INTEGRA UNDERGROUND - LONGWALL EXTENSION MODIFICATION

Ecological Impact Assessment

For:

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November 2017

Final

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Report No. 17059RP1

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Chapter 1

Introduction

1.1 Introduction

HV Coking Coal Pty Limited (HVCC) operates the Integra Underground Mine (Integra Underground) in the Upper Hunter Valley of New South Wales (NSW). HVCC is a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore).

Hansen Bailey is currently preparing an application on behalf of HVCC to modify Integra Underground's Project Approval (PA 08_0101). The modification application will be made under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act). HVCC is seeking approval to continue longwall mining of the Middle Liddell Seam further to the north of the currently approved longwall panels (the Modification). The Modification also involves the construction and operation of ancillary surface infrastructure. For the purposes of this assessment, an 'Assessment Boundary' has been defined, which includes all areas of direct and indirect impacts from the Modification. The location of the Modification and Assessment Boundary is shown in **Figure 1 (Hansen Bailey, 2017)**.

The *NSW Threatened Species Conservation Act 1995* (TSC Act) was recently repealed and replaced by the *NSW Biodiversity Conservation Act 2016* (BC Act) on 25 August 2017. All listings for threatened species, populations and ecological communities have been transferred to the BC Act. However, other provisions under the BC Act do not apply to applications under Section 75W of the EP&A Act. Therefore formal assessments under the former Section 5A of the EP&A Act have been prepared.

This Ecological Impact Assessment also considers the requirements to formally refer the Modification to the Minister for the Environment due to potential impacts to Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1.1 Description of the Proposal

The Modification includes the following components:

- Adjustments to the approved mine plan for the Middle Liddell Seam including:
  - Realignment and extension of the main headings further to the north-west;
  - Increases to the lengths and widths of the approved LWs 15-17; and

- Mining of additional longwall panels (LWs 18-19 or LWs 18-20).

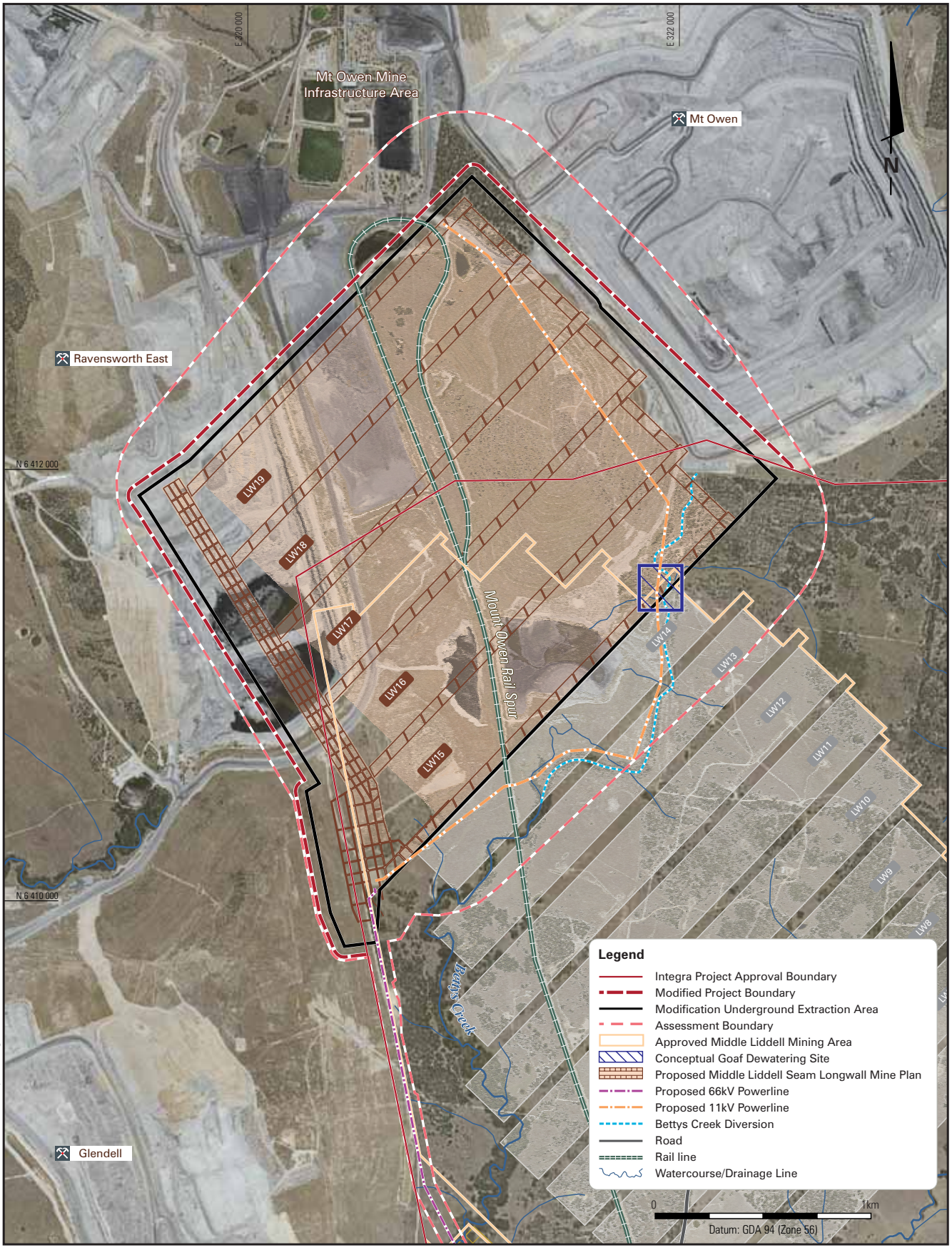
➢ Construction and use of additional surface infrastructure including:

- Proposed Goaf Dewatering Site consisting of additional dewatering boreholes and associated infrastructure;
- Auxiliary fans in the maingate of each longwall panel to assist in the efficient ventilation of the longwall mining area;
- Additional electricity transmission lines and distribution lines;
- Additional gas drainage boreholes to ensure the safety of underground operations;
- Increased usage of the currently approved gas flares; and
- Relocation of the existing store facility and the construction and use of an additional access road off Middle Falbrook Road.

➢ Use of the C4 Dam to store raw water from Glennies Creek.

The proposed mining activities and ancillary surface infrastructure associated with the Modification are conceptually illustrated in Figure 1 (Hansen Bailey, 2017)).

Integra Underground is located adjacent to the Mount Owen Complex (MOC) which is also owned and operated by Glencore. The Modification does not involve any alterations to the Development Consent for the MOC; however, the proposed mining activities and infrastructure development will be undertaken within the approved boundary of MOC.



HB INTEGRA MOD8 1702 F12b Conceptual Longwall Mine Plan 08 11 2017

INTEGRA UNDERGROUND MINE

GLENCORE | Hansen Bailey ENVIRONMENTAL CONSULTANTS

Conceptual Longwall Mine Plan (320m)

FIGURE 12b

Chapter 2

Methods

2.1 Desktop Assessment

A search of the Atlas of NSW Wildlife - Bionet (OEH, 2017) database was undertaken to identify the TSC Act and EPBC Act listed threatened flora and fauna species that have been recorded within a 10 km radius of the Modification since 1990. Additionally, the Protected Matters Search Tool (PMST) (DoEE, 2017a) was utilised to generate a list of MNES listed under the EPBC Act with potential to occur within the Assessment Boundary. A review was also undertaken of previous Environmental Impact Assessments prepared for the Integra Underground Coal Project (ERM, 2009) and Mount Owen Continued Operations Project (Umwelt, 2014).

2.2 Field Surveys

The area within the Assessment Boundary was assessed visually by an ecologist and a botanist on 6 July 2017. Areas outside of the Approved Operations Boundaries for MOC and Integra Underground were assessed visually; notes regarding the vegetation present and any associated fauna habitat values were made. As vegetation mapping throughout the Assessment Boundary already exists, this was considered sufficient to assess the potential ecological impacts associated with the Modification.

2.2.1 Flora Survey

Survey plots were conducted in each of the representative vegetation communities present in the Assessment Boundary (except for rehabilitation and exotic vegetation), using the Biodiversity Banking Assessment Methodology (BBAM) as per the methods of BioBanking (OEH, 2014).

The locations of flora quadrats were recorded using a hand-held GPS unit and are shown in **Figure 2.1**. The locations of the quadrats were selected so that sampling was conducted in areas most representative of the condition and composition of vegetation within the Assessment Boundary. The process of quadrat sampling was included as part of the BBAM plots surveys, and included the following parameters:

- Identifying and recording all vascular flora species present within a nested 20x20m quadrat, located within the 20x 50m plot;
- The stratum in which each species occurred;

- Assigning a cover-abundance value to each species recorded within the plot, using a modified Braun-Blanquet scoring system (Braun-Blanquet, 1927), to reflect their relative cover and abundance in the quadrat and estimating stem count for each species;
- Recording details about vegetation structure such as percentage foliage cover and height of each strata, recorded at 10 points on a 50m transect line;
- Recording the presence of native and exotic species at 1m intervals on a 50m transect;
- Identifying the canopy species that are regenerating;
- Measuring logs within the 50x20m plot;
- Counting hollows present in the plot; and
- Taking photographs of the quadrat to provide a record of vegetation condition and appearance.

i. Targeted Threatened Flora Surveys

Targeted threatened flora searches were undertaken as part of the random meander surveys within suitable habitat of threatened flora species known from the locality. The locations of threatened flora specimens (if present) were recorded using a hand-held GPS.

2.2.2 Fauna Survey

Detailed fauna surveys were generally not considered to be required, due to the cleared nature of the vegetation and lack of identified habitat for threatened fauna species. Additionally, detailed fauna surveys were conducted as part of the MOC EIA, and therefore a significant amount of data exists for the area within the Assessment Boundary.

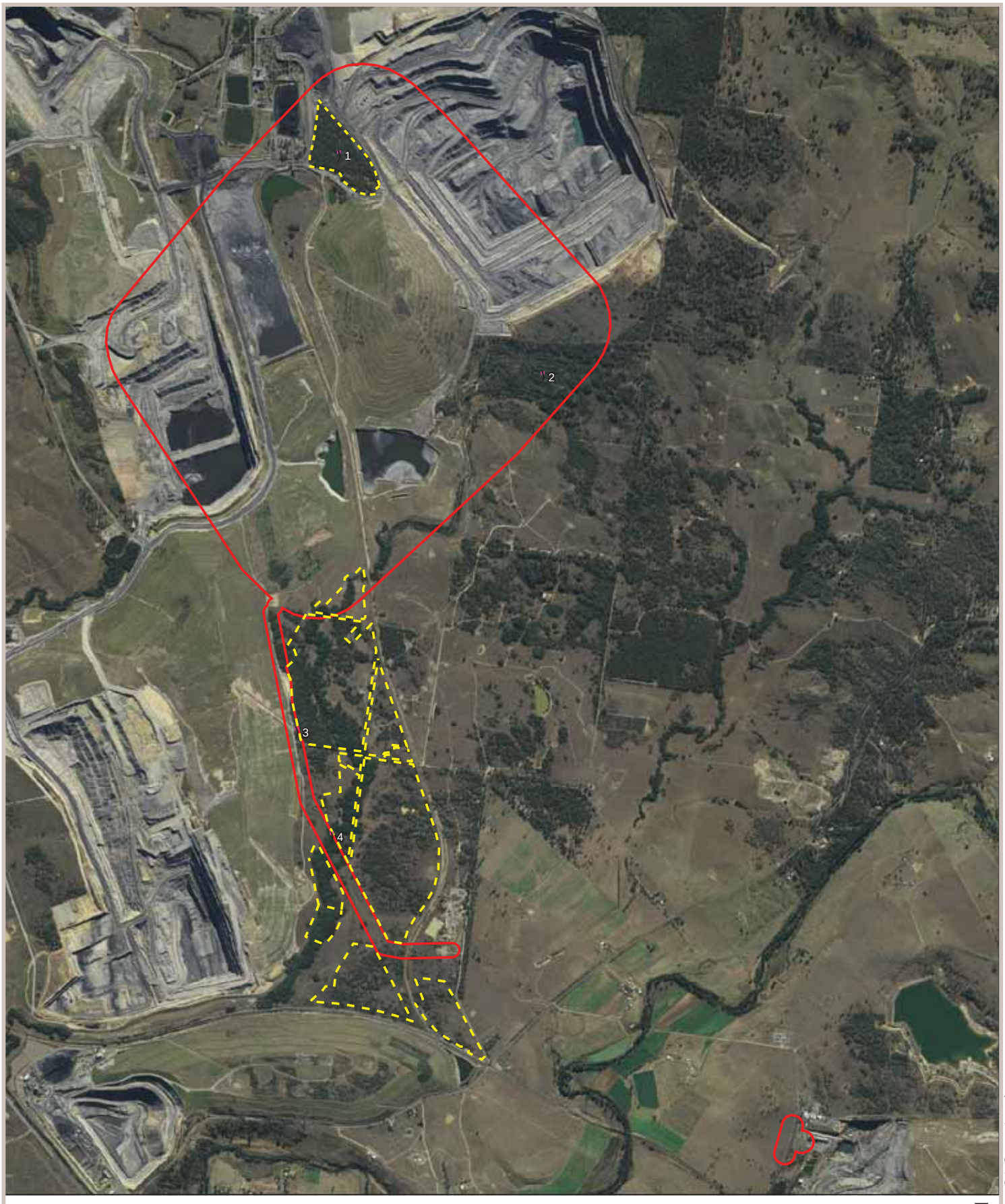
Habitat assessments were conducted as part of the flora survey plots according to the BBAM, and additional notes were made with reference to available habitat features such as areas of bushrock, dams, creeks and soaks. The survey also included an assessment of the presence of habitat features suitable for use by threatened fauna species known to occur in the locality.

2.3 Limitations

Vertebrate fauna and vascular flora of the locality are well known based upon a sizeable database of past records. The surveys by Cumberland Ecology added to the existing database and helped to provide a clear indication of the likelihood that various species occur, or are likely to occur within the Assessment Boundary. The data obtained from database assessment and previous surveys of the Assessment Boundary furnished an appropriate level of information to support this assessment.

The weather conditions at the time of the flora surveys were generally favourable for plant growth and production of features required for identification of most species. Shrubs, grasses, herbs and creepers were readily identifiable in most instances. It is expected that not all flora species present would have been recorded during the surveys. Despite this, it is considered that sufficient information has been collected to assess issues including conservation significance of the flora, condition and viability of vegetation and likely impact on native vegetation.

Limited targeted fauna surveys were undertaken for this assessment, which relied on literature review, database analysis and fauna habitat assessment.



Legend

- Assessment Boundary
- Offset Area
- Flora Plot Locations

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Hansen Bailey (2016)

cumberland ecology

I:\...\17059\Figures\RP1\20170822\Figure 2.1. Survey Locations

Figure 2.1. Survey Locations

0 250 500 750 1,000 m

Chapter 3

Results

In the areas undisturbed by mining operations, extensive historical vegetation clearing has converted much of the land within the Assessment Boundary to grassland with varying degrees of native plant species diversity. Such vegetation supports a much lower diversity of native flora and fauna than the wooded landscapes. The resultant landscape has simplified and fragmented habitats typical of many rural areas that support a subset of the pre-European fauna.

The flora and fauna species that occur within the approved boundaries of Integra Underground and MOC are well known, and existing vegetation mapping and threatened species records are documented across the Assessment Boundary.

The available literature (Peake, 2006; ERM, 2009; Umwelt, 2014) indicates that the vegetation communities within the Assessment Boundary include:

- **Central Hunter Ironbark – Spotted Gum – Grey Box Forest** (Endangered Ecological Community listed under the TSC Act (NSW Scientific Committee, 2011) and Critically Endangered Ecological Community listed under the EPBC Act as part of Central Hunter Valley eucalypt forest and woodland) (DoEE, 2017b);
- **Central Hunter Bulloak Forest Regeneration** (Not listed);
- **Central Hunter Swamp Oak Forest** (Not listed); and
- **Planted Vegetation** (Not listed).

The findings of the current assessment are generally consistent with the findings of previous EA documents (ERM, 2009; Umwelt, 2014). However, the legal statuses of a number of threatened species, populations and ecological communities relevant to the Assessment Boundary have changed since those previous assessments were completed. Vegetation communities present within the Assessment Boundary are shown in **Figure 3.1**.

The sections below detail the findings of the current survey and ecological assessment for the Modification.

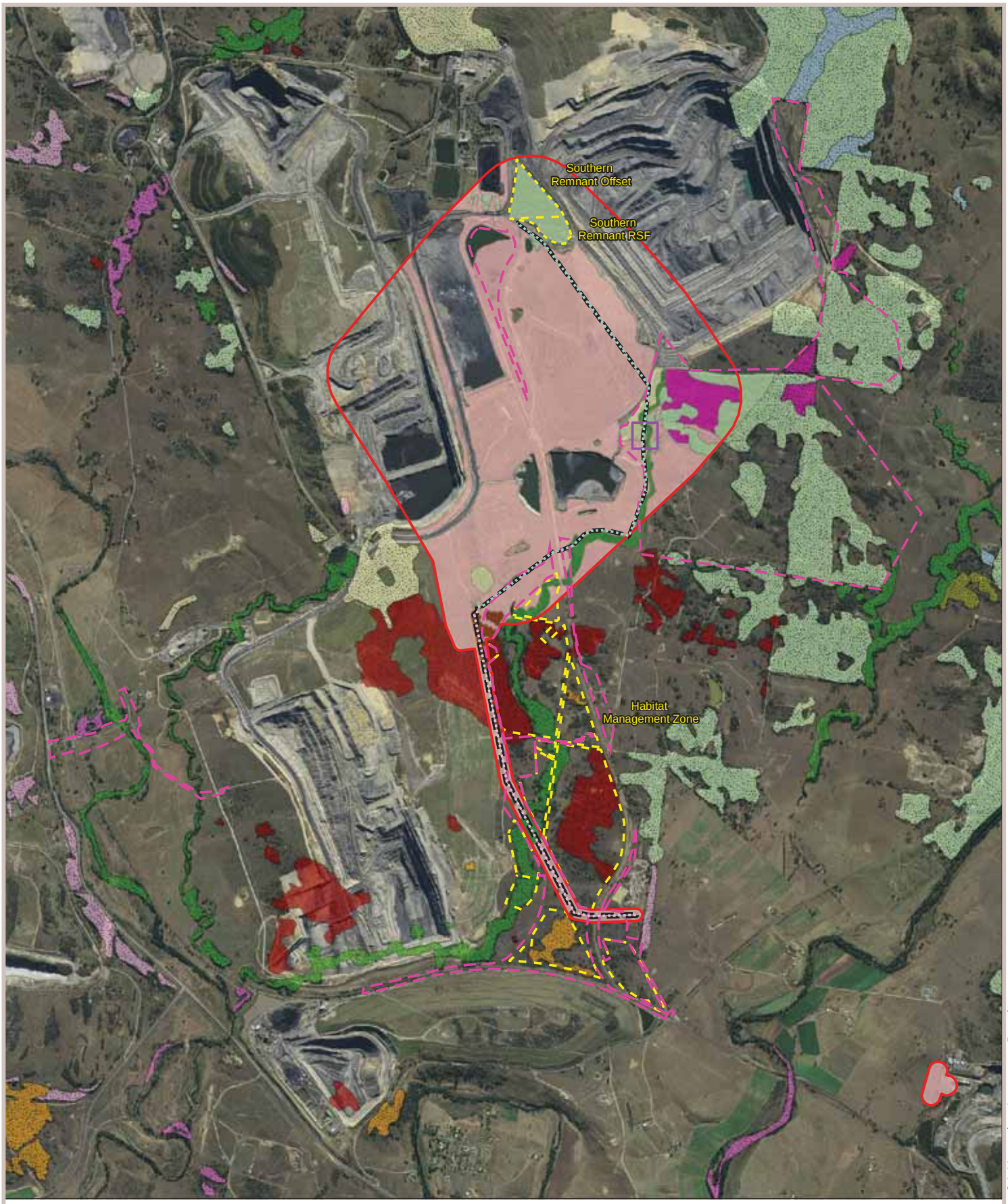


Figure 3.1. Vegetation of the Assessment Boundary

3.1 Vegetation Communities

3.1.1 Central Hunter Ironbark – Spotted Gum – Grey Box Forest

TSC Act Status: Central Hunter Ironbark – Spotted Gum – Grey Box Forest Endangered Ecological Community (EEC)

EPBC Act Status: Central Hunter Valley Eucalypt Forest and Woodland Critically Endangered Ecological Community (CEEC)

Central Hunter Ironbark – Spotted Gum – Grey Box Forest (CEEC/EEC) occurs throughout the Assessment Boundary as both mature and regenerating patches of open woodland, of various patch sizes. The largest and most intact patch is within the Southern Remnant Offset and Southern Remnant Area RSF, which is part of Ravensworth State Forest, as shown in **Figure 3.1** and **Photograph 3.1.**

The canopy is dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus moluccana* (Grey Box) with less frequent *Corymbia maculata* (Spotted Gum). A sparse or absent small tree and shrub layer is represented as regenerating canopy tree species. The understorey is dominated by grasses, including native species such as *Cymbopogon refractus* (Barbed Wire Grass), *Aristida ramosa* (Purple Wiregrass), *Paspalidium distans* and *Chloris truncata* (Windmill Grass), and some exotic species including *Chloris gayana* (Rhodes Grass), *Paspalum dilatatum* (Paspalum) and *Cynodon dactylon* (Couch). Herbs are also abundant in the understorey, including native species such as *Phyllanthus virgatus*, *Einadia trigonos* (Fishweed), *Enchylaena tomentosa* (Ruby Saltbush) and *Stackhousia viminea* (Slender Stackhousia), and exotic species including *Galenia pubescens* (Galenia), *Plantago lanceolata* (Lamb's Tongue) and *Opuntia stricta* (Prickly Pear).

In terms of the condition thresholds outlined in the EPBC Act Conservation Advice (referred to as Central Hunter Valley eucalypt forest and woodland) (Threatened Species Scientific Committee, 2015), the condition of this community within the Assessment Boundary is considered to be moderate and therefore meets the minimum requirements to conform to the CEEC. The minimum requirements for woodland patches are as follows:

- Must be greater than 0.5 ha in area, AND/OR
- Must have a predominantly native perennial groundcover and at least 12 native understorey species, OR
- Must be contiguous with a large patch (> 2 ha).

All patches of this community are also considered to conform to the TSC Act listing of Central Hunter Ironbark – Spotted Gum – Grey Box Forest.

There is no recognised derived native grassland included in the listing of either the TSC Act listing or EPBC Act listing for the CEEC/EEC.

Photograph 3.1 Central Hunter Ironbark – Spotted Gum – Grey Box Forest in the Southern Remnant Area RSF

i. Planted Central Hunter Ironbark – Spotted Gum – Grey Box Forest

An area of planted Central Hunter Ironbark – Spotted Gum – Grey Box Forest is present in the eastern extent of the Assessment Boundary, as shown in **Photograph 3.2**. This area has been mapped by MOC, and appears to have a planted shrub, midstorey and canopy layer over a naturally regenerating understorey. It is likely that the understorey has grown from placed top soil, as part of the mine rehabilitation process. The understorey is as per the intact variant of the community, and has low densities of exotic species. The shrub layer is sparse, with some *Acacia* sp. and regenerating canopy species. The midstorey and canopy has been planted in rows, but is representative of the naturally occurring community, being dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus moluccana* (Grey Box) and *Corymbia maculata* (Spotted Gum).

Photograph 3.2 Planted Central Hunter Ironbark – Spotted Gum – Grey Box Forest to the east of the MOC mining area.

3.1.2 Central Hunter Bulloak Forest Regeneration

TSC Act Status: Not listed

EPBC Act Status: Not listed

Central Hunter Bulloak Forest Regeneration occurs in the centre of the Assessment Boundary, as shown in **Photograph 3.3**. The canopy, sub canopy, and shrub layer are exclusively dominated by *Allocasuarina luehmannii* (Bulloak). A sparse understorey is present and includes grasses; *Aristida vagans* (Three-awned Grass), *Cynodon dactylon, Cymbopogon refractus* and *Eragrostis leptostachya* (Paddock Love Grass) and some herbs, including *Cyperus gracilis* (Slender Flat-sedge), *Einadia trigonos* and the exotic species *Galenia pubescens*.

Photograph 3.3 Bulloak Forest Regeneration in the centre of the Assessment Boundary

3.1.3 Central Hunter Swamp Oak Forest

TSC Act Status: Not listed

EPBC Act Status: Not listed

Central Hunter Swamp Oak Forest occurs in association with the minor watercourses in the Assessment Boundary, including Bettys Creek (as shown in **Photograph 3.4**), Main Creek and some dams. The canopy and sub-canopy are exclusively dominated by *Casuarina glauca* (Swamp Oak), which also dominates the shrub layer as juveniles. Other shrubs include sparse exotic species; *Olea europaea* subsp. *cuspidata* (African Olive), *Gomphocarpus fruticosus* (Narrow-leaved Cotton Bush) and *Lycium ferocissimum* (African Boxthorn). The understorey is dominated by the exotic herbs *Sida rhombifolia* (Paddys Lucerne), *Verbena bonariensis* (Purpletop) and *Cirsium vulgare* (Spear Thistle), and grasses, including the native species *Austrostipa verticillata* (Slender Bamboo Grass) and *Microlaena stipoides* (Weeping Meadow Grass) and exotic species *Chloris gayana* and *Phalaris canariensis* (Canary Grass).

This riparian community would potentially access groundwater when the creek is dry and dependent on base flows. It can therefore be classed as a 'Terrestrial Vegetation' Groundwater Dependant Ecosystem (GDE) community (as described in ***Section 3.3.3***).

Photograph 3.4 Central Hunter Swamp Oak Forest in the Bettys Creek riparian zone

3.1.4 Rehabilitation

TSC Act Status: Not listed

EPBC Act Status: Not listed

Planted vegetation and rehabilitation occurs in areas surrounding the MOC, as shown in **Photograph 5**. Patches vary in composition, and include a mix of indigenous canopy species representative of the woodland types described above, non-indigenous *Eucalyptus* sp., and mostly exotic understorey vegetation, where grasses have been sown for soil stability, and weeds have invaded or regenerated from the soil seed bank. Some lower-lying, wet areas include *Casuarina glauca*, which may have regenerated.

3.1.5 Low Diversity Derived Native Grassland and Exotic Pasture

TSC Act Status: Not listed

EPBC Act Status: Not listed

Low Diversity Derived Native Grassland / Exotic Pasture comprises the majority of the land within the Assessment Boundary (excluding land disturbed by mining activity). These areas of grassland have been intensively ploughed for cultivation; pasture-improvement; or have been subject to prolonged grazing in the past. These areas have typically been subject to a moderate to high level of soil disturbance (**Photograph 3.5**).

Scattered trees are present in the community; including *Eucalyptus crebra, E. moluccana* and *Allocasuarina luehmannii*.

The ground layer of the more disturbed areas is dominated by exotic grass species such as *Cynodon dactylon* and *Paspalum dilatatum*, which commonly occur with *Sida rhombifolia* (Paddys Lucerne) and *Medicago* spp. (Medics). Weed species were locally dominant, particularly *Galenia pubescens* and *Plantago lanceolata*.

The less disturbed areas are dominated by hardy native grasses such as *Sporobolus creber* (Rats Tail Grass), *Eragrostis brownii* (Browns Love Grass) and *Bothriochloa decipiens* (Red leg grass). Native forbs recorded include *Phyllanthus virgatus, Chrysocephalum apiculatum* (Common Everlasting) and *Enchylaena tomentosa*.

Low Diversity Derived Native Grassland / Exotic Pasture are typically of significantly poorer condition than the understorey of the woodland patches due to grazing and would not naturally regenerate to woodland without active rehabilitation. These areas are not listed as TECs under the EPBC Act and/or TSC Act.

Photograph 3.5 Low Diversity Derived Native Grassland / Exotic Pasture, as present throughout the Assessment Boundary

3.2 Flora

3.2.1 General Species

The vegetation within the Assessment Boundary supports a relatively low diversity of native species, due mostly to widespread degradation caused by past land clearance and grazing. The majority of the species recorded are ground layer species. The dominant plant families in the canopy and shrub layer are Myrtaceae and Chenopodiaceae, represented mostly by the genera of *Eucalyptus* and *Maireana*.

3.2.2 Threatened Species

No threatened flora species were recorded within the Assessment Boundary during the surveys undertaken for this assessment. Habitat for threatened flora species known to occur in the locality is considered to be highly limited within the Assessment Boundary, due to the existing disturbance of the ground-layer. Nonetheless, the patches of intact and regenerating woodland provide some marginal habitat for a small number of threatened flora species that have been recorded from the locality, or have the potential to occur. **Appendix A** analyses the likelihood of occurrence within the Assessment Boundary for each threatened flora species that is known or predicted to occur within the locality. **Table 3.1** lists the threatened flora species that have the potential to occur within the Assessment Boundary. Although these species have the potential to occur, they are not likely to occur within the Assessment Boundary. As no threatened flora species are considered likely to occur within the Assessment Boundary, these are not assessed further in this report.

Table 3.1 Threatened Flora with Potential to Occur within the Assessment Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Ozothamnus tesselatus	-	V	V
Acacia pendula	*Acacia pendula* population in the Hunter catchment	E	-
Eucalyptus glaucina	Slaty Red Gum	V	V
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	E	-
Asperula asthenes	Trailing Woodruff	V	V
Thesium australe	Austral Toadflax	V	V
Pterostylis gibbosa	Illawarra Greenhood	E	E

TSC Act Status / EPBC Act Status: V = Vulnerable; E = Endangered

3.3 Fauna

3.3.1 Fauna Habitat

In the areas undisturbed by mining operations, extensive historical vegetation clearing has converted much of the land within the Assessment Boundary to grassland with varying degrees of native plant species diversity. Such vegetation supports a much lower diversity of native fauna than the wooded landscapes. Agricultural land uses have simplified and/or removed the majority of ground habitat features such as logs and rocks.

The resultant landscape has simplified and fragmented habitats typical of many rural areas that support a subset of the pre-European fauna. The integrity of habitats is further challenged by the abundance of feral animals such as foxes and rabbits, which prey upon or compete with native fauna.

Despite its modified nature, the land within the Assessment Boundary still offers some broad habitat features for native fauna including:

- Larger patches of intact woodland provide foraging and breeding habitat for a range of species. However, poor connectivity to other large patches limits the dispersal of less mobile species;
- Regenerating woodland and scattered paddock trees that may facilitate dispersal for highly mobile species such as birds;
- Limited woodland understorey vegetation and ground cover, leaf litter and fallen timber for small terrestrial fauna species;
- Sparse riparian vegetation, which acts as a movement corridor through the landscape;
- Aquatic and semi-aquatic habitats provided by farm dams and ephemeral creeks, which provide drinking resources for birds and mammals, and limited wetland/dam habitats for amphibians;
- Limited tree hollows, which are suitable as shelter and breeding habitat for a range of hollow-dependant fauna; and
- Blossom-producing trees suitable as forage habitat for a range of nectivores.

3.3.2 Fauna Species

The Assessment Boundary is not considered to support a high diversity of fauna species, mostly due to the simplified and highly modified habitat present, and the intact patches of woodland are fragmented from proximate patches. The majority of the species known from the surrounding areas have been recorded from the more intact areas of forest and woodland. A large proportion of recorded species (ERM, 2009; Umwelt, 2014) are represented by birds and microchiropteran bats, which are highly mobile species. Reptiles, arboreal mammals and terrestrial mammals, which are less mobile, are not as well

represented. A number of feral animals have also been recorded including foxes (*Vulpes vulpes*) and rabbits (*Oryctolagus cuniculus*).

3.3.3 Threatened Fauna

No threatened fauna species were recorded within the Assessment Boundary during the surveys completed for this assessment. Previous records of threatened fauna occur from the Assessment Boundary and immediate surrounds, as per the MOC Ecological Assessment (Umwelt, 2014), although much of the identified habitat has already been cleared under existing approvals.

A number of threatened fauna species have been recorded from the locality, or have been predicted to occur. **Appendix A** analyses the likelihood of occurrence within the Assessment Boundary for each threatened fauna species that is known or predicted to occur within the locality. **Table 3.2** lists the threatened fauna species that have the potential to occur within the Assessment Boundary. Species considered likely to occur within the Assessment Boundary are assessed further in this report.

Table 3.2 Threatened Fauna with Potential to Occur within the Assessment Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
LIKELY			
Birds			
Chthonicola sagittata	Speckled Warbler	V	-
Circus assimilis	Spotted Harrier	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Stagonopleura guttata	Diamond Firetail	V	-
Daphoenositta chrysoptera	Varied Sittella	V	-
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-
Petroica phoenicea	Flame Robin	V	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-
Mammals			
Petaurus norfolcensis	Squirrel Glider	V	-
Dasyurus maculatus maculatus	Spotted-tailed Quoll	V	E
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Mormopterus norfolkensis	Eastern Freetail-bat	V	-

Table 3.2 Threatened Fauna with Potential to Occur within the Assessment Boundary

Scientific Name	Common Name	TSC Act Status	EPBC Act Status
Myotis macropus	Southern Myotis	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
POSSIBLE			
Amphibians			
Litoria aurea	Green and Golden Bell Frog	E	E
Birds			
Hirundapus caudacutus	White-throated Needle-tail	-	Mi
Apus pacificus	Fork-tailed Swift	-	Mi
Myiagra cyanoleuca	Satin Flycatcher	-	Mi
Anthochaera phrygia	Regent Honeyeater	CE	E
Grantiella picta	Painted Honeyeater	V	V
Glossopsitta pusilla	Little Lorikeet	V	-
Lathamus discolor	Swift Parrot	E	CE
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-
Ninox strenua	Powerful Owl	V	-
Tyto novaehollandiae	Masked Owl	V	-
Mammals			
Phascogale tapoatafa	Brush-tailed Phascogale	V	-
Phascolarctos cinereus	Koala	V	V
Pseudomys novaehollandiae	New Holland Mouse	V	V
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Nyctophilus corbeni	Corben's Long-eared Bat	V	V
Miniopterus australis	Little Bentwing Bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-

TSC Act Status / EPBC Act Status: V = Vulnerable; E = Endangered; CE = Critically Endangered; M = Migratory

i. Threatened Fauna Likely to Occur

a. Threatened woodland birds

A number of threatened woodland birds are likely to occur within the Assessment Boundary, as listed in **Table 3.2**. The patches of woodland present in the Assessment Boundary consist

of both intact and regenerating forms, and would provide some foraging and nesting habitats for a range of birds. Therefore, the threatened woodland bird species that have been recorded during recent surveys at the MOC are likely to occur as part of a broader foraging range.

b. Spotted-tailed Quoll

The Spotted-tailed Quoll is known to occur in the MOC (as per Figure 4.4 of the MOC EIA) and the Assessment Boundary, and individuals have occasionally been recorded foraging or moving through the local area (Umwelt, 2014). A breeding population was previously identified in the Ravensworth State Forest to the north east of the Assessment Boundary, although this habitat is isolated from the habitat in the Assessment Boundary by the open cut mining area at MOC. Nonetheless, it is therefore possible that this species could occur in the Assessment Boundary, albeit opportunistically, as part of a broad foraging range and during dispersal of adult males.

c. Squirrel Glider

Squirrel Gliders have been recorded in the woodland areas of MOC, Integra Underground and also Ravensworth State Forest (ERM, 2009) (Umwelt, 2014). This species prefers intact or shrubby understorey vegetation, and has been recorded foraging on blossoms and lerps in regrowth woodland and also rehabilitation areas. It is dependent on hollow-bearing trees for 'denning', and therefore could potentially occur within the Assessment Boundary, which includes some scattered old-growth remnant, hollow trees. Foraging habitat in the Assessment Boundary is sub-optimal, due to the lack of connectivity between larger intact patches of woodland. The most likely areas of habitat for this species occur in the larger connected patches of woodland to the east of MOC open cut mining area and Ravensworth State Forest.

d. Microchiropteran bats

A range of threatened microchiropteran bats (microbats) are likely to forage for insects in the woodland and over the mining infrastructure areas within the Assessment Boundary, including waterbodies. Some limited roosting habitat is available for hollow-dependant species; Yellow-bellied Sheath-tail Bat, Eastern Freetail-bat, Southern Myotis and Greater Broad-nosed Bat, within the scattered hollow-bearing trees in the Assessment Boundary.

e. Grey-headed Flying-fox

The Grey-headed Flying-fox forages in a range of habitats, across a very large home range, which includes flowering eucalypts in woodland areas. This species has previously been recorded at the MOC (as per Figure 4.4 of the MOC EIA) and within the Assessment Boundary. It is therefore likely to utilise woodland habitats in the Assessment Boundary opportunistically as forage habitat. No known maternity roost camps are known from the locality, with the closest occurring in Singleton, approximately 15km to the south-east of the Assessment Boundary (Department of the Environment and Energy, 2015).

ii. Potentially occurring threatened fauna

Additional threatened fauna species with potential to occur, as listed in **Table 3.2**, have very limited habitat available in the Assessment Boundary. These species are briefly discussed below:

One threatened amphibian (the Green and Golden Bell Frog) has some limited potential habitat within the Assessment Boundary. This includes a small farm dam to the south east of the Mount Owen rail loop, and another close to the Integra Underground Surface Infrastructure Area within the Assessment Boundary, and also several others occur to the south of the Assessment Boundary. The dams present contain *Typha* sp. and areas of open water, adjoining areas of woodland and other shelter habitat, which are considered suitable habitat features for the species. However, although the species has been recorded at the MOC in the past (from between 1994 – 1999), no records have been confirmed since this time, despite annual monitoring at the MOC and nearby Ravensworth Offset areas. It is thought that the local population is highly restricted to small numbers of individuals, which have drastically declined in the last decade due to the spread of Chytrid fungus. For these reasons, it is possible, although fairly unlikely for this species to occur within the Assessment Boundary.

A number of threatened woodland birds have the potential to occur, however, species such as Regent Honeyeater, Swift Parrot and Little Lorikeet are blossom-dependant nomads, and are likely to utilise foraging resources opportunistically, where flowering events coincide with their migration or foraging movements over a large home range. Mature woodland is generally restricted to the Southern Remnant Area and Southern Remnant Offset within the Assessment Boundary, and therefore foraging resources for these species are limited.

Owl species, including the Powerful Owl and Masked Owl, also have some potential to occur, and could utilise the Assessment Boundary as part of a large foraging range. These species require very large, high hollows for nesting, and dense forest or woodland vegetation for roosting, while they forage for prey over broad areas of vegetated and open land with suitable prey species. However, there is a lack of suitable roosting habitat, and large, high hollows are fairly limited in the Assessment Boundary.

Few records of Koala exist in the locality, although a single record exists from 2012 near Hebden Road to the west of the Assessment Boundary. Scattered historic records also have been identified to occur (OEH, 2017). Few Koala food tree species are present in the Assessment Boundary, and are limited to *Eucalyptus moluccana* (Grey Box). This species makes up less than 15% of the total canopy cover of the woodland or forest communities present and would therefore not constitute 'Potential Koala Habitat' as defined by the NSW *State Environmental Planning Policy No 44 – Koala Habitat Protection*. Furthermore, targeted Koala surveys conducted as part of the assessments of the MOC, including use of Spot Assessment Technique surveys (Phillips and Callaghan, 2000), and no individuals or scats were recorded (Umwelt, 2014).

A number of records of Brush-tailed Phascogale occur within the MOC, from rehabilitation areas and also Ravensworth State Forest to the west and north of the Assessment Boundary (Umwelt, 2014). This species prefers dense intact understorey vegetation, which is generally

lacking in the Assessment Boundary. However, it is possible for this species to pass through the Assessment Boundary on occasion.

Understorey vegetation is generally open and more of a woodland structure where present. There is no heathy understorey present, which is a habitat preference of the New Holland Mouse (*Pseudomys novaehollandiae*). This species has been recorded in the Ravensworth State Forest (to the north-east of the MOC North Pit) but it is less likely to occur in the open habitats within the Referred Action Boundary due to a lack of cover.

Cave-roosting Microbats are known to forage over large distances, and have been recorded in the Assessment Boundary and in the locality (OEH, 2017). However, cave habitats which are suitable for roosting are not known to occur within the Assessment Boundary. Therefore, these species have potential to occur in the Assessment Boundary, on occasion, but would not be dependent on the sparse woodland habitats present.

a. Migratory Species

A number of migratory bird species have the potential to occur in the Assessment Boundary, including; White-throated Needle-tail, Fork-tailed Swift and Satin Flycatcher. These migratory birds are aerial species, and utilise vast foraging ranges during their migration to Australia. None of the migratory species breed in the locality, and it is possible that they would be infrequent visitors to the wooded and open areas of the Assessment Boundary.

3.4 Groundwater Dependant Ecosystems

Pre-mining groundwater assessments for Integra Underground identified the groundwater regimes of the main watercourses; Bettys Creek, Glennies Creek and Main Creek. These regimes consist of unconsolidated alluvium along the channels of the creeks and low yielding bedrock aquifers, separated by aquicludes (mudstones and shales) and aquitards (sandstones). The alluvial aquifers of these creeks are defined as 'shallow upriver' aquifers and are characterised by low permeability clay and sandy sediments overlaying basal clayey gravels (ERM, 2009).

The water level of Glennies Creek is generally below the groundwater table, except during periods of high flow and flood events. Bettys Creek and Main Creek stream flows discharge into the underlying groundwater system aquifer. For these reasons, there is interaction between the groundwater aquifer and stream flows for each of the watercourses present in the Assessment Boundary (ERM, 2009). The groundwater impact assessment (AGE, 2017) has predicted a minor reduction in baseflow for each of these watercourses.

The riparian vegetation communities; including Central Hunter Swamp Oak Forest and Hunter Valley River Oak Forest, are therefore likely to access shallow groundwater aquifers where there is interaction with the alluvial aquifer and when flows are provided by base flows, and when the creek is dry. The communities can therefore be classed as 'Terrestrial Vegetation' Groundwater Dependant Ecosystems (GDEs).

The potential for Stygofauna to occur in the area as part of the Mount Owen projects plans to extend North Pit were investigated as part of the MOC application (AGE, 2017). Samples were collected from two bores in Permian coal seams, two in shallow rock and twelve 12 in Quaternary alluvial aquifers of Swamp Creek, Main Creek, Betty's Creek and Yorks Creek.

Five of the taxa collected were classified as stygofauna. These were Notobathynella sp., Cyclopoida sp., Ostracoda sp. (all crustaceans), Hydrobiidae sp. (a snail), *Carabhydrus stephanieae* (a subterranean diving beetle). These taxa were collected from the alluvial aquifers of Yorks Creek, Swamp Creek, and Station Creek/Glennies Creek. No stygofauna were collected from the shallow hard rock aquifers, coal seam aquifers, nor the Betty's Creek and Main Creek alluvial aquifers (AGE, 2017).

cumberland ecology

Chapter 4

Impact Assessment

4.1 Direct Impacts

4.1.1 Vegetation Removal

i. Habitat Removal

As the Modification is for underground mining, there will be very limited native vegetation removal, restricted to areas of surface infrastructure upgrades and the installation of new powerlines. In addition, some of the proposed surface infrastructure will be located with the approved disturbance area for the Mount Owen Continued Operations Project (MOCO), which is shown in **Figure 3.1**.

The Modification will result in the direct removal of 1.80 ha of Central Hunter Bulloak Forest, 2.02 ha of Central Hunter Swamp Oak Forest, 1.59 ha of rehabilitation and 12.77 ha of grassland for the installation and maintenance of a 66kV powerline, 11 kV powerline and the Goaf Dewatering Site, within the Assessment Boundary, as shown in **Table 4.1**. Of these areas, approximately 1.80 ha of Central Hunter Bulloak Forest, 0.15 ha of Central Hunter Swamp Oak Forest and 6.24 ha of grassland are outside of the approved disturbance area for MOCO. Therefore, these areas represent the additional disturbance due to the Modification.

Additional areas of exotic dominated grassland, and potentially small areas of native vegetation will be disturbed for the construction of additional surface infrastructure areas, including the auxiliary fans and for the sinking of sinking of gas drainage boreholes. The auxiliary fans and gas drainage boreholes will be located in areas of native vegetation that are within the approved MOCO disturbance area. Therefore, the auxiliary fans and gas drainage boreholes will not involve any additional disturbance of native vegetation. The native vegetation proposed for removal within the Assessment Boundary provides some limited habitat for native flora and fauna; including some species that are listed as threatened or migratory under the TSC Act and/or EPBC Act.

Although the indicative locations of the additional surface infrastructure areas are located in areas of grassland, there is the possibility that these sites will be located elsewhere within the Modification Underground Extraction Area. However, mature vegetation will be avoided to the greatest extent possible, and TEC vegetation will be avoided completely.

Aquatic and semi-aquatic habitats, in the form of farm dams and Bettys Creeks and associated riparian zones are not likely to be significantly impacted by the vegetation

removal. Disturbance to riparian vegetation and aquatic habitats during construction of the powerline across Bettys Creek has the potential to impact on the flora and fauna habitats present. The 30m wide corridor (for the 66kV powerline) and 15m wide corridor (for the 11kv powerline) will be required to be maintained free of vegetation in the long term, which may involve future tree trimming. However, the works will not require full vegetation removal, and groundcover vegetation can be retained, which will reduce the impact to the riparian zone, and help prevent creek erosion. Additional measures to avoid erosion should be implemented, as described in Chapter 5.

The loss of grassland areas is not considered to comprise an important impact in terms of flora and fauna habitat for the large majority of potentially occurring species. None of the threatened fauna species that are considered to have the potential to occur within the Assessment Boundary are likely to rely on such grassland habitats for their survival.

Table 4.1 Vegetation Present and to be Impacted within the Assessment Boundary

	Assessment Boundary	Directly Impacted by the Modification (Ha)		
Vegetation	Area (Ha)	Within approved disturbance area for MOCO		Outside of approved disturbance area for MOCO
		Powerline Disturbance Corrdiors	Goaf Dewatering Site	Powerline Disturbance Corrdiors
Central Hunter Ironbark - Spotted Gum - Grey Box Forest	33.97		0.00	0.00
Rehabilitation	9.02	0.37	1.22	
Planted Ironbark - Spotted Gum - Grey Box Forest	17.30			
Central Hunter Bulloak Forest Regeneration	6.53			1.80
Central Hunter Swamp Oak Forest	17.46	1.07	0.79	0.15
Grassland	386.07	4.90	1.63	6.24
Total	**470.34**	**6.34**	**3.64**	**8.19**

4.1.2 Indirect Impacts

The Modification has the potential to indirectly impact remaining vegetation and habitats. The indirect impacts could include:

- Subsidence – affects biodiversity as mining under watercourses and floodplains, or in other relatively flat-lying areas, may result in localised diversion of water flows and possible increases in the incidence of flooding, erosion and other impacts. The groundwater table is also predicted to be impacted, which can also affect ;
- Alteration to hydrological regimes – affects biodiversity through modification of hydrology necessary for vegetation and habitat survival, such as surface water drainage patterns and through the construction of hard surfaces;
- Habitat fragmentation - affects biodiversity by reducing the amount of available habitat for some species to occupy due to increased distances between habitat patches;
- Edge effects – affects biodiversity through microclimatic changes in light, temperature, humidity and wind, which can favour a suite of different species and therefore cause significant changes to the ecology of the patch (Lindenmayer and Fischer, 2006); and
- Increased sedimentation and erosion – affects biodiversity through the smothering of vegetation, increasing turbidity of waterways and transportation of weed matter and nutrients.

Each potential indirect impact is discussed further below:

i. Mine subsidence

The underground longwall method of mining that is currently employed at Integra Underground and further proposed by the Modification gives rise to the potential for impacts associated with subsidence, as outlined in the Integra Underground Mine Subsidence Assessment for Modification to PA08-0101 (SCT, 2017).

Subsidence occurs when the overlying strata collapse into the void left after the coal is extracted. This has the potential to change conditions on the land surface, including changes in elevation, cracking of the soil surface and associated impacts on water flows and hydrology. The limit, magnitude and nature of subsidence movements are dependent on numerous factors, such as mine design, geological conditions, surface topography, and the distance between the mine workings and the ground surface (NSW DPI, 2006).

Species and ecological communities that depend on aquatic and semi-aquatic habitats are particularly susceptible to the impacts of subsidence. Subsidence induced tilt, surface cracking and strains may increase the incidence and severity of erosion leading to a decrease in water quality and habitat condition. Furthermore, a reduction in surface water holding is a potential, which may lead to a decrease in aquatic habitats.

Alteration to habitat following subsidence from longwall mining constitutes a Key Threatening Process (KTP) under the TSC Act. The potential impacts arising from subsidence from the Modification are considered in detail below:

a. Strain and Surface Cracks

Strains are expected to occur in the area of Mt Owen Rail Spur above the proposed longwall panels. These strains are anticipated to be less than 8mm/m in tension and 11mm/m in compression over undisturbed ground. Tension cracks may occur in areas of tensile strain depending on the nature of the surface terrain. Cracks are expected to be generally less than about 20mm wide in flat or gently undulating land (SCT, 2017). However, these areas are of low ecological value, due to existing disturbance from mining operations.

Permanent compression humps and associated low angle fracturing may become apparent at topographic lows such as drainage channels, particularly where stream channels flow directly on bedrock (SCT, 2017). This may have some impact on the riparian zone of Bettys Creek and also some ephemeral drainage lines in the Assessment Boundary, as described below.

b. Vertical and Horizontal Subsidence and Tilt

The maximum subsidence due to the mining of 257m wide longwall panels is forecast to be up to 2.0m in areas of undisturbed ground. The maximum subsidence due to the mining of 320m wide longwall panels is forecast to be up to 2.2m in areas of undisturbed ground. Horizontal subsidence movements of up to 500mm are expected to occur in the Assessment Boundary as a result of proposed mining (SCT, 2017). These subsidence effects are predicted to have minimal impacts on biodiversity, except where groundwater impacts occur, as described below.

c. Groundwater Interactions

The results of the groundwater impact assessment undertaken by AGE (2017) indicate that the Modification will not result any in detectable incremental drawdown within Quaternary alluvial aquifers, due primarily to the significant depth of mining. Furthermore, the maximum net loss of groundwater from the Quaternary alluvium and from connected stream baseflow due to the Modification is predicted to be negligible at less than 1 ML/year. Therefore, surface water flows will also remain unaffected (AGE, 2017).(SCT, 2017)

d. Impacts on Riparian Vegetation

Impacts on the natural section of Bettys Creek (and is tributaries) from mining the proposed longwall layouts are expected to be no greater than impacts described in the Project EA (ERM, 2009) (SCT, 2017). This included no observable reduction in surface flows in Bettys Creek. Therefore surface water will remain present in the ephemeral system, and continue to support aquatic and semi-aquatic species.

As the depth to groundwater and the quantity of groundwater available to plants is not expected to change in the long term, this means that the communities that have developed

as a result of the current drainage patterns are likely to persist in their current form in the Assessment Boundary. Impacts to Bettys Creek are expected to be manageable under the existing management plans (Glencore, 2017b).

e. Impacts on Terrestrial Vegetation

Remnant forest present in the Southern Remnant Area RSF and the adjoining Southern Remnant Offset for the MOC are located within the area of expected subsidence. However, as this vegetation type is not a GDE, and surface impacts such as cracking are predicted to be marginal, the impacts to the forest vegetation are expected to be minor and manageable.

ii. Alterations to Hydrological Regimes

The proposed works may alter the hydrology of Bettys Creek through the draw-down of groundwater systems, as discussed above. However, the changes in hydrology are expected to be minimal, and surface water levels are likely to remain unaltered. The riparian vegetation present is likely to utilise the groundwater source to a varying extent, although mainly during times of drought when plants may access the shallow aquifer.

iii. Habitat Fragmentation

The Modificationincludes the construction and operation of two powerlines. The powerlines are located predominantly in open areas, and very little clearing will be required, however, some vegetation will be removed for the construction of the 66 kV powerline, which will fragment vegetation to a minor extent. Movement of the flora and fauna species likely to occur in the areas surrounding the area of works is not considered to be significantly impacted by the Modification.

iv. Increased Edge-effects

The proposed surface infrastructure has the potential to exacerbate edge-effects, however, the impacts are considered minimal given the already disturbed nature of the habitat within the Assessment Boundary.

v. Increased Sedimentation and Erosion

Without the implementation of appropriate mitigation measures, the Modification may increase sedimentation and erosion impacts on downstream environments during the construction of surface infrastructure and potentially during mining operations, as a result of subsidence. The implementation of the Land Management Plan (Glencore, 2017b) is expected to manage these potential impacts.

4.1.3 Impacts to Threatened Ecological Communities

No direct removal of TEC vegetation will occur as a result of the Modification. As described above, indirect impacts to dryland vegetation types include minor surface cracking to occur in the woodland of the Assessment Boundary. However, such indirect impacts are not likely to be significant such as to threaten a local occurrence of TEC vegetation, including Central Hunter Ironbark – Spotted Gum – Grey Box Forest.

Direct and indirect impacts have been discussed in detail above, and conclude that potential impacts to TECs are likely to be minimal. A formal assessment of significance (in accordance with the EP&A Act) for this community has been prepared and is included in **Appendix C**. This assessment indicates that no significant impact is predicted to occur as a result of the Modification.

This assessment also indicates that no significant impact to Central Hunter Valley Eucalypt Forest and Woodland, as listed under the EPBC Act, is likely to occur as a result of the Modification. In consideration of the EPBC Act Significant Impact Criteria for a Critically Endangered Ecological Community (DoE, 2013), no significant impact is expected, as per the EPBC Act impact criteria tabled in **Appendix D**. Nonetheless, as a precautionary measure, impacts to this CEEC/EEC and other MNES have been included in a referral to the Minister for the Environment. The referral indicates that the Modification is not considered to constitute a Controlled Action, on the basis of MNES.

4.1.4 Impacts to Threatened Flora Species and Endangered Populations

The Modification has the potential to result in a number of direct and indirect impacts to habitat for threatened flora species within the Assessment Boundary and immediate surrounds. In addition to the direct removal of habitat within the Assessment Boundary, potential indirect impacts to flora species include:

- Weed invasion;
- Runoff, erosion and sedimentation; and
- Modification of microhabitat features resulting from edge effects.

No threatened flora species, or endangered populations, were recorded during the current surveys of the Assessment Boundary. Four flora species are considered to have the potential to occur. The direct and indirect impacts have been considered within the Assessments of Significance within **Appendix C**. These assessments determined that the Modification is not considered to result in a significant impact to the potentially occurring threatened flora species.

4.1.5 Impacts to Threatened Fauna Species

The Modification has the potential to result in a number of direct and indirect impacts to fauna species within the Assessment Boundary and immediate surrounds. In addition to the direct removal of habitat within the Assessment Boundary, potential indirect impacts to fauna species include:

- Habitat disturbance during the construction phase of the Modification;
- Runoff, erosion and sedimentation;
- Hydrological changes resulting in altered fauna habitats; and

- Modification of microhabitat features resulting from long and short-term edge effects (e.g. changes in light filtration).

A number of threatened fauna species listed under the TSC Act or EPBC Act have been recorded within the Assessment Boundary as part of surveys for the MOC Project Application (Umwelt, 2014). This includes woodland birds; Grey-crowned Babbler, Brown Tree-creeper, Diamond Firetail, Speckled Warbler and Little Eagle, which were recorded within the larger patches of woodland and forest, including the offset areas and Bettys Creek riparian zone. Additionally, a total of 18 species are considered likely to occur. These species are predominantly highly mobile and are considered to utilise the Assessment Boundary as part of larger foraging ranges. The habitat to be removed within the Assessment Boundary exists in a fragmented landscape.

A further 12 species are considered as having the potential to occur, including less mobile species such as the Green and Golden Bell Frog. However, although potential habitat is present for these species, the lack of recent records in the locality, indicate that these species are unlikely to be present. Furthermore, impacts to potential habitat will be avoided to a large extent.

The direct and indirect impacts have been considered within the Assessments of Significance (within **Appendix C**). These assessments take into account the mitigation measures outlined within **Chapter 5** that have sought to minimise impacts to habitat for these species. Assuming that the recommended mitigation measures are implemented, these assessments determined that the Modification is not considered to result in a significant impact to the potentially occurring threatened fauna species.

4.1.6 Impacts to Groundwater Dependant Ecosystems

Terrestrial vegetation GDEs are present within the Assessment Boundary, in the form of the riparian community; Central Hunter Swamp Oak Forest. Removal of this Terrestrial GDE will be minimal (see **Table 3.1**), and restricted to the 30m wide corridor for the 66kV powerline corridor and 15m wide corridor for the 11kv powerline.

The results of the groundwater impact assessment undertaken by AGE (2017) indicate that the Modification will not result any in detectable incremental drawdown within Quaternary alluvial aquifers, due primarily to the significant depth of mining therefore GDEs reliant on the alluvial systems will not be significantly affected. Furthermore, the maximum net loss of groundwater from the Quaternary alluvium and from connected stream baseflow due to the Modification is predicted to be negligible at less than 1 ML/year. Therefore, surface water flows will also remain unaffected, and potential impacts to aquatic fauna in these stream systems are likely to be negligible.

The riparian vegetation communities; including Central Hunter Swamp Oak Forest and Hunter Valley River Oak Forest (**Figure 3.1**), are likely to access shallow aquifers where there is interaction with the alluvial aquifer and when flows are provided by baseflows, and when the creek is dry. The dependence of the vegetation communities on groundwater will depend on depth of the root systems and their efficiency at utilising rainfall and surface moisture. The dominant canopy species; Swamp oak (*Casuarina glauca*) and River Oak

(*Casuarina cunninghamiana*) are not solely reliant on groundwater. Within the Hunter Valley, the species is known to occur in locations where groundwater is not present (e.g. on hill slopes). This suggests that the species is an opportunistic coloniser that readily colonises areas where groundwater is not present or is negligible (Umwelt, 2015).

A survey of bores installed within the Betty's Creek and Main Creek alluvial aquifers did not detect the presence of stygofauna (AGE, 2017). Stygofauna detected Glennies Creek alluvium are considered unlikely to be significantly impacted based on the limited drawdown predicted to occur within the Quaternary alluvium (AGE, 2017). For these reasons, it is not expected that the Modification will significantly impact on stygofauna GDEs.

4.1.7 Impacts on Corridor Values

The Modification will act to fragment the Bettys Creek riparian zone through the clearing of a 30m wide 66kv powerline corridor and the 15m wide 11kv powerline corridor. In the location of the 66kv powerline crossing, the riparian zone is more than 100m wide, and therefore the entire riparian width will not be cleared, while the 11kv powerline will only remove small edge areas, if required. Furthermore, the powerline corridors will allow for low understorey vegetation to remain, and therefore the function of the riparian corridor for fauna movement will be maintained to some extent. The fauna species most likely to utilise the riparian corridor, including bats and birds, will not be limited in their movements by the fragmentation of the canopy.

Other fauna movement corridors which exist in the landscape are already highly fragmented, and exist as patches of woodland and forest vegetation, and also scattered trees. The Modification will not act to sever any corridors, and is not likely to greatly exacerbate the existing effects of fragmentation significantly, due to the small areas of clearing.

Chapter 5

Avoidance, Mitigation and Compensation Measures

5.1 Avoidance Measures

The majority of the land within the Assessment Boundary consists of open-cut mining areas and open areas of grassland with isolated patches of forest and woodland. Direct impacts to biodiversity are predicted to be minimal, and are restricted to clearing for a 66kV powerline corridor, an 11kv powerline corridor, the Goaf Dewatering Site, and some additional small surface infrastructure areas.

Due to the relatively small area of disturbance required and the linear nature of the powerline, it is likely that direct impacts to vegetation can be minimised through the avoidance of tree removal outside of the powerline corridors, wherever possible. It has been assumed that an additional track will not be required for the powerline installation, where it passes through forest vegetation.

The Modification is predicted to result in a maximum of 2.0 to 2.2 m of subsidence, which may give rise to indirect impacts on ecological values. Due to the nature of longwall mining, subsidence cannot be avoided completely. However, measures have been incorporated to reduce the potential impacts to biodiversity, as discussed below.

5.2 Mitigation Measures

Integra Underground operates under the Biodiversity Management Plan (Glencore, 2017a) and the Bettys Creek Land Management Plan (Glencore, 2017b). The Modification will continue to operate under these plans, which include comprehensive mitigation measures and strategies to address impacts to biodiversity from underground mining and surface infrastructure. The Biodiversity Management Plan includes a Trigger Action Response Plan (TARP) has been developed to identify triggers and responses in the event of unexpected variations to the outcomes of proposed management strategies.

The following additional mitigation measures are provided to ensure the overall potential ecological impact and removal of habitat during installation is minimised:

- Avoid removal of stags, or hollow-bearing trees, where possible;
- Conduct pre-clearance assessments and clearance supervision for vegetation removal, if required for surface infrastructure construction;

- Maintain hydrological function and fauna passage in the creeks and riparian zones during construction;
- Use existing tracks wherever possible and minimise the creation of temporary access tracks (during construction);
- Return topsoil as soon as practicable to minimise risk of native seeds losing viability through extended storage; and
- Communicate the above measures to all contractors involved in construction activities to ensure that the measures are understood and observed.

Additional mitigation measures specifically to address the impacts of subsidence include:

- Revegetation of riparian areas which are at high risk of erosion within the areas of subsidence, including parts of Main Creek and Bettys Creek, prior to mining;
- Monitor creek flows, surface cracking, erosion and general stream health regularly, as per the Bettys Creek Land Management Plan (Glencore, 2017).

Given the relatively minor extent of clearing of native woodland vegetation, which is based on a conservative estimate of disturbance required, and the proposed implementation of a suite of mitigation measures, the Assessments of Significance completed for this Modification have determined that there will be no significant impacts to threatened ecological communities or species listed under the TSC Act and/or EPBC Act.

5.3 Compensation Measures

Since the proposed modification application is being made under section 75W of the EP&A Act, for which an EIS is not required, and given that the Secretary has not issued any environmental assessment requirements in respect of the applications, the *NSW Biodiversity Offsets Policy for Major Projects* and the *Framework for Biodiversity Assessment* do not apply to the applications.

All CEEC/EEC vegetation will be completely avoided, and woodland and forest vegetation removal will be very minimal. Additionally, the main areas of forest and woodland vegetation located within the Assessment Boundary are already located within offset areas, and will continue to be managed for conservation.

Chapter 6

Conclusion

Despite the impacts of previous disturbance and its location within a fragmented landscape, the Modification will require the clearing of some native vegetation that provides suitable habitat for some threatened flora and fauna species.

Within the Assessment Boundary, approximately 5.40 ha of native vegetation will be cleared for the installation of powerline corridors and the Goaf Dewatering Site, which includes 2.02 ha of Central Hunter Swamp Oak Forest, 1.80 ha of Central Hunter Bulloak Forest regeneration and 1.59 ha of rehabilitation. Some additional areas of surface infrastructure will require clearing of Low Diversity Derived Native Grassland/Exotic Pasture, and potentially some small areas of native vegetation where avoidance is not possible (although CEEC/EEC vegetation will be completely avoided).

No threatened flora or fauna species have been recorded within the Assessment Boundary; however a number of species have been recorded within the adjoining areas and in the locality, and are considered as having the potential to occur. None of these species are considered to rely upon the habitats to be cleared for the Modification.

Indirect impacts include the potential for additional subsidence, beyond levels predicted as part of the approved mining operations. However, the subsidence assessment indicates that the impacts will be minor, but will include some surface cracking and strains. The groundwater impact assessment (AGE, 2017) indicates that there will be increased groundwater draw-down experienced in Bettys Creek, Main Creek and Glennies Creek, however, the changes are expected to be undetectable in the alluvium and baseflows will remain unchanged. This assessment has concluded that the potential subsidence impacts and changes in groundwater levels are not expected to significantly impact on riparian vegetation, which is classified as a GDE. Surface cracking and strains are not expected to lead to impacts to CEEC/EEC vegetation, such that the local occurrence would be placed at risk of extinction. Stygofauna detected Glennies Creek alluvium are considered unlikely to be significantly impacted based on the limited drawdown predicted to occur within the Quaternary alluvium (AGE, 2017).

A number of mitigation measures have been recommended for the Modification, including vegetation protection measures and vegetation community rehabilitation; erosion, sedimentation and pollution control; and pre-clearance assessments and clearance supervision. Ongoing monitoring of stream health and impacts of subsidence are to continue, as per the Bettys Creek Land Management Plan (Glencore, 2017).

The direct and indirect impacts of the Modification on TSC Act and EPBC Act communities, species and populations have been assessed. Assuming all recommended mitigation

measures are implemented, no significant impact to these entities is predicted to occur as a result of the Modification.

An assessment of the Modification was completed in accordance with the *Threatened Species Assessment Guidelines* (DECC (NSW), 2007) and '*Matters of National Environmental Significance, Significant impact guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999*' (DoE, 2013). These assessments concluded that there is not likely to be a significant impact on threatened ecological communities or species listed under the TSC Act and/or EPBC Act, as demonstrated in the assessments presented in **Appendix C** and **Appendix D** respectively. Nonetheless, as a precautionary measure, and due to changes in groundwater as a result of the Modification, a referral is being submitted to the Minister for the Environment. It is not expected that the Modification will be deemed a Controlled Action, and is not expected to be assessed further under the EPBC Act.

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Appendix A

Likelihood of Occurrence Assessments

Table A.1 Threatened Flora Species Likelihood of Occurrence Assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Ozothamnus tesselatus		V	V	Restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth. Grows in eucalypt woodland.	Yes	No	Possible. Suitable woodland habitat is present in the Assessment Boundary. Was not recorded during the current surveys. One individual was previously recorded within the MOC, outside of the Assessment Boundary.
Acacia pendula	Acacia pendula population in the Hunter catchment	E		The species occurs on the western slopes, western plains and far western plains of NSW. In the Hunter, the population is known in the Muswellbrook and Singleton Local Government Areas (LGAs). Within the Hunter catchment the species typically occurs on heavy soils, sometimes on the margins of small floodplains, but also in more undulating locations. It is not known to occur within any conservation areas.	No	No	Possible. Some suitable habitat is present at the crossing of creeklines in the Assessment Boundary. Not recorded during the current surveys.

Table A.1 Threatened Flora Species Likelihood of Occurrence Assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Eucalyptus glaucina	Slaty Red Gum	V	V	Found only on the north coast of NSW and in separate districts: near Casino where it can be locally common, and further south, from Taree to Broke, west of Maitland. Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	No	No	Possible. Some suitable habitat is present at the crossing of creeklines in the Assessment Boundary. Not recorded during the current survey.
^^*Cymbidium canaliculatum*	Cymbidium canaliculatum population in the Hunter Catchment	E		This large epiphytic orchid has a scattered distribution across northern and eastern Australia. In NSW it is known to occur in the north-eastern quarter of the State, including the Hunter River region, Hunter Valley, Ravensworth, Muswellbrook, Denman, Sandy Hollow, Merriwa plateau, Bylong, Gungal, Goulburn River. Typically grows in the hollows, fissures, trunks and forks of trees in dry sclerophyll forest or woodland, where its host trees typically occur on Permian Sediments of the Hunter Valley floor. It usually occurs singly or as a single clump, which can form large	No	No	Possible. Suitable woodland habitat is present in the Assessment Boundary. Was not recorded during the current surveys.

Table A.1 Threatened Flora Species Likelihood of Occurrence Assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
				colonies on trees, between two and six metres from the ground. Recruitment, germination and persistence is reliant on rotting wood and mycorrhizal fungal associations. It is also known to use man-made structures, such as fence posts and wooden bridges as its host.			
Asperula asthenes	Trailing Woodruff	V	V	This small herb occurs only in NSW. It is found in scattered locations from Bulahdelah north to near Kempsey, with several records from the Port Stephens/Wallis Lakes area. Occurs in damp sites, often along river banks.	No	No	Possible. Marginal suitable habitat present in the Assessment Boundary. There is an isolated record of Asperula asthenes (listed as Vulnerable under the EPBC Act) from Ravensworth in 2006.
Dichanthium setosum	Bluegrass	V	V	Associated with heavy basaltic black soils and red-brown loams with clay subsoil.	No	No	Unlikely. No suitable habitat present.
Euphrasia arguta		CE	CE	The Euphrasia arguta populations found in 2008 occur in eucalypt forest with a mixed grass and shrub understorey within Nundle State Forest. Historical information from Euphrasia arguta	No	No	Unlikely. No suitable habitat present.

Table A.1 Threatened Flora Species Likelihood of Occurrence Assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
				collections suggest the species could be found in open forest around Bathurst in subhumid places, or more generally, in grassy areas near rivers at elevations up to 700 m above sea level, with an annual rainfall of 600 mm.			
Prasophyllum sp. Wybong (C.Phelps ORG 5269)	a leek orchid		CE	Prasophyllum sp. Wybong (C. Phelps ORG 5269) is known from seven populations in open eucalypt woodland and grassland in NSW. The distribution of this species overlaps with the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	No	No	Unlikely. No Box Gum Grassy Woodland habitat present. Furthermore, the restricted distribution of this species makes it unlikely to occur.
Pterostylis gibbosa	Illawarra Greenhood	E	E	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark E. crebra, Forest Red Gum and Black Cypress Pine Callitris endlicheri.	No	No	Possible. Grassy woodland with Narrow-leaved Ironbark is present in the Assessment Boundary.
Thesium australe	Austral Toadflax	V	V	Austral Toadflax is semi-parasitic on roots	No	No	Possible. Grassy woodland and

Table A.1 Threatened Flora Species Likelihood of Occurrence Assessment

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
				of a range of grass species, notably Kangaroo Grass. It occurs in shrubland, grassland or woodland, often on damp sites.			grassland is present, with some areas containing Kangaroo Grass. However, the majority of the grassland is low diversity, and in marginal habitat at best.

NOTES: V - vulnerable; E - Endangered; CE - Critically Endangered

MOC - Mt Owen Complex (2014) Biodiversity Management Plan. Incorporating the Flora and Fauna Management Plan and Offset Management Plan.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
AMPHIBIA								
Heleioporus	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Breeding habitat of this species is generally soaks or pools within first or second order streams.	No	No	Unlikely. No suitable breeding habitat present in the Assessment Boundary. Not recorded in targeted surveys of MOC.
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E	V	The species is found in a wide range of water bodies except fast moving streams. It commonly inhabits disturbed sites such abandoned quarries and mines, though generally breeds in habitats that include still, shallow, unpolluted water bodies, that are unshaded, contain aquatic plants are free of Mosquito fish and other predators, with a range of diurnal shelter sites (emergent aquatic vegetation).	Yes	No	Possible. Some suitable habitat is present, primarily in the farm dams with fringing aquatic vegetation that adjoin woodland, located to the south of the Assessment Boundary.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Hylidae	*Litoria booroolongensis*	Booroolong Frog	E	E	Live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	No	No	Unlikely. No suitable stream habitat due to a lack of instream vegetation or rocky substrate.
AVES								
Accipitridae	*Pandion cristatus*	Eastern Osprey		Mi, M	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers. They require extensive areas of open fresh, brackish or saline water for foraging.	No	No	Unlikely. No suitable coastal habitat present or large water bodies.
Apodidae	*Hirundapus caudacutus*	White-throated Needletail		Mi	Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the	No	No	Possible. Some suitable habitat is present within the MOC and the species

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					ground. Occur over most types of habitat, particularly above wooded areas including open forest and rainforest, between trees or in clearings and below the canopy.			can occasionally cross over the Assessment Boundary.
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	E		Occurs in floodplain wetlands of major coastal rivers along with minor floodplains, coastal sandplain wetlands and estuaries. Species builds nest in high in trees close to water.	No	No	Unlikely. No suitable habitat.
Accipitridae	*Circus assimilis*	Spotted Harrier	V		Occurs throughout mainland Australia except in densely forested or wooded habitats of the coast, escarpment, and ranges. It inhabits open grassy woodland, shrubland, and grassland. It nests in trees and preys on terrestrial mammals, birds, and reptiles, and will occasionally consume carrion.	Yes	No	Likely. Some marginal habitat present in the open woodland present in the Assessment Boundary, as part of a large home range.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	Mi	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water.	No	No	Unlikely. No suitable habitat.
Accipitridae	^^*Erythrotriorchis radiatus*	Red Goshawk	CE	V	This unique Australian endemic raptor is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. It inhabits open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of	No	No	Unlikely. The Assessment Boundary is not within the predicted range of the species.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					food, and permanent water, and is often found in riparian habitats along or near watercourses or wetlands.			
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V		The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland, or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch.	Yes	No	Likely. Some marginal habitat present in the open woodland present in the Assessment Boundary, as part of a large home range.
Apodidae	*Apus pacificus*	Fork-tailed Swift		Mi	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They forage aerially, up to hundreds of metres above ground, but also less than 1 m above open areas or over water.	No	No	Possible. May forage aerially over the Assessment Boundary.
Dicruridae	*Monarcha melanopsis*	Black-faced		Mi	The Black-faced Monarch mainly	No	No	Unlikely. No suitable

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
		Monarch			occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.			habitat.
Motacillidae	*Motacilla flava*	Yellow Wagtail		Mi	The yellow wagtail occurs in a variety of damp or wet habitats with low vegetation, from rushy pastures, meadows, hay fields and marshes to damp steppe and grassy tundra. This migratory species occurs across Europe, Africa and Asia, to Alaska and northern Australia.	No	No	Unlikely. Outside the expected range within Australia.
Muscicapidae	*Myiagra cyanoleuca*	Satin Flycatcher		Mi	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-	No	No	Possible. Marginal suitable habitat is present

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.			in the Assessment Boundary, in eucalypt forest.
Muscicapidae	*Rhipidura rufifrons*	Rufus Fantail		Mi, M	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts, usually with a dense shrubby understorey often including ferns.	No	No	Unlikely. No suitable moist eucalypt forest habitat present.
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V		Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Also utilises isolated flowering trees in open country, e.g. paddocks,	Yes	No	Possible. Some suitable habitat is present in the woodland patches in the Assessment Boundary.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					roadside remnants and urban trees. Roosts in treetops, often distant from feeding areas. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked Eucalypts.			
Psittacidae	*Lathamus discolor*	Swift Parrot	E	CE	In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon, and E. albens. Breeds in Tasmania in spring and summer.	Yes	No	Possible. Some suitable habitat is present in the woodland patches in the Assessment Boundary.
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	E	E	Prefers fringes of swamps, dams and nearby marshy areas where	No	No	Unlikely. No suitable wetland habitat present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					there is a cover of grasses, lignum, low scrub or open timber.			
Scolopacidae	*Actitis hypoleucos*	Common Sandpiper		Mi, M	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	No	No	Unlikely. No suitable wetland habitat present.
Scolopacidae	*Calidris acuminata*	Sharp-tailed Sandpiper		Mi, M	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	No	No	Unlikely. No suitable wetland habitat present.
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper		CE, Mi, M	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps,	No	No	Unlikely. No suitable wetland habitat present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					lakes and lagoons near the coast, and ponds in saltworks and sewage farms.			
Scolopacidae	*Calidris melanotos*	Pectoral Sandpiper		Mi, M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands.	No	No	Unlikely. No suitable wetland habitat present.
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe		Mi, M	Latham's Snipe is a non-breeding visitor to south-eastern Australia. In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level (Chapman 1969; Naarding 1981). They usually inhabit open, freshwater wetlands with low, dense vegetation.	No	No	Unlikely. No suitable wetland habitat present.
Scolopacidae	*Numenius madagascariensis*	Eastern Curlew		CE, Mi, M	The eastern curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on	No	No	Unlikely. No suitable intertidal mudflat habitat present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					crabs and molluscs in intertidal mudflats.			
Strigidae	*Ninox strenua*	Powerful Owl	V		In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials.	Yes	No	Possible. Some suitable habitat is present in the woodland patches of the Assessment Boundary, including habitat for prey species, and nesting habitat within the scattered hollow-bearing trees.
Tytonidae	*Tyto longimembris*	Eastern Grass Owl	V		Occurs in areas with tall grass including swamps, grassy plains	No	No	Unlikely. No substantial grassy floodplain habitat

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					and flood plains. Species breeds on the ground within dense trodden grass.			is present. Grazing of the majority of grassland areas is likely to make the grassland areas unsuitable.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V		Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats.	Yes	No	Possible. Marginal suitable habitat is present in the Assessment Boundary, primarily within the riparian areas.
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V		Found in eucalypt woodlands and dry open forest of the inland slopes and plains inland of the Great Dividing Range. The species favours woodlands	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. Fallen timber is an important habitat component for foraging.			
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V		Occurs in communities dominated by Eucalyptus, with a grassy understorey, most commonly occurring on rocky ridges and gullies.	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of	No	No	Possible. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					mature trees, high canopy cover and abundance of mistletoes.			
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	E	E	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spikerushes (Eleocharis spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	No	No	Unlikely. No suitable wetland habitat present.
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V		Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora) and Forest Red Gum (E. tereticornis). In NSW it is widespread, with records from	Yes	No	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina.			
	Grantiella picta	Painted Honeyeater	V	V	Inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	No	No	Possible. Suitable grassy eucalypt forests present.
Pomatostomidae	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler (eastern subspecies)	V		Occurs in open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Also found in Woodlands on fertile soils in coastal regions.	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V		Inhabits eucalypt forests and	Yes	No	Likely. Some suitable

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Inhabits most of mainland Australia except the treeless deserts and open grasslands.			habitat is present in the woodland habitats of the Assessment Boundary.
Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V		In NSW the species is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. The Dusky Woodswallow is found in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. The species primarily eats invertebrates, mainly insects, which are captured whilst hovering and sallying above the	No	No	Possible. Suitable woodland habitat present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					canopy or over water.			
Petroicidae	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V		Hooded Robins are found in lightly timbered woodland, mainly dominated by acacia and/or eucalypts.	Yes	No	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.
Petroicidae	*Petroica boodang*	Scarlet Robin	V		Occurs in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	Yes	No	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.
Petroicidae	*Petroica phoenicea*	Flame Robin	V		Breeds in upland tall, moist,	Yes	No	Likely. Some suitable

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					eucalypt forests and woodlands, often on ridges and slopes. Ground layer of breeding habitat is dominated by native grasses. It occasionally occurs in herbfields, heathlands, shrublands, and sedgelands at high altitudes. In winter the species migrates to drier, more open habitats in the lowlands. The species forages from low perches, pouncing on small invertebrates on the ground or off logs, and other coarse woody material.			habitat is present in the woodland habitats of the Assessment Boundary.
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V		Occurs in grassy eucalypt woodland, open forest and riparian areas.	Yes	No	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary.
MAMMALIA								
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	Recorded across a range of habitat types, including	Yes	No	Likely. Known to traverse the Assessment

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites.			Boundary and locality. Suitable habitat is present in the woodland patches in the Assessment Boundary, although denning and latrine sites are limited due to a general lack of hollow-bearing trees or rock areas.
Dasyuridae	*Phascogale tapoatafa*	Brush-tailed Phascogale	V		Prefers dry sclerophyll open forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter. Occasionally inhabits rainforest and heath. Nests and shelters in tree hollows.	Yes	Yes	Possible. Marginal suitable habitat is present in the woodland patches in the Assessment Boundary. Limited denning sites are present in hollow-bearing trees.
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north.	No	No	Unlikely. No suitable habitat.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Phascolarctidae	*Phascolarctos cinereus*	Koala	V	V	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred feed species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	Yes	No	Possible. Scattered Grey Box trees represent a secondary feed tree species in the Assessment Boundary. However, records are very sparse, and it is unlikely that the Assessment Boundary supports a local population, but rather transient individuals from known populations including Ravensworth State Forest.
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V		Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Widely, though sparsely,	Yes	Yes	Likely. Small patches of suitable habitat is present in the woodland patches in the Assessment Boundary. Limited denning sites are present in hollow-bearing trees.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					distributed in eastern Australia, from northern Queensland to western Victoria.			
Petauridae	*Petauroides volans*	Greater Glider		V	The Greater Glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows.	No	No	Unlikely. No suitable habitat.
Potoroidae	*Potorous tridactylus tridactylus*	Long-nosed Potoroo	V	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas.	No	No	Unlikely. No suitable habitat.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary. The species has been recorded previously in the Assessment Boundary.
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V		Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary. Roosting habitat is present in few hollows present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					aerial territory.			
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V		Found in dry sclerophyll forest, woodland, swamp forest and mangrove forests east of the Great dividing Range. Primarily roosts in tree hollows but will also utilise man-made structures.	Yes	Yes	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary. Roosting habitat is present in few hollows present.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	The species is associated with areas dominated by sandstone escarpments; sandstone cliffs and fertile woodland valley habitat occurring in close proximity to each other is important for the species. It roosts in cliff/escarpment areas and forages in fertile forest. Roosting is predominately in arch caves with dome roofs.	Yes	No	Possible. Marginal suitable woodland habitat is present, although no suitable cave-roosting habitat is present. Has been recorded in the MOC.
Vespertilionidae	*Miniopterus australis*	Little Bentwing Bat	V		Moist eucalypt forest, rainforest or dense coastal banksia scrub.	Yes	No	Possible. Marginal suitable woodland habitat

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					Little Bentwing-bats roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.			is present, although no suitable cave-roosting habitat is present. Has been recorded in the MOC.
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V		Forages above the canopy and eats mostly moths. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Yes	Yes	Possible. Marginal suitable woodland habitat is present, although no suitable cave-roosting habitat is present. Has been recorded in the MOC.
Vespertilionidae	*Myotis macropus*	Southern Myotis	V		Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Yes	No	Likely. Waterbodies suitable for foraging present in the Assessment Boundary, although no suitable cave-roosting habitat is present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
Vespertilionidae	*Nyctophilus corbeni*	Corben's Long-eared Bat	V	V	Inhabits a variety of vegetation types, including mallee, bulloak and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark.	No	No	Possible. Suitable grassy eucalypt forests and Bulloak forest present. No records in the locality.
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V		Found mainly in the gullies and river systems that drain the Great Dividing Range. Usually roosts in tree hollows and buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as	Yes	No	Likely. Some suitable habitat is present in the woodland habitats of the Assessment Boundary. Roosting habitat is present in few hollows present.

Table A.2 Threatened Fauna Species Likelihood of Occurrence Assessment

Class/Family	Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Requirements	Recorded at MOC (Umwelt, 2014)	Recorded at Integra (ERM, 2009)	Likelihood of Occurrence
					it searches for beetles and other large, slow-flying insects.			
Vespertilionidae	*Vespadelus troughtoni*	Eastern Cave Bat	V		A cave-roosting species which inhabits dry open forest and woodland. Normally near rocky overhangs and cliffs, but has also been recorded in disused mines. Occasionally found in rainforest ad wet sclerophyll forest.	No	No	Unlikely. No suitable habitat
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse		V	Occurs in open habitats (heathland, woodland and forest) with a heath understorey and vegetated sand dunes. The species prefers deep soft top soils in order to burrow.	Yes	No	Possible. Marginal suitable woodland habitats present, although most patches lack dense understorey. Records from MOC surveys are primarily within the northern parts of Ravensworth SF.

NOTES: V - vulnerable; E - Endangered; CE - Critically Endangered, Mi = Listed as Migratory under International Agreements (CAMBA, JAMBA, ROKAMBA, BONN Convention), M = Listed Marine Species

MOC - Mt Owen Complex (2014) Biodiversity Management Plan. Incorporating the Flora and Fauna Management Plan and Offset Management Plan.

Appendix B

Survey Data

Table B.1 Flora Survey Data

Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Myrtaceae		*Corymbia maculata*	Spotted Gum	-	-	1			
Myrtaceae		*Eucalyptus moluccana*	Grey Box	-	-		1		
Myrtaceae		*Angophora floribunda*	Rough-barked Apple	-	-		1		
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum	-	-		1		
Myrtaceae		*Eucalyptus fibrosa*	Red Ironbark	-	-	1			
Casuarinaceae		*Casuarina glauca*	Swamp Oak	-	-				1
Casuarinaceae		*Allocasuarina luehmannii*	Bulloak	-	-			1	
Myrtaceae		*Angophora floribunda*	Rough-barked Apple	-	-		1		
Myrtaceae		*Eucalyptus tereticornis*	Forest Red Gum	-	-		1		
Myrtaceae		*Corymbia maculata*	Spotted Gum	-	-	1			
Myrtaceae		*Eucalyptus moluccana*	Grey Box	-	-	1			
Casuarinaceae		*Casuarina glauca*	Swamp Oak	-	-				1
Myrtaceae		*Corymbia maculata*	Spotted Gum	-	-	1			
Fabaceae (Mimosoideae)		*Acacia parvipinnula*	Silver-stemmed Wattle	-	-	1			

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Fabaceae (Mimosoideae)		*Acacia decurrens*	Black Wattle	-	-		1		
Fabaceae (Mimosoideae)		*Acacia implexa*	Hickory Wattle	-	-		1		
Fabaceae (Mimosoideae)		*Acacia spectabilis*	Mudgee Wattle	-	-		1		
Fabaceae (Faboideae)		*Indigofera australis*	Australian Indigo	-	-	1			
Fabaceae (Faboideae)		*Templetonia stenophylla*	Leafy Templetonia	-	-			1	
Apocynaceae	*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush	-	-		1		
Pittosporaceae		*Bursaria spinosa*	Native Blackthorn	-	-	1	1		
Cactaceae	*	*Opuntia stricta*	Common Prickly Pear, Smooth Pest Pear	-	-	1			
Casuarinaceae		*Casuarina glauca*	Swamp Oak	-	-				1
Casuarinaceae		*Allocasuarina luehmannii*	Bulloak	-	-	1		1	
Chenopodiaceae		*Maireana microphylla*	Small-leaf Bluebush	-	-				1

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Cactaceae	*	*Opuntia stricta*	Common Prickly Pear, Smooth Pest Pear	-	-				
Adiantaceae		*Cheilanthes sieberi*	Rock Fern	-	-	1	1	1	1
Lobeliaceae		*Pratia purpurascens*	Whiteroot	-	-	1	1		1
Convolvulaceae		*Dichondra repens*	Kidney Weed	-	-	1	1		1
Solanaceae		*Solanum prinophyllum*	Forest Nightshade	-	-	1			
Oxalidaceae	*	*Oxalis corniculata*	Creeping Oxalis	-	-				1
Oxalidaceae		*Oxalis perennans*		-	-	1			
Asteraceae	*	*Cirsium vulgare*	Spear Thistle	-	-	1	1		1
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle	-	-	1			
Myoporaceae		*Eremophila debilis*	Amulla	-	-	1			1
Asteraceae		*Vernonia cinerea var. cinerea*		-	-	1	1		
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle	-	-				1
Asteraceae	*	*Bidens pilosa*	Cobbler's Pegs	-	-	1	1		
Malvaceae	*	*Sida rhombifolia*	Paddy's Lucerne	-	-				1
Malvaceae		*Sida corrugata*	Corrugated Sida	-	-	1			

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues	-	-				
Plantaginaceae		*Veronica plebeia*	Trailing Speedwell	-	-				1
Plantaginaceae		*Plantago debilis*	Shade Plantain	-	-	1			1
Solanaceae	*	*Solanum pseudocapsicum*	Madeira Winter Cherry	-	-				1
Solanaceae	*	*Solanum nigrum*	Black-berry Nightshade	-	-	1	1		1
Acanthaceae		*Brunoniella australis*	Blue Trumpet	-	-	1			1
Apiaceae		*Centella asiatica*	Indian Pennywort	-	-		1		
Apiaceae	*	*Cyclospermum leptophyllum*	Slender Celery	-	-	1	1		
Asteraceae	*	*Sonchus oleraceus*	Common Sowthistle	-	-		1		
Asteraceae		*Chrysocephalum apiculatum*	Common Everlasting	-	-	1			
Rubiaceae		*Asperula conferta*	Common Woodruff	-	-	1	1		
Asteraceae		*Calotis lappulacea*	Yellow Burr-daisy	-	-	1			
Asteraceae	*	*Hypochaeris microcephala var. albiflora*	White Flatweed	-	-				1
Asteraceae	*	*Hypochaeris radicata*	Catsear	-	-		1		
Chenopodiaceae		*Einadia nutans subsp. nutans*	Climbing Saltbush	-	-	1			

Table B.1 Flora Survey Data

Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Rubiaceae	*	*Richardia stellaris*		-	-		1		
Primulaceae	*	*Lysimachia arvensis*	Scarlet Pimpernel	-	-	1	1		
Asteraceae	*	*Lactuca serriola*	Prickly Lettuce	-	-				1
Asteraceae	*	*Facelis retusa*		-	-		1		
Asteraceae		*Vittadinia cuneata*	Fuzzweed	-	-	1	1		
Verbenaceae	*	*Verbena rigida*	Veined Verbena	-	-		1		
Goodeniaceae		*Goodenia hederacea*	Ivy Goodenia	-	-		1		
Goodeniaceae		*Goodenia rotundifolia*		-	-	1			
Haloragaceae		*Haloragis heterophylla*	Variable Raspwort	-	-		1		
Asteraceae		*Vittadinia sulcata*		-	-	1			
Asteraceae	*	*Senecio madagascariensis*	Fireweed	-	-		1		1
Asteraceae	*	*Bidens subalternans*	Greater Beggar's Ticks	-	-		1		
Asteraceae	*	*Taraxacum officinale*	Dandelion	-	-				1
Chenopodiaceae		*Enchylaena tomentosa*	Ruby Saltbush	-	-	1			
Chenopodiaceae		*Einadia polygonoides*	Knotweed Goosefoot	-	-				1
Chenopodiaceae		*Einadia nutans*	Climbing Saltbush	-	-				1

Table B.1 Flora Survey Data

Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Campanulaceae		*Wahlenbergia stricta*	Tall Bluebell	-	-	1			
Lamiaceae		*Ajuga australis*	Austral Bugle	-	-	1			
Campanulaceae		*Wahlenbergia communis*	Tufted Bluebell	-	-	1			
Campanulaceae		*Wahlenbergia gracilenta*	Annual Bluebell	-	-				1
Rubiaceae		*Opercularia diphylla*	Stinkweed	-	-		1		
Rubiaceae	*	*Richardia stellaris*		-	-				1
Asteraceae		*Lagenifera stipitata*	Blue Bottle-daisy	-	-		1		1
Polygalaceae		*Polygala japonica*	Dwarf Milkwort	-	-		1		
Stackhousiaceae		*Stackhousia viminea*	Slender Stackhousia	-	-		1		
Asteraceae		*Epaltes australis*	Spreading Nut-heads	-	-		1		
Asteraceae		*Euchiton sphaericus*	Star Cudweed	-	-	1			
Poaceae		*Aristida ramosa*	Purple Wiregrass	-	-	1	1	1	
Poaceae		*Chloris ventricosa*	Tall Chloris	-	-	1	1		1
Poaceae		*Bothriochloa macra*	Red Grass	-	-		1		
Poaceae		*Bothriochloa decipiens*	Pitted Bluegrass	-	-	1	1	1	1
Poaceae		*Microlaena stipoides*	Weeping Grass	-	-	1	1	1	1

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Poaceae		*Enteropogon acicularis*	Curly Windmill Grass	-	-	1			
Poaceae		*Rytidospermum racemosum*		-	-	1			
Poaceae		*Cymbopogon refractus*	Barbed Wire Grass	-	-	1	1		
Poaceae		*Aristida vagans*	Threeawn Speargrass	-	-	1	1	1	
Poaceae		*Eragrostis brownii*	Brown's Lovegrass	-	-		1		1
Poaceae		*Eragrostis leptocarpa*	Drooping Lovegrass	-	-	1	1		
Poaceae		*Austrostipa verticillata*	Slender Bamboo Grass	-	-	1			1
Poaceae		*Austrostipa scabra*	Speargrass	-	-	1			
Poaceae		*Paspalidium distans*		-	-	1	1		1
Poaceae	*	*Briza subaristata*		-	-		1		
Poaceae	*	*Axonopus fissifolius*	Narrow-leafed Carpet Grass	-	-		1		
Poaceae		*Cynodon dactylon*	Common Couch	-	-		1		
Poaceae		*Enteropogon acicularis*		-	-		1	1	
Poaceae		*Panicum effusum*	Hairy Panic	-	-			1	
Poaceae		*Digitaria diffusa*	Open Summer-grass	-	-				1

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Poaceae		*Paspalidium caespitosum*	Brigalow Grass	-	-	1			
Poaceae		*Bothriochloa decipiens var. decipiens*	Pitted Bluegrass	-	-				1
Poaceae	*	*Hyparrhenia hirta*	Coolatai Grass	-	-				1
Poaceae	*	*Setaria parviflora*		-	-				1
Anthericaceae		*Arthropodium sp. B sensu Harden (1993)*		-	-	1			
Phormiaceae		*Dianella revoluta*	Blueberry Lily	-	-		1		
Cyperaceae		*Cyperus gracilis*	Slender Flat-sedge	-	-		1		
Phormiaceae		*Dianella longifolia*	Blueberry Lily	-	-		1		
Lomandraceae		*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush	-	-	1	1	1	
Lomandraceae		*Lomandra filiformis subsp. filiformis*		-	-	1	1	1	
Commelinaceae		*Commelina cyanea*	Native Wandering Jew	-	-				1
Fabaceae (Faboideae)		*Desmodium gunnii*	Slender Tick-trefoil	-	-	1			

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Family	*	Scientific Name	Common Name	EPBC Act Status	TSC Act Status	Central Hunter Valley Spotted Gum Ironbark Forest	Planted Central Hunter Valley Spotted Gum Ironbark Forest	Bulloak Forest Regeneration	Swamp Oak Floodplain Forest
						Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4
Fabaceae (Faboideae)		*Glycine microphylla*	Small-leaf Glycine	-	-	1	1		1
Fabaceae (Faboideae)		*Desmodium brachypodum*	Large Tick-trefoil	-	-	1			
Fabaceae (Faboideae)		*Glycine tabacina*	Variable Glycine	-	-	1	1		
Apocynaceae		*Marsdenia viridiflora subsp. viridiflora*	Native Pear	-	-	1			
Fabaceae (Faboideae)		*Glycine clandestina*	Twining glycine	-	-	1			

Appendix C

Assessments of Significance (7 Part Test)

C.1 Introduction

This appendix contains formal Assessments of Significance according to Section 5A of the EP&A Act. The Assessments of Significance provide a means by which to gauge the significance of predicted impacts to threatened species, populations and ecological communities listed under the TSC Act. They have been prepared to help examine the magnitude of impacts to local occurrences of threatened biota which are known or likely to occur.

Both direct and indirect impacts are taken into account within these assessments. Direct impacts have been quantified within the assessments and are represented by the Modification. Whilst it is acknowledged that indirect impacts can potentially be significant for a variety of species, such impacts cannot be mapped or accurately calculated in advance.

Each Assessment of Significance is a series of questions (shown as italicised text below) for which a response has been supplied beneath in plain text. The assessments have been prepared without considering the ameliorative and compensatory measures proposed for the Modification as instructed under the *Threatened Species Assessment Guidelines* (DECC (NSW), 2007).

C.2 Threatened Ecological Communities

C.2.1 Central Hunter Ironbark – Spotted Gum – Grey Box Woodland

Assessment of Significance

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable for an ecological community.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable for an ecological community.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

The Modification will not result in the removal or disturbance of any Central Hunter Ironbark – Spotted Gum – Grey Box Woodland in the Assessment Boundary.

The Modification has potential to adversely modify the composition of the community within the Assessment Boundary, due to indirect impacts resulting from subsidence, such as surface cracking and strains, however, this is unlikely to modify the extent of the community within the locality. The Modification is unlikely to adversely affect the composition of the community such that its local occurrence is placed at risk of extinction.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

The Modification will not result in the removal of any area of Central Hunter Ironbark – Spotted Gum – Grey Box Woodland in the Assessment Boundary.

The Modification will not act to fragment or isolate an area of the community within the Assessment Boundary.

Central Hunter Ironbark – Spotted Gum – Grey Box Woodland has suffered a large decline in the Central Hunter Valley (Peake, 2006). However, the occurrence in the Assessment Boundary will be avoided, and potential indirect impacts, including subsidence, are not expected to reduce the area of this community. The importance of the habitat in the Assessment Boundary is considered to be important to the long-term survival of the community in the locality and will continue to be managed for conservation in the Assessment Boundary.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for this EEC has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plans or threat abatement plans exist for this community. No priority actions have been identified for this community.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process (KTP)

The Modification constitutes or will exacerbate the following KTPs:

- **Subsidence**
- **Invasion of native plant communities by exotic perennial grasses** as this affects regeneration capabilities and results in loss of structural complexity and of key food plants and habitat;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The Modification will not remove or modify an area of Central Hunter Ironbark – Spotted Gum – Grey Box Woodland in the Assessment Boundary. The proposal is not likely to reduce the extent of this community or place this EEC at risk of local extinction. No Species Impact Statement is required.

C.3 Threatened Fauna

C.3.1 Woodland Birds

The following Seven-part Test has been prepared as a composite test for a number of woodland bird species, which are listed as Vulnerable under the TSC Act, and are considered likely to occur within the Assessment Boundary:

- Speckled Warbler (*Chthonicola sagittata*);
- Diamond Firetail (*Stagonopleura guttata*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- Flame Robin (*Petroica phoenicea*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*); and
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modification will remove potential forage, shelter and roosting habitat for these woodland birds that are considered to have likely to occur based on records from the Integra or MOC Project Boundaries, their distributional range, and the availability of suitable habitat and locality records.

Due to the small areas of forest proposed for removal, which constitutes sub-optimal habitat primarily for shelter and dispersal, the Modification is not likely to have an adverse effect on the life cycle of individuals likely to occur within the Assessment Boundary. The species are considered to have long-term viability in the locality and region due to the local abundance of the species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Approximately 5.40 ha of native vegetation (as part of movement and foraging areas) is proposed to be removed or modified by the Modification, which includes potential forage, breeding and nesting habitat for a variety of woodland birds. However, the proposed works will involve minimal clearing within a 30m wide 66kv powerline corridor and 15m wide 11kv powerline corridor, and a small area for construction of the Goaf Dewatering Site and other surface infrastructure, and will not completely remove the vegetation present, therefore the majority of habitat will remain in the Assessment Boundary.

Additionally, there is potential for indirect impacts to woodland habitat, through impacts such as edge-effects and subsidence. However, these indirect impacts are expected to be minor, and would not remove or modify the habitat present such that it would be unsuitable for these species.

The clearing within the powerline corridors will contribute to fragmentation of habitat to a minor extent. However, this fragmentation is not likely to represent a barrier to movement of these highly mobile species, in an already fragmented landscape. No isolation of habitat areas will occur.

The forest habitat to be removed or modified is not likely to be great importance to these bird species, as the majority of the patch will be retained in the riparian corridor. The larger intact woodland patches within the Assessment Boundary, including Ravensworth State Forest, will continue to be managed for conservation.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for these woodland birds has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plans exist for these species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for these species;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;
- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox (*Vulpes vulpes*)** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of forest in the Assessment Boundary will result in a loss of potential foraging, shelter and breeding habitat for threatened birds. Additionally, there is the potential for indirect impacts to areas of woodland habitat due subsidence. However, the area of forest habitat proposed for removal or modification is fairly small and the intact woodland habitat is unlikely to be significantly altered. As such, the Modification is not likely to have a significant impact on woodland bird species which are likely to occur in the Assessment Boundary.

C.3.2 Diurnal Raptors

The following Seven-part Test has been prepared as a composite test for the Spotted Harrier (*Circus assimilis*) and Little Eagle (*Hieraaetus morphnoides*), which are listed as Vulnerable under the TSC Act, and are considered likely to occur within the Assessment Boundary.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modification will remove potential forage habitat for these diurnal raptors that are considered to be likely to occur based on records from the Integra or MOC Project Boundaries, their distributional range, the availability of suitable habitat and locality records. No nest trees were identified in the Assessment Boundary for these species.

Due to the small areas of forest proposed from removal or modification, the Modification is not likely to have an adverse effect on the life cycle of individuals likely to occur within the Assessment Boundary. The species are considered to have long-term viability in the locality and region due to the local abundance of the species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

Approximately 5.40 ha of native vegetation (as part of movement and foraging areas) is proposed to be removed or modified by the Modifications, which includes potential forage, breeding and nesting habitat for a variety of diurnal raptors. However, the proposed works will involve minimal clearing within powerline corridors and a small area for construction of the Goaf Dewatering Site and other surface infrastructure, and will not completely remove the riparian vegetation present, therefore the majority of habitat will remain in the Assessment Boundary.

Additionally, there is potential for indirect impacts to forest and woodland habitat, located in the Southern Remnant Offset and Southern Remnant Area RSF and other proximate patches, through impacts such as edge-effects and subsidence. However, these indirect

impacts are expected to be minor, and would not remove or modify the habitat present such that it would be unsuitable for these species.

The clearing within the powerline corridors will contribute to fragmentation of habitat to a minor extent. However, this fragmentation is not likely to represent a barrier to movement of these highly mobile species, in an already fragmented landscape. No isolation of habitat areas will occur.

The forest habitat to be removed or modified is not likely to be great importance to these bird species, as the the majority of the patch will be retained in the riparian corridor. The larger intact woodland patches within the Assessment Boundary, including Ravensworth State Forest, will continue to be managed for conservation.

The abundance of prey species is unlikely to be significantly reduced by the proposed habitat removal. Significantly larger and more intact woodland patches occur in proximate areas, including Ravensworth State Forest.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for these species has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plans exist for these species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for these species and reduces prey densities;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces prey densities and availability of nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;
- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox (*Vulpes vulpes*)** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and

ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;

- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;

- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and

- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of forest in the Assessment Boundary will result in a loss of potential foraging and breeding habitat for threatened diurnal raptors. However, the areas of forest habitat proposed for removal or modification is fairly small and is in a young regenerating form. Furthermore, the proposed works are not likely to significantly reduce the abundance of prey species available in the Assessment Boundary. As such, the Modification is not likely to have a significant impact on diurnal raptor species which are likely to occur in the Assessment Boundary.

C.3.3 Nectivorous Birds

The following Seven-part Test has been prepared as a composite test for a number of nectivorous bird species, which are considered likely (Black-chinned Honeyeater), or having the potential to occur within the Assessment Boundary:

- Black-chinned Honeyeater (*Melithreptus gularis gularis)* – Vulnerable (TSC Act);

- Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable (TSC Act);

- Swift Parrot (*Lathamus discolor*) – Endangered (TSC Act), Critically Endangered (EPBC Act); and

- Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered (TSC Act and EPBC Act).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modifications will remove potential forage habitat for these nectivorous birds that are considered to have potential to occur based on records from the Integra or MOC Project Boundaries, their distributional range, the availability of suitable habitat and locality records.

Only the Black-chinned Honeyeater has been recorded in the Integra Project Boundary or MOC Project areas (ERM, 2009) (Umwelt, 2014). The other bird species are strongly associated with Ironbark and Box Woodland types, and therefore have the potential to occur.

Due to the small areas of regenerating forest proposed from removal or modification, the Modification is not likely to have an adverse effect on the life cycle of individuals likely to occur within the Assessment Boundary. The species are considered to have long-term viability in the locality and region due to the local abundance of the species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

Approximately 5.40 ha of native vegetation (as part of movement and foraging areas) is proposed to be removed or modified by the Modification, which includes potential forage, breeding and nesting habitat for a variety of woodland birds. However, the proposed works will involve minimal clearing within powerline corridors and a small area for construction of the Goaf Dewatering Site and other surface infrastructure, and will not completely remove the vegetation present, therefore the majority of habitat will remain in the Assessment Boundary.

Additionally, there is potential for indirect impacts to woodland habitat, located in the Southern Remnant Offset and Southern Remnant Area RSF and other proximate patches, through impacts such as edge-effects and subsidence. However, these indirect impacts are expected to be minor, and would not remove or modify the habitat present such that it would be unsuitable for these species.

The clearing within the powerline corridor will contribute to fragmentation of habitat to a minor extent. However, this fragmentation is not likely to represent a barrier to movement of

these highly mobile species, in an already fragmented landscape. No isolation of habitat areas will occur.

The forest habitat to be removed or modified is not likely to be great importance to these bird species, as the majority of the patch will be retained in the riparian corridor. The large intact woodland patches within the Assessment Boundary, including Ravensworth State Forest, will continue to be managed for conservation.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for these woodland birds has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The "Threat Abatement Plan for Beak and Feather Disease affecting endangered psittacine species" is relevant to the Little Lorikeet. The Proposal is unlikely to increase the likelihood of extinction or escalate the threatened status of psittacine birds and is therefore consistent with the objectives of this plan.

Relevant recovery plans for nectivorous species are the "Swift Parrot (*Lathamus discolor*) Recovery Plan 2001-2005" (Swift Parrot Recovery Team, 2001), "National Recovery Plan for the Swift Parrot (*Lathamus discolor*)" (Saunders and Tzaros, 2011) and "Regent Honeyeater (*Xanthomyza phrygia*) Recovery Plan 1999 – 2003" (Department of Environment and Conservation NSW, 2004). The general aims of these recovery plans include the protection and enhancement of key breeding and foraging habitats for these species. The Assessment Boundary does not include any key breeding or foraging areas for these species and is therefore consistent with these plans.

No specific recovery plans have been prepared for the Black-chinned Honeyeater or Little Lorikeet.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for these species;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;

- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat and encourages flock-foraging species;

- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion;

- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;

- **Predation by the European Red Fox (*Vulpes vulpes*)** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;

- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources;

- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of forest in the Assessment Boundary will result in a loss of potential foraging, shelter and breeding habitat for threatened birds. Additionally, there is the potential for indirect impacts to areas of woodland habitat due to indirect impacts including subsidence. However, the area of forest habitat proposed for removal or modification is fairly small and the intact woodland habitat is unlikely to be significantly altered. As such, the Modification is not likely to have a significant impact on these bird species which are likely to occur in the Assessment Boundary.

C.3.4 Hollow-roosting Microbats

The following Seven-part Test has been prepared as a composite test for a number of hollow-roosting microbat species known or considered likely to occur within the Assessment Boundary:

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);

- Eastern Freetail-bat (*Mormopterus norfolkensis*);

- Southern Myotis (*Myotis macropus*);

- Greater Broad-nosed Bat (*Scoteanax rueppellii*); and

- Corben's Long-eared Bat (*Nyctophilus corbeni*).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modification will remove potential forage, shelter and roosting habitat for these microbat species that are considered to be likely to occur based on records from the Integra or MOC Project Boundaries, their distributional range, the availability of suitable habitat and locality records.

Due to the small areas of regenerating forest proposed from removal or modification, the Modification is not likely to have an adverse effect on the life cycle of individuals likely to occur within the Assessment Boundary. The species are considered to have long-term viability in the locality and region due to the local abundance of the species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Approximately 5.40 ha of native vegetation (as part of movement and foraging areas) is proposed to be removed or modified by the Modification, which includes potential forage, breeding and nesting habitat for a variety of microbats. However, the proposed works will involve minimal clearing within the powerline corridors, and a small area for construction of a goaf dewatering dam and other surface infrastructure, and will not completely remove the vegetation present, therefore the majority of habitat will remain in the Assessment Boundary.

Additionally, there is potential to indirect impacts to woodland habitat, located in the Southern Remnant Offset and Southern Remnant Area RSF and other proximate patches, through impacts such as edge-effects and subsidence. However, these indirect impacts are

expected to be minor, and would not remove or modify the habitat present such that it would be unsuitable for these species.

The clearing within the powerline corridor will contribute to fragmentation of habitat to a minor extent. However, this fragmentation is not likely to represent a barrier to movement of these highly mobile species, in an already fragmented landscape. No isolation of habitat areas will occur.

The forest habitat to be removed or modified is not likely to be great importance to these bat species, as the majority of the patch will be retained in the riparian corridor. The large intact woodland patches within the Assessment Boundary, including Ravensworth State Forest, will continue to be managed for conservation.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for these species has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

No recovery plans exist for these species.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitute or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for these species;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and nesting habitat;
- **Competition from feral honey bees (*Apis mellifera*)** as they compete with native fauna for tree hollows and floral resources; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of forest in the Assessment Boundary will result in a loss of potential foraging, shelter and breeding habitat for threatened hollow-dependant microbats. However, the area

of woodland habitat proposed for removal or modification is fairly small and is in a young regenerating form. As such, the Modification is not likely to have a significant impact on microbat species which are likely to occur in the Assessment Boundary.

C.3.5 Squirrel Glider

The Squirrel Glider (*Petaurus norfolcensis*) is listed as Vulnerable under the TSC Act. This species has not been recorded in the Assessment Boundary, but was recorded during surveys of MOC (Umwelt, 2014) and elsewhere in the locality.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modifications will not remove potential woodland forage habitat for the Squirrel Glider. However, there is potential for indirect impacts to the habitat present within the mature and intact areas of woodland in the Assessment Boundary, however, the extent of this impact is not likely to reduce an area of habitat for this species. The Modification is unlikely to have an adverse effect on locally occurring individuals of this species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

No area of suitable forest or woodland habitat will be removed for this species. There is the potential for some indirect impacts to intact habitat in the Assessment Boundary through impacts such as edge-effects and subsidence, although such impacts are unlikely to result in a reduction or modification of habitat for the Squirrel Glider.

The species is adversely impacted by woodland clearing, particularly of remnant hollow-bearing trees. As the Modification will not require removal of suitable woodland or forest habitat, or hollow-bearing trees, the magnitude of impacts is likely to be minimal.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the Squirrel Glider has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The Action Plan for Australian Marsupial and Monotremes, prepared by Wildlife Australia (1996), is applicable to the Squirrel Glider. The Modification is not inconsistent with the objectives of the Action Plan, as important habitat features will be retained. There are no adjoining Conservation Areas of relevance.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces structural complexity and the abundance of important ground foraging and nesting habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this structural complexity and results in the loss of key food plants and habitat;
- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox (*Vulpes vulpes*)** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The Modification will not result in removal of suitable woodland and forest habitat for the Squirrel Glider in the Assessment Boundary. Potential indirect impacts to suitable habitat are unlikely to result in a reduction of habitat for the species. As such, the Modification is not likely to have a significant impact on this species which is likely to occur in the Assessment Boundary.

C.3.6 Spotted-tailed Quoll

The Spotted-tailed Quoll (*Dasyurus maculatus*) is listed as Vulnerable under the TSC Act and Endangered under the EPBC Act. The species has been recorded in the Assessment Boundary and is considered to have potential to occur on occasion based on the availability of forage habitat. The species has been recorded at MOC and elsewhere in the locality.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modification will remove potential forage habitat for the species, which includes open grassy woodland and riparian forest, which the Spotted-tailed Quoll may potentially use on occasion, as part of a broad range. However, the home ranges of this species greatly exceed the habitat to be removed within the Assessment Boundary. Furthermore, no suitable den sites are available in the Assessment Boundary; the species requires caves, which are not present and large hollow logs which are limited as most of the understorey and woody debris of the Assessment Boundary has previously been cleared for agriculture.

Therefore the Modifications are unlikely to have adverse effects on the life cycle of the species or place it at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Approximately 5.40 ha of native vegetation is proposed to be removed as part of the Modification. This comprises potential forage habitat for the Spotted-tailed Quoll; its removal may restrict the availability and abundance of prey species for the species to a minor extent.

The potential for subsidence to impact on hydrology and groundwater availability has potential to impact on the riparian habitat of this species. However, the changes to surface water flow and shallow aquifers is not expected to be significantly altered from current conditions. Overall, it is considered unlikely to reduce the habitat for Spotted-tail Quoll.

The Modification will increase the fragmentation of existing habitats in the locality to a minor extent, although this is unlikely to affect the capacity of individuals to disperse across the open landscape, particularly as surrounding land is predominantly cleared.

Notwithstanding the above, the home ranges of this species greatly exceed the habitat to be removed within the Assessment Boundary. It is likely that the species occurs in the locality in very low numbers and only infrequently visits the Assessment Boundary. Risks such as predation by foxes and vehicle strike already exist and are unlikely to be significantly increased by the Modification. The Modification is not likely to reduce the function of any movement corridors, such as the vegetated riparian zones, due to the limited disturbance. The Assessment Boundary is also unlikely to be an important breeding habitat as no suitable den sites occur.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the Spotted-tailed Quoll has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A draft national recovery plan for the Spotted-tailed Quoll is currently being prepared. The Action Plan for Australian Marsupial and Monotremes, prepared by Wildlife Australia in 1996, is applicable to the Spotted-tailed Quoll. The Modification is not inconsistent with the objectives of the Action Plan, as important habitat features will be retained.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage and nesting habitat available for this species and its prey;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Removal of dead wood and dead trees** as this reduces the abundance of important ground foraging and den habitat;
- **Invasion of native plant communities by exotic perennial grasses** as this results in the loss of key food plants and habitat;
- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation by the European Red Fox (*Vulpes vulpes*)** as they pose a major threat to the survival of native Australian fauna, with non-flying mammals and ground-nesting birds at greatest risk, particularly as they predate on nests and nesting females;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of riparian forest in the Assessment Boundary will result in a loss of potential foraging habitat for the Spotted-tailed Quoll. However, the area of forest habitat proposed for removal or modification is very small and will not alter the function of the riparian corridor. Notwithstanding the above, the home ranges of this species greatly exceed the habitat to be removed within the Assessment Boundary. It is likely that the species occurs in the locality in very low numbers and only infrequently visits the Assessment Boundary. Risks such as predation by foxes and vehicle strike already exist and are unlikely to be significantly increased by the Modification. The Modification is considered unlikely to result in a significant impact to the Spotted-tailed Quoll.

C.3.7 Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is listed as Vulnerable under both the TSC Act and EPBC Act. The species has previously been recorded in the Assessment Boundary and has potential to occur based on the availability of forage habitat. The species

has been recorded at MOC and elsewhere in the locality and may occasionally fly over the Assessment Boundary.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Modification will remove potential forage habitat for the Grey-headed Flying-fox. Individuals may fly through or forage in the Assessment Boundary as part of their nightly dispersal from roost sites up to 20km away to feed on flowering eucalypts. However, the Modification is not likely to impact on the viability of potentially occurring local populations as they are a highly mobile species and as no camps or local populations occur in the Assessment Boundary.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(d) in relation to the habitat of a threatened species, population or ecological community:

> *(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality*

Approximately 5.40 ha of native vegetation is predicted to be removed as part of the Modification, which includes potential forage habitat for the Grey-headed Flying-fox.

Habitat in the Assessment Boundary is not considered to provide core habitat for the species. The closest known camp is in Singleton. The species typically travels 20km to forage from roost sites and it is likely that individuals will fly over and potentially forage in the Assessment Boundary and elsewhere in the locality as part of their extensive home range.

The clearing within the powerline corridors will contribute to fragmentation of habitat to a minor extent. However, this fragmentation is not likely to represent a barrier to movement of these highly mobile species, in an already fragmented landscape. No isolation of habitat areas will occur.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

No critical habitat for the Grey-headed Flying-fox has been identified by the Director-General of OEH under the TSC Act.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A "Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus)*" (2009) exists, the objectives of which are to encourage recovery by identifying actions to be undertaken to reverse decline and ensure long-term viability of the species. As no camps are present, and the majority of the available foraging habitat will remain, the Modification is consistent with the objectives of the Recovery Plan.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The Modification constitutes or may exacerbate the following KTPs:

- **Clearing of native vegetation** as this reduces the area of forage habitat available for this species;
- **Alteration of habitat due to subsidence from longwall mining** as this reduces habitat availability;
- **Invasion of native plant communities by exotic perennial grasses** as this structural complexity and results in the loss of key food plants and habitat;
- **Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*)** as they compete with native fauna for resources, alter the structure and composition of vegetation, and degrade the land;
- **Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)** as wallowing and rooting causes direct disturbance to habitats and may increase erosion; and
- **Anthropogenic climate change** as this can reduce the geographic range of species and alter the structure and composition of communities.

These KTPs are not expected to be exacerbated to a significant extent, beyond current conditions in the Project Boundary.

Conclusion

The removal of forest in the Assessment Boundary will result in a loss of potential foraging habitat for the Grey-headed Flying-fox. However, the area of forest habitat proposed for removal or modification is very small and is in a young regenerating form. Known camps exist elsewhere in the region and based on a lack of records, the Assessment Boundary does not support a local population. It is likely that the species forages in the Assessment

Boundary on occasion as part of a much larger home range. The removal of vegetation is unlikely to affect the capacity of individuals to continue to disperse through the locality. The Modification is considered unlikely to have a significant impact on the species.

Appendix D

EPBC Act Significant Impact Criteria Assessments

D.1 Assessment of EPBC Act Significant Impact Criteria

The 'significant impact criteria', for each Matter of National Environmental Significance (MNES), are intended to assist you in determining whether the impacts of your proposed action on any matter of national environmental significance are likely to be significant impacts. The criteria are intended to provide general guidance on the types of actions that will require approval and the types of actions that will not require approval (DoE, 2013).

The following tables provide any assessment of the potential for a significant impact to occur to MNES which are present in, or have potential to occur in the Assessment Boundary.

An action is likely to have a significant impact on extinct in the wild species if there is a real chance or possibility that it will satisfy the following criteria:

Table D.1 Assessment of Significant Impact Criteria for Endangered and Critically Endangered Species

Criteria	Significant Impact Expected to Critically Endangered or Endangered Species				
	Illawarra Greenhood	Spotted-tailed Quoll	Green and Golden Bell Frog	Regent Honeyeater	Swift Parrot
Lead to a long-term decrease in the size of a population	No	No	No	No	No
Reduce the area of occupancy of the species	No	No	No	No	No
Fragment an existing population into two or more populations	No	No	No	No	No
Adversely affect habitat critical to the survival of a species	No	No	No	No	No
Disrupt the breeding cycle of a population	No	No	No	No	No
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	No	No	No	No
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No	No	No	No	No
Introduce disease that may cause the species to decline, or	No	No	No	No	No
Interfere with the recovery of the species.	No	No	No	No	No
Significant Impact Predicted?	No	No	No	No	No

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will satisfy the following criteria:

Table D.2 Assessment of Significant Impact Criteria for Vulnerable Species

Criteria	Significant Impact Expected to Vulnerable Species							
	Ozothamnus tesselatus	**Slaty Red Gum**	**Trailing Woodruff**	**Austral Toadflax**	**Grey-headed Flying-fox**	**Painted Honeyeater**	**Large-eared Pied Bat**	**Corben's Long-eared Bat**
Lead to a long-term decrease in the size of an important population of a species	No	No	No	No	No	No	No	No
Reduce the area of occupancy of an important population	No	No	No	No	No	No	No	No
Fragment an existing important population into two or more populations	No	No	No	No	No	No	No	No
Adversely affect habitat critical to the survival of a species	No	No	No	No	No	No	No	No
Disrupt the breeding cycle of an important population	No	No	No	No	No	No	No	No
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	No	No	No	No	No	No	No
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No	No	No	No	No	No	No	No
Introduce disease that may cause the species to decline, or	No	No	No	No	No	No	No	No
Interfere substantially with the recovery of the species.	No	No	No	No	No	No	No	No

Table D.2 Assessment of Significant Impact Criteria for Vulnerable Species

Criteria	Significant Impact Expected to Vulnerable Species							
	Ozothamnus tesselatus	Slaty Red Gum	Trailing Woodruff	Austral Toadflax	Grey-headed Flying-fox	Painted Honeyeater	Large-eared Pied Bat	Corben's Long-eared Bat
Significant Impact Predicted?	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will satisfy the following criteria:

Table D.3 Assessment of Significant Impact Criteria for Critically Endangered Ecological Communities

Criteria	Significant Impact Expected to Critically Endangered Ecological Communities
	Central Hunter Valley Eucalypt Forest and Woodland
Reduce the extent of an ecological community	No
Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	No
Adversely affect habitat critical to the survival of an ecological community	No
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological	No

Table D.3 Assessment of Significant Impact Criteria for Critically Endangered Ecological Communities

Criteria	Significant Impact Expected to Critically Endangered Ecological Communities
	Central Hunter Valley Eucalypt Forest and Woodland
community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	No
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:	No
-- assisting invasive species, that are harmful to the listed ecological community, to become	No
-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	No
Interfere with the recovery of an ecological community.	No
Significant Impact Predicted?	**No**

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will satisfy the following criteria:

Table D.4 Assessment of Significant Impact Criteria for Migratory Species

Criteria	Significant Impact Expected to Migratory Species?		
	Fork-tailed Swift	White-throated Needle-tail	Satin Flycatcher
Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	No	No	No
Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or	No	No	No
Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	No	No	No
Significant Impact Predicted?	**No**	**No**	**No**