between 2022 and 2039:

- $1,259 Million in output;
- $585 Million in value-added;
- $153 Million in gross wages; and
- 1,789 jobs.

Table 28
Summary of Average and Incremental Annual Effects on Local Community

Local Effects (Local Effects Analysis)	Direct Total	Direct Already Resident in the Local Area	Net
Average Annual Total FTE of MOD 8 (2022-2039)	620	353[1]	173
Average Annual Total Income of MOD 8 ($Million) (2022-2039)	58		16
Average Annual Total Non-labour expenditure of MOD 8 in the Local Area (2022-2039)	225	-	-
Incremental Annual FTE of MOD 8 Relative to the Base Case (2022-2039)	Range of -57 to 638 (avg. 286)	Range of -32 to 364 (avg. 163)	Range of -16 to 178 (avg. 80)
Incremental Annual Income of MOD 8 Relative to the Base Case ($Million) (2022-2039)	Range of -5 to 60 (avg. 27)		Range of -2 to 17 (avg. 8)
Incremental Annual Non-labour expenditure in the Local Area of MOD 8 Relative to the Base Case ($Million) (2022-2039)	Range of -9 to 197 (avg. 91)		
Local Impacts (Input-Output Analysis)	**Direct**	**Flow-on**	**Total**
Output ($M Million)	863	396	1,259
Value-added ($M Million)	378	207	585
Income ($M Million)	46	107	153
Employment	620	1,169	1,789
Other Local Economic Impacts			
Contraction in other sectors e.g. tourism	No material impact*		
Displaced activities e.g. agriculture and forestry	No material impact*		
Wage rise impacts	No material impact*		
Housing impacts	No material impact*		
Price impacts on food and other services	No material impact*		
Local Environmental Impacts			
GHG emissions (Scopes 1 and 2)	$0.0003 Million [2]		
Operational noise	Modelled 1 dBA exceedance of criteria at three residences during the night only – exceedances of 0-2dBA are not discernible		
Air quality	Modelled cumulative 24-hour PM_{10} criteria exceeded one day per year at three private residences		
Visual	Continued moderate to low visual impacts to the south east, with no material additional impacts on any private receptor		

[1] This is based on the proportion (57%) of BCM workers that reside in the Local Area.

[2] The Narrabri and Gunnedah population is 0.3% of the NSW population. NSW GHG impact have been apportioned accordingly.

** NSW regulations require many impacts to be borne by the proponent via mitigation, offset and compensation. Where these measures perfectly mitigate, offset or compensate then no residual impacts occur and all impacts are borne by the proponent. This table identifies who bears residual impacts where mitigation, offset and compensation is imperfect.*

Conclusion

In summary, MOD 8 is estimated to have net social benefits to both Australia and NSW of $293 Million and $240 Million, respectively. MOD 8 will provide direct economic activity, including jobs, to the local economy, and indirect economic activity to the local area via both wage and non-wage expenditure, while having no material adverse impacts.

MOD 8 can be considered to provide an improvement in economic efficiency and hence is justified on economic grounds.

7.14.4 Mitigation and Management

Mitigation measures for the specific environmental and social issues considered in the EIA are described within the relevant sections throughout this Modification Report.

7.15 WASTE AND HAZARDS

BCOPL currently conducts its activities in accordance with the existing waste and hazardous materials management processes and Material Safety Data Sheet (MSDS) database.

Construction and operational waste generated by MOD 8, including general and hazardous materials will be handled in accordance with the Waste Management Plan.

All hazardous wastes associated with BCM will continue to be transported offsite by a licensed waste contractor in accordance with the relevant regulatory requirements and Australian Standards.

BCOPL will continue to use its Environmental Management Plans and Operational Health and Safety (OH&S) procedures to manage the potential hazards and risks associated with MOD 8. These procedures and management plans are regularly reviewed and updated to include any changes that have the potential to result in hazards.

BCOPL will continue to ensure all carriers of dangerous goods are licensed and that relevant procedures are followed when travelling to and from the BCM.

7.16 BUSHFIRE

MOD 8 is not seeking to materially increase the footprint of the BCM Project Boundary or land within which it currently has responsibility to manage the risk of bushfire.

Accordingly, MOD 8 is not expected to result in the increased risk of bushfire at BCM and the current management strategies utilised on site are still applicable.

The Biodiversity Management Plan and Biodiversity Offset Strategy prescribe BCOPL's bushfire management strategies for the Project Boundary (including rehabilitation of post-mine landforms) and the biodiversity offset areas, respectively. BCOPL are currently in the process of establishing an appropriate fire regime for the maintenance of biodiversity in Leard State Forest in consultation with the relevant regulatory authorities.

The current management strategies being utilised on site as detailed in the Biodiversity Management Plan include the following:

- Monitor and maintain equipment and areas where bushfire hazards are present to prevent and minimise the potential outbreak of bushfire;
- Communicate issues relating to bushfire management at toolbox meetings;
- Ensure that all BCM personnel report any environmental incident involving fire or flammable liquids to the site supervisor as soon as practically possible in the event of an accidental fire, implement the Incident Management Protocol;
- If controlled burning is required, implement mosaic burning to reduce the extent of any negative outcomes, provide refuge for wildlife and promote structural and species diversity;
- The timing of any burning will be determined based on fuel loads, vegetation maturity and weather/seasonal conditions; however, it will generally be undertaken in autumn to encourage native species recruitment;
- Source relevant permits and approvals before any burning event; and
- Monitor the effects of the fire regime in the corridor for effects on biodiversity.

The existing strategies will be reviewed and updated to ensure that any potential bushfire risks of MOD 8 are appropriately managed.

7.17 OTHER ENVIRONMENTAL CONSIDERATIONS

The Boggabri EA provided a comprehensive assessment of the various socio-economic and environmental impacts and risks associated with the operation of BCM. This is further supported by subsequent assessments completed as part of the modifications to SSD 09_0182 (see **Section 2.1**).

The potential socio-economic and environmental impacts identified in previous assessments prepared for BCM were reviewed in relation to the changes sought by MOD 8. The review determined that MOD 8 will not result in any material additional impacts beyond those previously considered. Therefore, the impact assessments and mitigation measures presented in the Boggabri EA remain unchanged and are relevant to MOD 8.

BCOPL has prepared and implements several environmental management strategies and procedures to manage, monitor and minimise the potential impacts of its operations on the surrounding environment in addition to numerous management plans required under the conditions of SSD 09_0182. These procedures and strategies provide the framework for the ongoing monitoring and management of environmental impacts at BCM. These will be reviewed and updated as required to incorporate aspects of MOD 8.

8 EVALUATION OF MERITS

MOD 8 as assessed within this Modification Report will result in changes to two aspects of the approved activities at BCM, being the increase in the approved mining depths and the construction of a fauna movement crossing over the existing haul road. The proposed increase in the approved mining depth will subsequently result in the following changes to BCM:

- Recover an additional 61.6 Mt of ROM coal;
- Increasing the operational mine life by six years to the end of 2039;
- Minor increase to the peak annual ROM coal production rate to 9.1 Mtpa of ROM coal;
- Increase to overburden and coal processing waste production to recover additional ROM coal;
- Reconfiguration of the mining fleet and workforce; and
- Adjustments to the Conceptual Final Landform design.

The following aspects of BCM will remain essentially unchanged as a result of MOD 8:

- Project Boundary and the Mine Disturbance Boundary;
- Open cut mining methods and hours of operation;
- The existing mine infrastructure and/or site access (apart from the construction of the Fauna Movement Crossing)
- CHPP processing methods and rates;
- Product coal transport to market; and
- Rehabilitation objectives for the Conceptual Final Landform design.

BCM is an active open cut coal mine which has been operating within the Leard State Forest since 2006. The Leard State Forest also accommodates mining at the neighbouring Maules Creek Mine and Tarrawonga Mine. The Leard State Forest is recognised as Zone 4 under the BNC Act which dedicates the area for the purposes of forestry, recreation and mineral extraction, thus acknowledging the suitability of the site for mining purposes on a regional level. MOD 8 is permissible and consistent with the existing and surrounding land uses.

BCOPL has consulted with relevant regulatory and community stakeholders over the Modification Application and have considered their feedback when preparing this Modification Report.

The environmental, social and economic assessments completed as part of this Modification Report (**Section 7**) have not identified any material additional environmental, social or economic impacts which will result from MOD 8 beyond those currently approved by SSD 09_0182.

These assessments concluded that MOD 8:

- Noise and Blasting - BCM can operate MOD 8 utilising existing equipment (i.e. with sound power levels greater than those assessed within the original NBIA), whilst generally maintaining compliance with approved noise and blasting criteria set out in SSD 09_0182. The only exception is to incorporate minor amendments to SSD 09_0182 to include the predicted noise levels for three privately owned receivers surrounding BCM, two of which were not assessed within the original NBIA.
- Air Quality and GHG - Dust impacts for BCM including MOD 8 will remain within the relevant air quality criteria for the neighbouring privately owned receivers. Accordingly, no additional mitigation or management measures are required. BCOPL will continue to manage the energy efficiencies of its operations at BCM in accordance with the Air Quality and GHG Management Plan. The reported GHG emissions for the BCM, including MOD 8 are conservative estimates of the BCM's influence to the carbon climate in light of the extensive revegetation works being completed in the biodiversity offset areas (pursuant to its biodiversity offset strategy) and mine rehabilitation areas together with a significant native vegetation corridor which will create a future carbon sink.
- Groundwater - The increase to mining depths for MOD 8 will result in additional groundwater inflows from the less productive Permian coal seam aquifers and extend the water table drawdown within the Permian coal seam strata, which in turn will lead to negligible drawdown within the alluvial groundwater systems. The predicted incremental impacts of MOD 8 will not result in significant impacts to any privately owned water supply work or any GDE known to occur within the area. All predicted groundwater takes from the various water sources will remain within WAL allocations currently held by BCOPL. The incremental impacts of MOD 8 on the surrounding water sources relative to approved mining at BCM, are minimal, while cumulative impacts are fundamentally equivalent to those for already approved mining activities. Accordingly, MOD 8 is not likely to have a significant impact on the hydrological characteristics of surrounding water sources.
- Surface Water – The mine plan changes proposed by MOD 8 will remain within the approved Mine Disturbance Boundary, accordingly negligible catchment impacts will be experienced. The site water balance modelling indicates that the additional groundwater inflows to the mining area will lead to a reduction in the quantity of imported water required to satisfy site water demands. The existing water management system as described within the Water Management Plan will continue to operate according to the requirements of SSD 09_0182 and EPL 12407.
- Visual and Lighting – visual impacts will continue to vary from moderate to low for open views towards the OEA on privately owned land to the south east and south west of BCM. Visual impacts will be reduced to low once the final rehabilitation activities on the southern slopes of the OEA have been carried out.

MOD 8 will improve the visual integration of the landform by including relief on the top of the OEA. Lighting impacts will not measurably change as a result of mine plan changes sought by MOD 8.

- Biodiversity - The 1.21 ha of new disturbance for the construction of the western embankment of the fauna movement crossing will not impact any listed threatened community. Whilst this vegetation community is likely to provide suitable habitat for the various threatened flora and fauna species which are known to occur within the area, the limited clearing proposed will not result in significant impacts to these species. The construction and final rehabilitation of the fauna movement crossing will provide improved habitat connectivity between the Leard State Forest and established mine rehabilitation areas for the various threatened fauna which are known within the region.
- Heritage and Soils - No Aboriginal cultural heritage or historic heritage constraints were identified for the proposed disturbance associated with the fauna movement crossing within the MOD 8 Disturbance Footprint. Further the soils within the MOD 8 Disturbance Footprint are consistent with soils encountered in other locations at the BCM and will be managed according to existing soil management protocols.

BCOPL is seeking approval to increase the depth of mining operations at BCM to avoid sterilisation of and to realise the value in the additional coal resource immediately below the currently approved mining depth. Approval of MOD 8 will increase BCM's coal reserve base whilst allowing mining operations to continue for a further six years within the approved Mine Disturbance Boundary.

MOD 8 is expected to deliver net social benefits (i.e. considering the social costs in relation to net production benefits) to both Australia and NSW of $293 Million and $240 Million, respectively. These benefits will generally be distributed as Royalties to the NSW Government ($216 Million, present value) and as Company tax ($78 Million, present value to Australian Government and $25 Million, present value apportioned to NSW).

MOD 8 will continue to provide the following total annual direct and indirect benefits to the local economy (i.e. Narrabri and Gunnedah LGAs) between 2022 and 2039:

- $1,259 Million in output;
- $585 Million in value-added;
- $153 Million in gross wages; and
- 1,789 jobs.

MOD 8 will not result in any material environmental or social impacts beyond those currently approved for BCM and it will continue to deliver very material direct and indirect economic activity to the local, State and National economies. MOD 8 is justified on environmental, social and economic grounds, accords with the principles of ecologically sustainable development and is in the public interest.

9 ABBREVIATIONS

Term	Definition
µg/m^3	Micrograms per cubic metre
AGE	Australasian Groundwater and Environmental Consultants Pty Limited
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
AIP	NSW Aquifer Interference Policy
AMD	Acid Mine Drainage
ANC	Acid Neutralising Capacity
ANZECC	Australian and New Zealand Environment and Conservation Council
AS	Australian Standard
ASCF	Aboriginal Stakeholder Consultative Forum
Austroads Guide	*Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis*
AWS	Automated Weather Station
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Calculator
BC Act	*Biodiversity Conservation Act 2016*
BCD	NSW Department of Planning, Industry and Environment - Biodiversity Conservation Division
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Limited
BCT	Biodiversity Conservation Trust
BDAR	Biodiversity Development Assessment Report
BMP	Blast Management Plan
BNCCA Act	*Brigalow and Nandewar Community Conservation Area Act 2005*
Boggabri EA	Continuation of Boggabri Coal Mine Environmental Assessment
BOS	Biodiversity Offsets Scheme
Box Gum Woodland	White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands ecological community
BSAL	Biophysical Strategic Agricultural Land
BTM Complex	Boggabri Coal Mine, Tarrawonga Mine, Maules Creek Mine
CBA	Cost Benefit Analysis
CCC	Community Consultative Committee
CEC	Cation Exchange Capacity
CEEC	Critically Endangered Ecological Community
CHMP	Cultural Heritage Management Plan
CHPP	Coal Handling and Preparation Plant
CL	Coal Lease
Dark Sky Guideline	*The Dark Sky Planning Guideline: Protecting the observing conditions at Siding Spring* (DPIE,2016)
DAWE	Department of Agriculture, Water and the Environment
dB	Decibel

Term	Definition
dBA	The peak sound pressure level, expressed as decibels (dB) and scaled on the 'A-weighted' scale, which attempts to closely approximate the frequency response of the human ear
DCP	Development Control Plan
DEM	Digital Elevation Model
DPIE- Water Division	NSW Department of Planning, Industry and Environment – Water Division
DPIE	NSW Department of Planning, Industry and Environment
Draft SIA Guideline	*NSW Social Impact Assessment Guideline State Significant Projects 2020*
EC	Electrical Conductivity
Economic Guidelines	*Guidelines for the economic assessment of mining and coal seam gas proposals*
EIA	Economic Impact Assessment
EMP	Environmental Management Plans
Engeny	Engeny Water Management
ENM	Environmental Noise Model
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Planning Instruments
EPL	Environmental Protection Licence
ESP	Exchangeable Sodium Percentage
Forestry Corporation	Forestry Corporation of NSW
FTE	Full Time Equivalent
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
GIA	Groundwater Impact Assessment
GSC	Gunnedah Shire Council
ha	Hectares
Hansen Bailey	Hansen Bailey Environmental Consultants Pty Limited
IAR	Idemitsu Australia Resources
ICNG	*Interim Construction Noise Guideline 2009*
IESC	Independent Expert Scientific Committee
INP	Industrial Noise Policy
IO	Input- Output
IPC	Independent Planning Commission
km	Kilometres
Koala SEPP	*State Environmental Planning Policy (Koala Habitat Protection) 2020*
LAeq	The A-weighted equivalent continuous, or logarithmic average, noise level over a defined time period either measured or predicted at a specific location
LEA	Local Effects Analysis
LGA	Local Government Area
LoS	Level of Service

Term	Definition
m	Metres
Mbcm	Million bank cubic metres
MCCPL	Maules Creek Coal Pty Limited
MDB	Murray Darling Basin
MDB Porous Rock WSP	*Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources Order 2020*
MEG	Department of Regional NSW – Mining Exploration and Geosciences
MIA	Mine Infrastructure Area
Mining Act	*Mining Act 1992*
Mining SEPP	*State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*
ML	Mining Lease
ML/year	Megalitres per year
MLA	Mining Lease Application
MNES	Matter of National Environmental Significance
MOD 2	Boggabri Coal Project Modification – Environmental Assessment (Hansen Bailey, 2013a)
MOD 3	Boggabri Coal Mine Project Approval Modification EA (Hansen Bailey, 2013b)
MOD 4	Boggabri Coal Mine – Project Approval Modification EA (Parsons Brinckerhoff, 2014)
MOD 5	Boggabri Coal Mine – Project Approval Modification EA (Parsons Brinckerhoff, 2015)
MOD 6	Boggabri Mine Project Approval 09_0182 – Minor Modification (BCOPL, 2017)
MOD 7	Boggabri Coal Mine – Project Approval Modification EA (Umwelt, 2018)
MOD 8	The Modification seeks to increase the depth of approved mining operations to recover an additional coal resource and to facilitate the construction of a fauna movement crossing.
MOP	Mining Operations Plan
MSDS	Material Safety Data Sheet
Mt	Million tonnes
Mt CO_2-e	Metric tonne of carbon dioxide equivalent
Mtpa	Million tonnes per annum
NAF	Non Acid Forming
Namoi Groundwater WSP	*Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020*
Namoi Regulated River WSP	*Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016*
Namoi Unregulated WSP	*Water Sharing Plan for the Namoi and Peel Unregulated River Water Sources 2020*
Narrabri LEP	*Narrabri Local Environmental Plan 2012*
Native Title Act	*Native Title Act 1993*
NBIA	Noise and Blasting Impact Assessment
NENW	New England North West Area
NO_2	Nitrogen Dioxide

Term	Definition
NPfI	*NSW Noise Policy for Industry 2017*
NPW Act	*National Parks and Wildlife Act 1974*
NRAR	Natural Resource Access Regulator
NRW	NRW Contracting Pty Ltd (formerly BGC Contracting Pty Ltd)
NSC	Narrabri Shire Council
NSW	New South Wales
NT Act	*Native Title Act 1993*
OEA	Overburden Emplacement Area
OH&S	Operational Health and Safety
OneKey	OneKey Resources
PA	Project Approval
PAC	Planning Assessment Commission, now known as Independent Planning Commission (IPC)
PCI	Pulverised Coal Injection
PCT	Plant Community Type
$PM_{2.5}$	Particulate Matter less than 2.5 microns
PM_{10}	Particulate Matter less than 10 microns
POEO Act	*Protection of the Environment Operations Act 1997*
PSNL	Project Specific Noise Level
RAP	Registered Aboriginal Party
Resources Regulator	Department of Regional NSW – Resources Regulator
RING	*Rail Infrastructure Noise Guideline*
RMP	Rehabilitation Management Plan
RMS	Roads and Maritime Services
RNP	*Road Noise Policy*
ROM	Run of Mine
SAL	Strategic Agricultural Land
SEPP 44	Superseded *State Environmental Planning Policy No 44 – Koala Habitat Protection*
SEPP 55	*State Environmental Planning Policy No 55 – Remediation of Land*
SIA	Social Impact Assessment
SIA Guideline	*Social impact assessment guideline for State significant mining, petroleum production and extractive industry development 2017*
SIMP	Social Impact Management Plan
SRA	Southern Rehabilitation Area
SRD SEPP	*State Environmental Planning Policy (State and Regional Development) 2011*
SRMS	Scaled Root Mean Square
SS	State Suburb
SSD	State Significant Development
Standard LEP	*Standard Instrument (Local Environmental Plans) Order 2006*
SVC	Site Verification Certificate
SWMP	Surface Water Management Plan

Term	Definition
TBDC	Threatened Biodiversity Data Collection
TCPL	Tarrawonga Coal Pty Limited
TEC	Threatened Ecological Community
TMP	Traffic Management Plan
TOC	Total Organic Carbon
TSP	Total Suspended Particulate
TSS	Total Suspended Solids
TTA	Traffic and Transport Assessment
VIA	Visual Impact Assessment
VLAMP	*Social impact assessment guideline for State significant mining, petroleum production and extractive industry development*
VPA	Voluntary Planning Agreement
WAL	Water Access License
WEPP	Water Erosion Prediction Model
Whitehaven Coal	Whitehaven Coal Limited
WM Act	*Water Management Act 2000*
WMS	Water Management System
WSP	Water Sharing Plan
ZOA	Zone of Acquisition

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