Area 2 does not directly cross suitable habitat, however suitable habitat was recorded in cliff lines running adjacent to the proposed access road on its northern side (refer to **Photo 3.3**). Areas of low cliffs, overhangs and small to large caves exist throughout much of the area, while a central high cliff line containing large caves, some inaccessible and therefore not investigated, are present in this location. Area 2, and lands north of it within the proposed Ulan Underground Mine Modification area, contain the highest density of moderate/high quality cave-roosting bat habitat recorded during surveys. Despite surveys, no evidence of a maternity cave or large roost population was recorded in these cliff line areas.

Photo 3.3 Example of cliff line habitats present, north of Area 2

Area 4 does not directly cross suitable habitat, however a small area of cliff overhangs and honeycomb rock was recorded south of the proposed access road within the Approved Ulan West Mine Plan area, representing moderate quality habitat. One such honeycomb contained a small amount of microbat scats and therefore comprises a likely roost for small numbers of bats. The location this was found is shown on **Figure 3.10** and an image on **Photo 3.4**.

Photo 3.4 Potential microbat scats in sandstone overhang, south of Area 4

Within the Potential Indirect Impact Area, there are three main cliff line areas that support potential micro-bat breeding habitat. There is one length of cliff lines in the Potential Indirect Impact Area, where Ulan West longwall 12 is proposed to be expanded, a second one just north of the proposed access track (Area 2 of the Direct Impact Area) and a third just south of Area 2. These are best identified on **Figure 2.10** which

shows where the harp trap surveys were undertaken at these three cliff line locations. The cliff lines around Bat Site 1 had numerous small crevices and overhangs, but no large caves, honeycomb rock or overhangs that would be suitable for a large maternity roost. The cliff lines around Bat Sites 2 and 3 comprised honeycombed sandstone and larger crevices, caves and overhangs. These two sites were considered to support potential breeding habitat for cave-roosting bat species, in particular the large-eared pied-bat (*Chalinolobus dwyeri*). However, no evidence of a maternity roost in any of these three cliff line habitats was recorded during surveys.

While potentially providing roost habitat for the large-eared pied-bat, the large bent-winged bat and the eastern cave bat, the small crevices/overhangs observed within proximity to the Proposed Direct Impact Area were considered to only have potential to support small microbat numbers and are unlikely to comprise maternity roosts.

3.4.2 Harp Trap Results

The results of the harp trapping surveys in January – February 2022 are provided in **Table 3.4**. Note that all harp traps were installed in areas of cliff line habitat in the Potential Indirect Impact Area. There are no cliff lines that will be directly impacted in the Direct Impact Area.

Table 3.4 Harp Trap Results

Bat Site ID	Dates Surveyed	Habitat	Results
1	10-14th Jan 2022 (4 full nights)		No captures
2	10-14th Jan 2022 (4 full nights)		12/01/22 – One *Vespadelus vulturnus* (male)

Bat Site ID	Dates Surveyed	Habitat	Results
3	11-14th Jan 2022 (3 full nights)		11/01/22 - One *Chalinolobus dwyeri* (male) 12/01/22 – one *Nytcophilus geoffroyi* (male)
4	31st Jan – 3rd Feb 2022 (4 full nights)		02/02/22 - one *Chalinolobus dwyeri* (male); one *Vespadelus vulturnus* (male) 03/02/22 – one *Vespadelus vulturnus* (male) 04/02/22 – one *Nyctophilus geoffroyi* (female); one *Vespadelus vulturnus* male)
5	31st Jan – 3rd Feb 2022 (4 full nights)		02/02/22 – one *Chalinolobus dwyeri* (male); one *Rhinolophus megaphyllus* (male) 03/03/22 – one *Nyctophilus geoffroyi* (male)
6 (just east of HT3)	31st Jan – 3rd Feb 2022 (4 full nights)		01/02/22 – one *Rhinolophus megaphyllus* (male) 04/02/22 – one *Nyctophilus geoffroyi* (male)

Bat Site ID	Dates Surveyed	Habitat	Results
7	31st Jan – 3rd Feb 2022 (4 full nights)		Anabat only
8	31st Jan – 3rd Feb 2022 (3 full nights)		Anabat only

3.4.3 Anabat Results

Anabat recording was undertaken in two weeks in January and February 2022, primarily targeting potential breeding habitat for cave-roosting bat species. A total of over 20,000 files were recorded from the eight Anabat units. The Anabat recordings were analysed by Biodiversity Monitoring Services, the results of which are provided in **Appendix A**. The results were filtered to approximately 5000 clear call files, which were identified to species level where possible. The microbat species recorded are listed in **Table 3.5**.

Table 3.5 Summary of Anabat Results

Species	Sites Recorded	BC Act Status	EPBC Act Status
Austronomus australis	All sites except 5 and 6		
Chalinolobus dwyeri	2, 3, 4, 5, 8	V	V
Chalinolobus gouldii	All sites except 6		
Chalinolobus morio	All sites		
Chalinolobus picatus	1, 3, 8		
Miniopterus orinae oceanensis	1, 2, 3, 4, 6, 8	V	-
Mormopterus petersi	1, 2, 3, 4, 5, 8		

Species	Sites Recorded	BC Act Status	EPBC Act Status
Mormopterus planiceps	1, 2, 3, 4, 5, 8		
Mormopterus ridei	All sites except 7		
Nyctophilus geoffroyi	1, 2, 4, 5, 6, 7, 8		
Nytcophilus gouldii	1, 3, 4, 5, 8		
Rhinolophus megaphyllus	All		
Scotorepens balstoni	1, 2, 3, 4, 5, 8		
Vespadelus vulturnus	All		

Note: threatened species are indicated in bold

The results of the Anabat recordings, in combination with the harp trapping results and habitat assessment, were thoroughly reviewed in order to make an informed assessment of the likely presence of a maternity roost for any cave-roosting bat species.

The vulnerable, cave-roosting bat species, large-eared pied-bat (*Chalinolobus dwyeri*), was recorded at most Anabat sites and male individuals were captured at three of the harp sites. While the large-eared pied-bat appears to have a strong presence across the site, the call passes were of relatively low occurrence (most sites were <10 call passes, sites 2 and 3 were <30 passes). Furthermore, no female individuals were captured. Given the evidence from harp trapping, Anabat recordings and habitat assessment, there is no evidence that indicates the presence of a maternity roost for the large-eared pied-bat that is currently in use.

The large bentwing-bat (*Miniopterus orinae oceanensis*) was recorded by Anabat at most sites, generally in low numbers. The highest activity level for this species was recorded at site 3, where 33 and 29 call passes were recorded on the two nights of survey. Given that no individuals were trapped, and the recorded activity levels were relatively low, there is considered to be a low likelihood of the presence of a maternity roost for the large bentwing-bat that is currently in use.

The eastern horseshoe bat (*Rhinolophus megaphyllus*) is considered a regionally significant species at Ulan, given it is a cave-roosting species and is at the western extent of its known distribution. Although not listed as threatened under state or Commonwealth legislation, any potential breeding habitat for this species would be regionally significant. High activity levels of the eastern horseshoe bat were recorded at site 5, with 588 call passes. At the same site (site 5), only one individual male eastern horseshoe bat was captured in the harp trap, despite four nights of trapping. The cave had only a single entrance, and the harp trap covered a significant portion of the entrance, and therefore if it were a roost you would expect higher capture rates. One male of the species was also captured at nearby site 6. Less than ten call passes of the species were recorded by Anabat at nearby sites 6 and 7. On review of these results, it is considered that there is no strong evidence that indicates the presence of a maternity roost for the species at this location. High activity levels at Site 5 could be explained by localised foraging activity by one or more individuals nearby.

4.0 Description of Potential Impacts

4.1 Direct Impacts

The Proposed Modification will result in direct impacts on biodiversity values within the Proposed Direct Impact Area. Direct impacts include the loss of native vegetation and fauna habitats as a result of clearing works for surface infrastructure. It is assumed that all vegetation with the Direct Impact Area will be removed. Where possible, infrastructure areas (Areas 1, 3 and 4) will be rehabilitated (in accordance with UCC approved rehabilitation strategies) when no longer required. The proposed access track (Area 2) is likely to be required for the longer term however, this will be rehabilitated when no longer required.

The total removal of vegetation for direct impacts is calculated to be 27.4 ha. Of this, 9.5 ha is consistent with the White Box Woodland CEEC.

4.2 Maximum Parameters Assessment Area

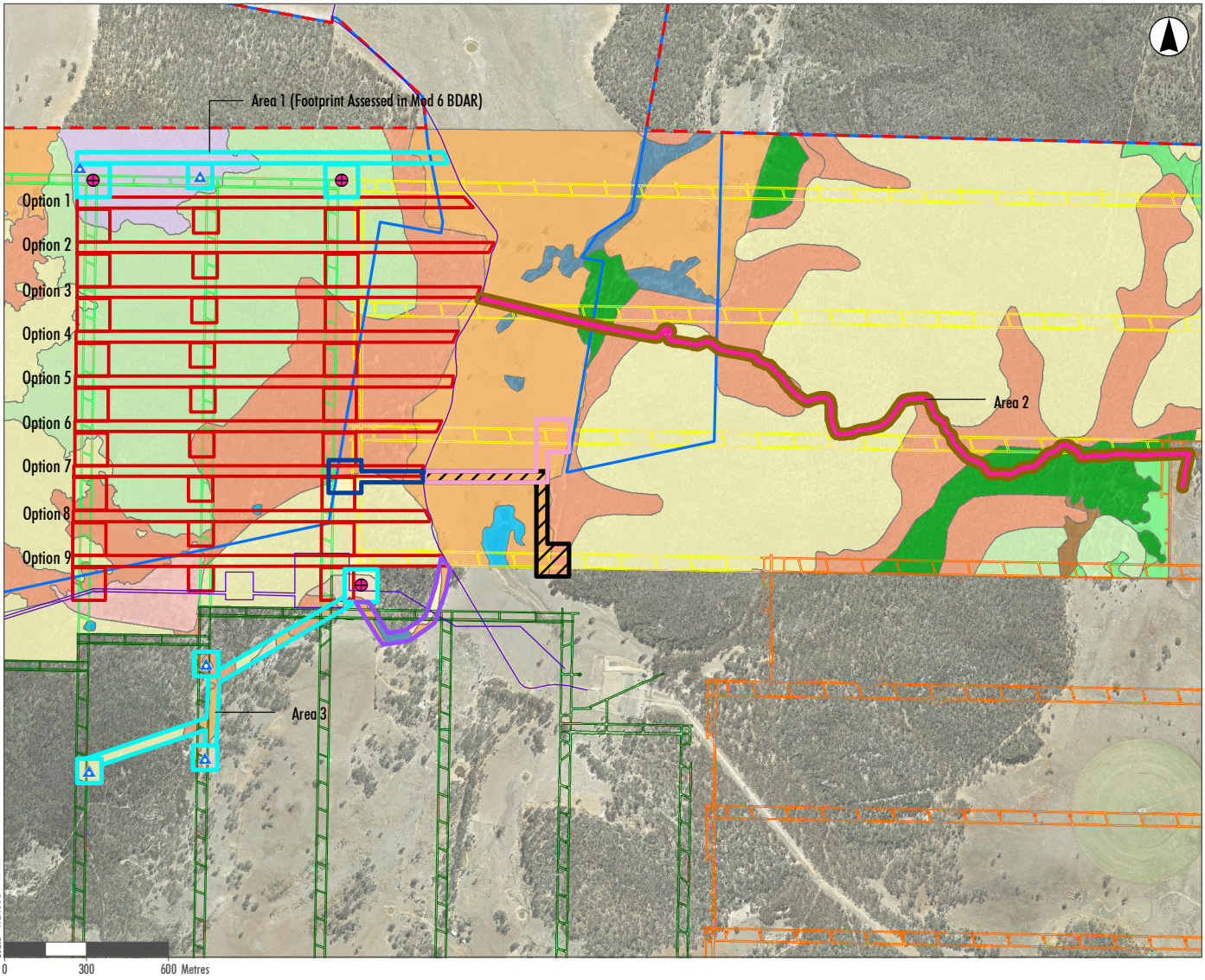
As discussed in **Section 1.3**, a maximum parameters assessment has been prepared to cover 14 additional infrastructure contingency footprints to allow for flexibility in the siting of surface facilities and to provide a worst-case scenario of direct impact should these contingency footprints be selected following project approval. There are nine infrastructure contingency footprints proposed for the Ulan West surface infrastructure, four contingency footprints for the Ulan Underground surface infrastructure and a buffer to the proposed access track (Area 2) which allows for flexibility in the alignment of the track. All 14 contingency footprints are shown on **Figure 1.4**. These 14 infrastructure contingency footprints, along with the Direct Impact Area make up the maximum parameters assessment area. The maximum total potential footprint of direct impacts on vegetation and habitats that may occur from any combination of the Infrastructure Contingency Footprints is 37.1 ha. This compares with a total footprint of disturbance for the assessed Direct Impact Area of 27.4 a The final infrastructure footprints will be determined once the mine plan has been finalised, and will be micro-sited to minimise impacts on biodiversity as much as practicable, including a particular focus on avoiding impacts on the CEEC and other MNES.

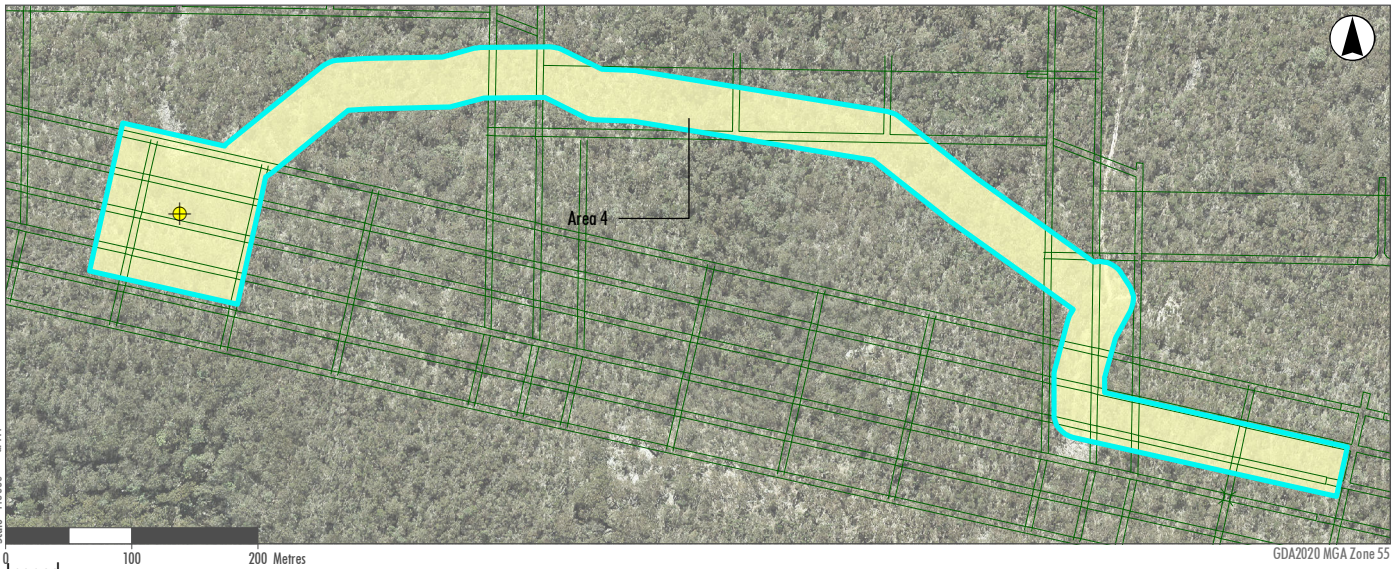
In order to calculate the total area of impact for each vegetation zone for the maximum parameters assessment, an analysis of the areas of each of the vegetation zones that fall within the 14 infrastructure contingency footprints (shown on **Figure 4.1**) was undertaken. From this, the largest area of impact on any one vegetation zone across all footprints was determined. This largest area of impact for each vegetation zone from the contingency footprints was then added to the areas of the Direct Impact Area that have been assessed and are fixed (Areas 1 to 4). The total potential impact on vegetation zones possible from all 14 contingency options are presented in **Table 4.1**.

Table 4.1 Plant community types and vegetation zones within the Maximum Parameters Assessment Area

Zone	PCT ID	PCT Name	Condition Class	Maximum Impact Area (ha)
1	281	Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Derived Native Grassland	0.7
2	281	Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Intact	2.7
3	476	Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	Intact	4.8
4	478	Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Intact	8.4
5	479	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Intact	17.1
6	481	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Derived Native Grassland	7.2
7	481	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Intact	10.8

Zone	PCT ID	PCT Name	Condition Class	Maximum Impact Area (ha)
8	481	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Thinned	0.6
9	618	White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	Thinned	2.1





GDA2020 MGA Zone 55

Legend

- Project Approval Boundary
- Proposed Project Approval Boundary
- Approved Ulan Underground Mine Plan
- Approved Ulan West Mine Plan
- Approved Infrastructure
- Proposed Borehole
- Proposed Vent Shaft
- Proposed Dewatering Bores
- Proposed Infrastructure (Footprint Assessed in Mod 6 BDAR)
- Proposed Access Track Corridor (Footprint Assessed in Mod 6 BDAR)
- Proposed Ulan Underground Mine Plan Modification
- Proposed Ulan West Underground Mine Plan Modification
- Proposed Access Track Corridor Buffer
- Ulan West Infrastructure Options

Ulan Underground Infrastructure Pad Options

- Area A
- Area B
- Area C
- Area D

FIGURE 4.1

Maximum Parameters Area Vegetation Zones

Image Source: Glencore (2018) Data source: Glencore (2020); NSW DFSI (2020)

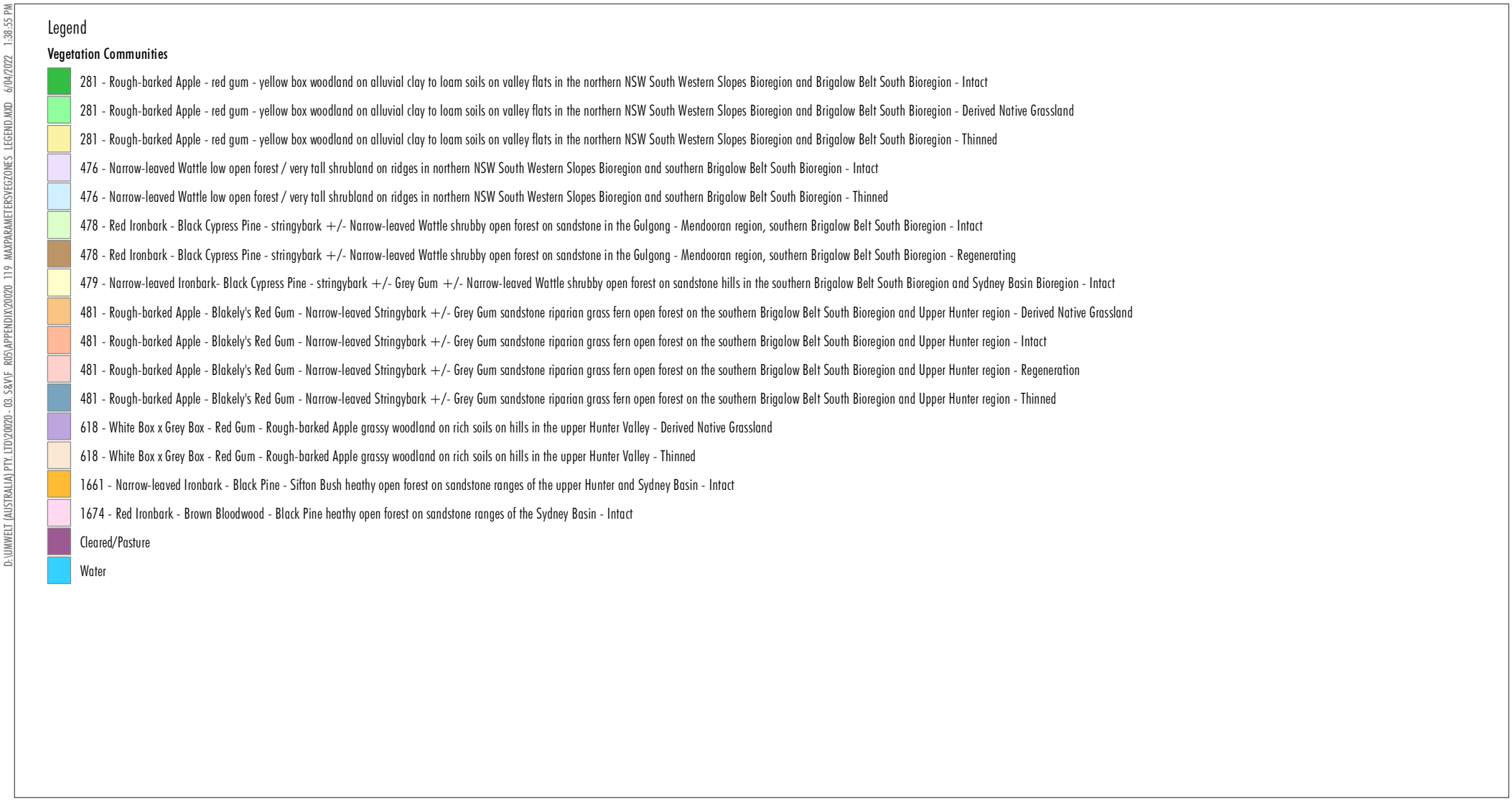


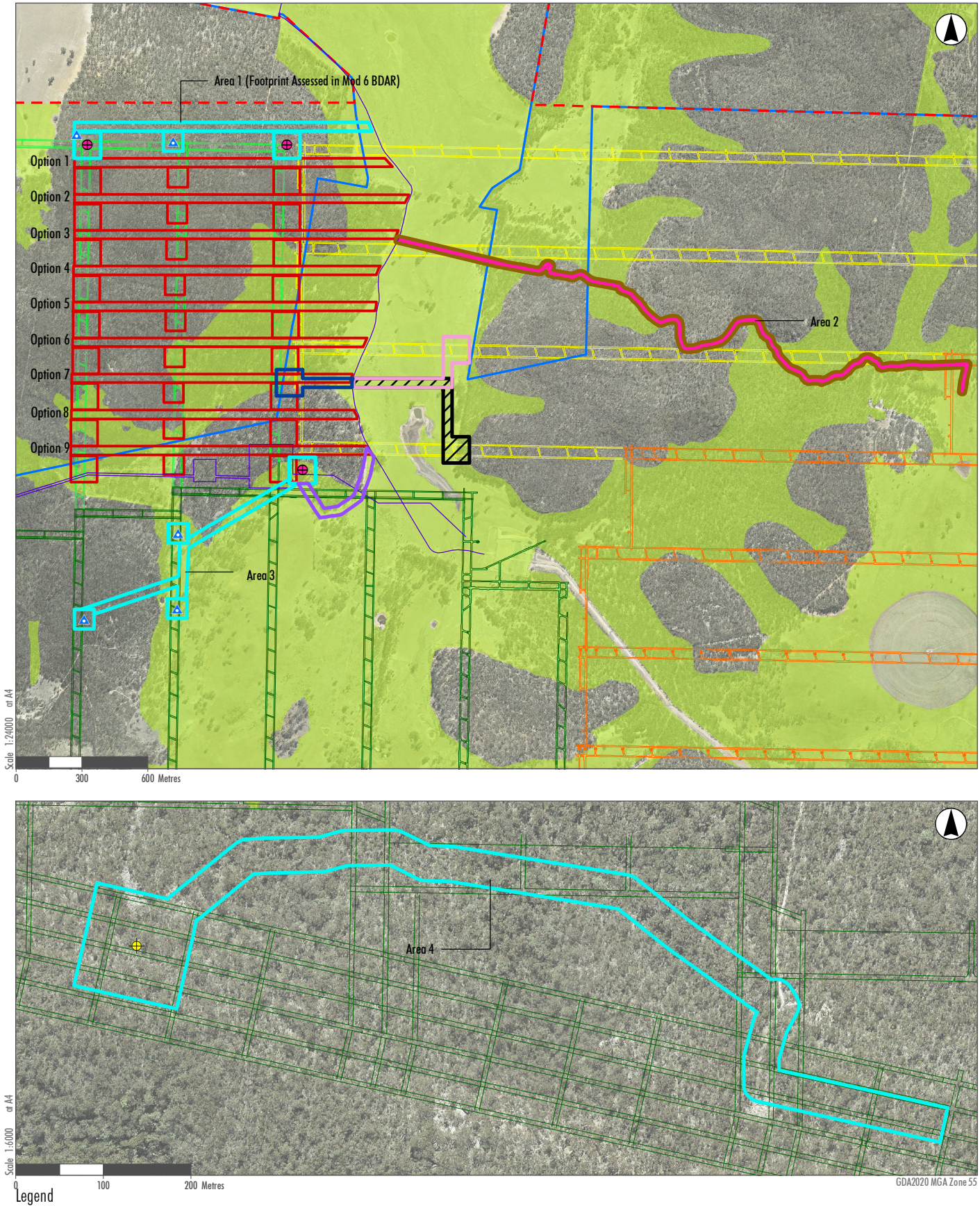
FIGURE 4.1

Maximum Parameters Area
Vegetation Zones

While the calculations presented in **Table 4.1** are important for the BAM assessment presented in the BDAR, in the context of the Referral, the above calculations of total impact on vegetation zones is important in determining the maximum potential impact on the White Box Woodland CEEC. Each vegetation zone that is consistent with the CEEC is listed in **Table 4.2**. This demonstrates that under the maximum parameters assessment approach, 24.1 hectares is the maximum potential impact on the White Box Woodland CEEC. The extent of the White Box Woodland CEEC within the maximum parameters area is shown on **Figure 4.2.**

Table 4.2 Summary of Vegetation Zones within the Maximum Parameters Area that Comprise the White Box Woodland CEEC

Zone	PCT ID	PCT Name	Condition Class	Maximum Area (ha)
1	281	Rough-barked Apple – red gum – yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Derived Native Grassland	0.7
2	281	Rough-barked Apple – red gum – yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Intact	2.7
6	481	Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Derived Native Grassland	7.2
7	481	Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Intact	10.8
8	481	Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region	Thinned	0.6
9	618	White Box x Grey Box – Red Gum – Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	Thinned	2.1
			TOTAL	**24.1**



Legend

- Project Approval Boundary
- Proposed Project Approval Boundary
- Approved Ulan Underground Mine Plan
- Approved Ulan West Mine Plan
- Approved Infrastructure
- Proposed Borehole
- Proposed Vent Shaft
- Proposed Dewatering Bores
- Proposed Infrastructure (Footprint Assessed in Mod 6 BDAR)
- Proposed Access Track Corridor (Footprint Assessed in Mod 6 BDAR)
- Proposed Ulan Underground Mine Plan Modification
- Proposed Ulan West Underground Mine Plan Modification
- White Box - Yellow Box - Blakely's Red Gum CEEC
- Proposed Access Track Corridor Buffer
- Ulan West Infrastructure Options

Ulan Underground Infrastructure Pad Options

- Area A
- Area B
- Area C
- Area D

FIGURE 4.2

Maximum Parameters Area CEEC Extent

Image Source: Glencore (2018) Data source: Glencore (2020); NSW DFSI (2020)

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4.3 Potential Indirect Impacts on Native Vegetation

Subsidence impacts are expected to be relatively consistent with what has occurred for previous mining of longwall areas in the UCC. It is reasonable then to expect that any impacts on native vegetation would be similar to what has been observed and documented to date.

The predicted subsidence impacts for the Proposed Modification indicate that there would be negligible impacts on surface vegetation. The subsidence impacts are not expected to result in loss of vegetation in terms of direct tree failure or death, nor are they expected to result in impact to the condition or viability of vegetation communities within the subsidence affectation area. These predictions draw on the outcomes from extensive monitoring of previous underground mining within the UCC. A summary of the outcomes of relevant documents that monitor/assess native vegetation condition in subsidence affected areas is provided below. These documents are provided as **Appendices B** and **C**.

Review of Historical Subsidence Areas and Impacts on Vegetation (Eco Logical 2015a) (provided in **Appendix B**)

A review was undertaken to determine whether longwall mine subsidence has had an impact on the condition of vegetation communities within the Ulan Underground No. 3 mine area (now referred to as Ulan Underground). There was not sufficient extent of the White Box – Yellow Box – Blakely's Red Gum CEEC above the longwalls targeted to allow for a statistically valid study on that community. The study focused on one of the dominant vegetation types in the UCC, being Ironbark Open Forest Complex.

The study included subsidence impact sites and control sites. The impact sites were in three previously mined longwall areas, within two impact zones within those longwalls. The longwall panels were selected to represent a wide time span (1, 10 and 20 years). Control sites were established in areas where longwall mining had not been undertaken and where subsidence was not expected to occur. The study included plot-based field sampling of a range of vegetation health and condition attributes at control and impact sites. All data were analysed using statistical comparisons.

The following summarises the key outcomes of the study that were reported:

- *for the majority of woodland parameters assessed, there was no significant difference between the longwalls and the control area, or the longwall zones and the control area.*
- *Only percent foliage cover (PFC) of native shrubs (<1m and >1m) showed any statistical differences and in these cases the control area was either lower or similar to the other values.*
- *At the sites surveyed for Year 20, there was a higher PFC of native shrubs >1 metre in comparison to other longwalls surveyed. This was likely related to the evidence of fire at these locations, which would encourage shrub regeneration, and the sites were predominantly located on ridges with shallow sandy soils: a landscape position and substrate observed within the region to be associated with higher densities of shrub species.*
- *The results for habitat values showed that there was no statistical difference for the parameters studied, and therefore no difference between the control and impact sites surveyed.*

Subsidence Monitoring within White Box Woodland (Eco Logical 2015b) (provided in **Appendix C**)

This document provided a summary of the results obtained from monitoring of floristic-based subsidence plots located within the White Box Woodland Critically Endangered Ecological Community and variants under the EPBC Act. Floristic-based subsidence surveys were undertaken above underground mining areas

at locations over a range of vegetation types to monitor the impact of subsidence on vegetation floristic composition and structure. Floristic data obtained from previously mined areas was compared with data from monitoring sites in areas that have not been mined.

The attributes measured included total native and exotic species, as well as native/exotic canopy, midstorey and ground cover species. Results were also compared against the biometric benchmarks for HU654, *White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South*.

The following statements were made in relation to subsidence impacts on the White Box Woodland:

- *Results have shown that overall, the trend in the total number of plant species has remained consistent between sites that have and have not undergone subsidence.*
- *Native species richness has declined across both residual unsubsided and subsided sites.*
- *Numbers of exotic species has been variable across all monitoring periods examined. These trends are consistent between residual and subsided sites.*
- *There were no discernible differences between sites that have and have not undergone subsidence for ground cover.*
- *Canopy cover and midstorey cover have been variable between sites across the monitoring period. Declining midstorey cover has occurred in both residual and subsided sites.*
- *Variability occurs between years and sites, and in comparison to the vegetation condition benchmarks, similarly in plots that are and are not subject to subsidence.*
- *No discernible difference could be attributed to subsidence and the monitoring indicates that the White Box Woodland CEEC floristic plots are not significantly impacted by subsidence*.

Ulan Coal Mines Pty Ltd (UCMPL) Annual Floristic Monitoring in 2020 (Eco Logical 2021a) (provided in **Appendix D**)

The 2020 annual floristic monitoring at UCC was undertaken in autumn and spring, and comprised floristic monitoring, floristic based subsidence monitoring and natural regeneration monitoring (in offset areas). Monitoring was undertaken in accordance with the UCMPL Biodiversity Management Plan (UCMPL 2020). In large part, the document reports on rehabilitation progress, however floristic-based subsidence monitoring is also a component. Floristic-based subsidence was undertaken along six longwall panels in autumn and seven longwall panels in spring. At each site, a range of attributes are recorded, including canopy projected foliage cover (PFC), canopy health and defoliation and photos are taken at fixed monitoring points.

The following statements were made in relation to subsidence impacts on native vegetation:

- *Subsidence impacts to threatened species, populations, habitat or ecological communities were negligible and did not trigger a response from the TARP.*
- *Trees adjacent to or near recorded cracking or slumping appeared to be in good health at time of monitoring.*
- *Field observations of trees appear to be healthy or not adversely affected near subsidence related cracking or slumping.*
- *The effects of root tearing caused by subsidence related cracking and/or slumping cannot be determined with current methodology.*
- *All longwalls recorded a decrease in foliage cover across longwall sites and/or transition sites* since monitoring began.*

- *Monitoring data for the duration of monitoring for each longwall indicates that there has not been a >10% decrease in canopy foliage cover (note than a decrease of >10% would trigger the performance indicator)*
- *Greater decreases in average canopy foliage cover at longwall sites compared to transition sites were recorded across all longwalls except UW LW6 and UW LW4*.

* the transition zone was determined to be from the centre of the longwall pillar to approximately 75 m into the panel (Eco Logical 2015a).

UCMPL Annual Floristic Monitoring in 2019 (Eco Logical 2020a):

The 2019 annual floristic monitoring at UCC was undertaken in autumn and spring, and comprised floristic monitoring, floristic based subsidence monitoring and natural regeneration monitoring (in offset areas). Monitoring was undertaken in accordance with the UCMPL Biodiversity Management Plan (UCMPL 2020). In large part, the document reports on rehabilitation progress, however floristic-based subsidence monitoring is also a component. Floristic-based subsidence was undertaken along six longwall panels in autumn and seven longwall panels in spring. At each of the 60 monitoring sites, a range of attributes are recorded, including canopy projected foliage cover (PFC), canopy health and defoliation and photos are taken at fixed monitoring points.

The following statements were made in relation to subsidence impacts on native vegetation:

- *Results indicate that percentage change in PFC across all monitoring locations is reasonably consistent between longwall and transition sites for the duration of monitoring. Both decreases and, to a lesser extent, increases in PFC have been recorded.*
- *The dominance of a decrease in PFC across both longwall and transition sites may be associated with ongoing drought conditions in the canopy and, to some extent, observer variation between monitoring periods. Therefore it can't be determined if subsidence is impacting upon the vegetation on UW LW4, UG LWW4 and UG LWW5, however, no longwalls recorded a >10% negative move in PFC for the duration of monitoring.*
- *There is no consistent decline in native species richness that indicates an adverse effect of subsidence on tree health.*
- *There is no clear trend showing canopy decline over time that would indicate an adverse impact of subsidence on tree health.*
- *Monitoring sites FBS5 and FBS6 are above White Box Woodland CEEC. Neither site recorded a >10% negative change in overstorey cover.*
- *Results indicate that subsidence is having a negligible impact on ecological communities and that therefore relevant performance measures are being met.*

4.4 Potential Indirect Impacts on Microbat Species

The impact of subsidence on cliff line habitat within the proposed modification areas could potentially involve impacts on rocky habitats which may comprise caves/overhangs/crevices, and therefore could potentially impact on cave dependent microbat species. Current and previous surveys have identified a number of cave-dependent microbat species occurring within the UCC, of which only one species is EPBC Act listed, being the large-eared pied bat (*Chalinolobus dwyeri*). The EPBC Act listed Corben's long-eared bat (*Nyctophilus corbeni*) has been recorded, however it is not a cave-roosting species, rather, it roosts in tree hollows, crevices and under loose bark.

Individual male large-eared pied-bats were captured during harp trap surveys in 2022 (within the Potential Indirect Impact Area only), and low activity levels were detected with the Anabats. Suitable cave habitats

were identified within the Potential Indirect Impact Area (particularly the cliff lines to the north and south of Area 2), however no evidence of maternity roosts or breeding individuals were recorded. No cliff line habitats occur within the Direct Impact Area or within the Contingency Area for the maximum parameters assessment. The species roosts in caves, crevices in cliffs and old mine workings. The structure of maternity roosts appears to be very specific (arch caves with dome roofs) (Department of Environment and Resource Management 2011). Maternity caves generally accommodate colonies of up to 50 females, however some colonies can be up to 500 females in size. There is evidence of two confirmed maternity roost for this species within the UCC, however these do not occur within the Potential Indirect Impact Area, the nearest ones occurring approximately 3 km south-east of the Potential Indirect Impact Area (**Figure 3.10**). Individual records from the surveys for the current project and past surveys are shown on **Figure 3.10**.

The Potential Indirect Impact Area contains a number of cliff line areas and the wider UCC is known to support threatened microbat species that may utilise those cliff line habitats for breeding. The locations of the two confirmed maternity roosts/breeding sites for the large-eared pied-bat are shown on **Figure 3.10** Following investigations of the sandstone cliff line formations within the Potential Indirect Impact Area, cliff line habitats to the north and south of Area 2 were determined to support caves potentially suitable for maternity roosts for the above threatened micro-bat species. However, no evidence of roosts were identified, and harp trapping over two weeks did not result in the capture of any females. There is no evidence of the presence of a currently utilised maternity roost for the above microbat species within the Potential Indirect Impact Area.

If micro-bat species are breeding or roosting within the cliff lines of the Proposed Modification Area, there is potential that subsidence-related rockfall could impact on breeding or roosting caves (if present). If so, two scenarios could occur on:

- Breeding caves (depending on the timing of the impact) – rockfall could damage a cave that is suitable for breeding. Such caves are rare in the landscape as they require very specific temperature and microclimate parameters. The loss of such a cave could prevent breeding in the area (or possibly a larger area) if no other suitable caves were present. Pregnant or lactating females and young could be injured or killed, or juveniles left in crèches could be injured or killed (while females are foraging). Such impacts could significantly impact the ability of the local population to breed and persist in the area.

- Roosting caves (depending on the time of year) – may cause injury or death to colonies of males or females (usually roost in single-sex colonies). Such impacts could significantly impact the ability of the local population to breed and persist in the area.

The above scenarios describe extreme outcomes in terms of potential impacts on breeding or roosting caves, which would occur if there was complete collapse of a breeding cave.

There has been an instance of cave collapse in the UCC previously. In April 2020, complete collapse of a 41 m wide section of sandstone cliff line was observed at monitoring site 811, above Ulan West Longwall 5. This was reported in the 2020 subsidence monitoring report (Pacific Environmental, 2020). This is the largest, continuous rock fall observed to date at Ulan West. Pre-mining micro-bat monitoring surveys of longwall 5 (Hoye 2017) did not detect a breeding roost of any cave-roosting micro-bats in the area of the rockfall. As such, the rockfall did not impact on a known breeding roost of any threatened micro-bats. No post rockfall monitoring has occurred.

Extensive survey and monitoring of microbats has indicated that the subsidence impacts to caves has had no perceptible impact on bat activity within the UCC to date. No maternity roosts for any threatened bat species have been recorded within the Potential Indirect Impact Area, however if one were to occur there is some potential, albeit very low, that cave collapse could occur, based on this previous event described above.

Given that there is a potential risk of damage to cave-roosting bat species, close monitoring of impact areas will continue to be undertaken so that any changes are detected as soon as possible and can be rectified. Pre-mining monitoring will be undertaken in potential cliff line habitats within the Potential Indirect Impact Area to investigate potential cave roosts and therefore to prioritise ongoing monitoring focus.

4.4.1 Past Evidence from Monitoring in Longwall Areas

Detailed monitoring surveys of fauna species (in particular cave roosting microbat species) and the condition of the vegetation above underground mining areas within the UCC have been undertaken since 1980, with studies in the Ulan West area commencing in 2006. These surveys were completed before, during and after underground mining in various locations across the UCC. The results of the monitoring programs have consistently concluded that there have been no discernible impacts on vegetation condition or microbat activity that may be attributed to subsidence impacts. Extracts from recent monitoring documents are provided below that outline these findings.

Particular attention has been paid to the three cave-dependent species that are regularly recorded throughout the UCC and are considered potentially vulnerable to underground mining impacts. These are the large-eared pied bat (*Chalinolobus dwyeri*), eastern bent-winged bat (*Miniopterus orianae oceanensis*) and eastern horseshoe bat (*Rhinolophus megaphyllus*) (although the latter is not threatened it is locally significant). The most recent microbat monitoring program implemented in 2020 (Eco Logical 2021b) also recorded potential records of the eastern cave bat (*Vespadelus troughtoni*) at five impact monitoring sites.

Subsidence performance indicators applicable to the microbat monitoring program are established in the UCC Biodiversity Management Plan (BMP) (UCMPL 2020) and if not met would result in the Trigger Action Response Plan (TARP) being implemented:

- *Analysis of micro-bat monitoring data identifies decreasing activity levels (>10% decline) of endangered micro-bat species during cliff line monitoring (within the Application Area (LW1-6) or within the mined area) over two or more monitoring periods, outside of seasonal variations.*

Extracts from recent microbat monitoring reports are included below, which demonstrate that there has been limited evidence of any substantial or sustained alteration to threatened micro-bat presence and activity in areas following longwall mining. Note that to date, no monitoring has specifically occurred that considers the impacts of the cave collapse observed in longwall 5 of Ulan West. Given that subsidence predictions for the Proposed Modification are similar to those for the previously approved mining and modification areas, similar outcomes would be expected in the areas of the current modification following longwall mining.

Microbat Monitoring 2020 (Eco Logical 2021b) (provided in **Appendix E**)

In response to the TARP being implemented following the analysis of the 2019 microbat monitoring results (see below), a comprehensive review of the monitoring program and monitoring data was undertaken by Eco Logical (2021). The microbat monitoring in 2020 was undertaken generally in accordance with previous monitoring, however the methodology was modified to increase survey effort and therefore the robustness of the resulting dataset. During the 2020 monitoring program, 29 impact sites and eight control sites across the UCC were surveyed in December 2020, with a combination of Anabat recording and harp trapping being used. A summary of some of the key results from the 2020 monitoring program, as reported in Eco Logical (2020), are provided below:

- *Overall large-eared pied-bat and large bent-winged bat activity (definite calls per night) recorded in 2020 was the highest to date.*
- *Large-eared pied-bat call activity at both control and impact sites increased from 2019 to 2020.*
- *Large bent-winged bat call activity increased at control sites and decreased at impact sites from 2019 to 2020. While there was a decline in activity of >10% in 2020 compared with 2019, this decline has not been recorded across two or more survey years and as such the microbat subsidence performance indicator for this species was achieved.*

The 2019 monitoring report (Hoye 2020) (summarised below) reported some monitoring sites where there was a decline in activity levels of the large-eared pied-bat or large bent-winged bat over two or more consecutive years. Eco Logical Pty Ltd undertook subsequent monitoring surveys in 2020 and the activity levels were not reported to trigger any actions. Eco Logical (2021) did not document any concerns or declines in relation to micro-bat activity levels. No explanation or elaboration of the decline in activity level documented in the previous year (Hoye 2020) was provided.

Overall, the 2020 monitoring results (Eco Logical 2021b) suggest that threatened cave-dependant microbat species large-eared pied-bat and large bent-winged bat continue to persist across the UCC, and lactating females continue to be recorded in impact sites, indicating continued breeding in these areas.

Microbat Monitoring 2019 (Hoye 2020) (provided in **Appendix F**)

The 2019 monitoring program saw the continued presence of threatened microbat species that have been recorded during previous monitoring events. However, declining activity levels over a two year period for the large-eared pied-bat and large bent-winged bat were reported at some monitoring sites. This resulted in the implementation of the TARP and further investigations to be undertaken. The 2020 monitoring program saw the introduction of a new monitoring approach in response to this, the outcomes of which are summarised above.

The following statements in relation to subsidence impacts are from the 2019 annual bat monitoring report for UCML (Hoye 2020):

> *General monitoring of microbat species across the Ulan complex shows no trigger relating to the presence/absence of threatened species. No species of threatened microbat previously identified within the Biodiversity Offset Area (BOA) for two or more consecutive monitoring years was not detected in BOA during 2019 annual (in the case of target cliffline and control sites) or biennial (in the case of general sites) monitoring.*
>
> *There were a number of declines in target microbat species activity at impact sites above the longwalls of Ulan West and Ulan Undergroun. Lactating female large-eared pied bats were captured in the 2019 survey at the Ulan Underground LWW3 monitoring site indicating that maternity roosts are still persisting in this area post-mining. Given the significant and sustained declines for these species* [*Chalinolobus dwyeri* and *Miniopterus oriniae oceanensis*] *across individual longwalls, further investigation such as that detailed in the Trigger Action Response Plan (TARP) detailed in the UCML Extraction Plan BMP will need to be enacted for longwalls UWLW2, UWLW3 and UWLW4 (UCML 2019). The actual cause of the declines is not currently known and may be difficult to determine under the current monitoring program. Noted declines up to at least four years post-monitoring indicate that other processes may be causing a reduction in activity. Additional monitoring will assist in determining what processes (including mining impacts) may be resulting in decreased activity.*

It should be noted that prior to 2019, monitoring has not detected any significant difference in microbat activity levels in longwall underground mining areas. The results of the 2019 monitoring did detect declines, and further monitoring was recommended to better understand those results and determine the causes behind those declines. The Eco Logical monitoring completed in 2020 (Eco Logical 2021b) captured further data and provided recommendations of adaptations to the monitoring program so that the most appropriate data is captured and that performance measures are appropriate. Eco Logical (2021) did not report on any concerning activity level declines and no explanation or elaboration of the decline in activity level documented in the previous year of monitoring (Hoye 2020) was provided.

Given that detailed subsidence predictions are comparable between these previously mined areas and the currently proposed mining areas, these conclusions from past monitoring programs are expected to the applicable to the maximum subsidence affectation area for the Referral Area.

The Ulan Coal Continued Operations Modification 4 application proposed to extend longwall panels at both Ulan Underground and Ulan West Operations in order to access an additional 6.4 Mt of ROM coal. Modification 4 was of a similar nature to the current Proposed Action with similar predicted subsidence outcomes, albeit for a smaller area. UCMPL's Modification 4 was referred in 2018 (EPBC 2018/8337). Modification 4 was determined to not be a controlled action.

5.0 Matters of National Environmental Significance

This section provides additional information related to Section 2.0 of the Referral. **Figure 3.1** to **Figure 3.5** display the vegetation zones present in the Referral Area, **Figure 3.6** to **Figure 3.9** show the extent of the White Box Woodland CEEC and **Figure 3.10** displays the threatened species records.

Threatened and/or migratory species and TECs listed under the EPBC Act that have the potential to occur in the Referral Area have been identified based on the results of the searches of the BioNet Atlas of NSW Wildlife Database and DAWE Protected Matters Search Tool (PMST) (accessed February 2022). The results of the PMST are provided as **Appendix F**. An assessment of the likelihood of occurrence has been undertaken, using the definitions provided in **Table 5.1**. Species and communities considered in the assessment are outlined in **Table 5.2**.

Species/communities with a reasonable potential to be impacted by the Proposed Action are subject to Assessments of Significance under the EPBC Act (refer to **Section 6.0**).

Abbreviations used within **Table 5.1** include the following:

V	Vulnerable
E	Endangered
EEC	Endangered Ecological Community
CE	Critically Endangered
CEEC	Critically Endangered Ecological Community
VEC	Vulnerable Ecological Community
C	CAMBA
J	JAMBA
K	ROKAMBA
B	Bonn.

Assessment of likelihood of occurrence of MNES and threatened species in the Referral Area has been provided based on the results of the desktop assessment and field survey outcomes, using the definitions as provided in **Table 5.1.**

Table 5.1 Definitions of Likelihood of Occurrence

Likelihood of Occurrence	Definition
Known	Recent and reliable records of this matter exist within the Referral Area.
Likely	Despite a lack of records, it is probable that the matter occurs in the Referral Area.
Potential / potential habitat	Characteristics of the locality are consistent with the requirements of the matter; however use of this area would be infrequent and episodic, potentially associated with unusual or extreme climatic events (e.g. prolonged drought).
Unlikely	There are no records for this matter, habitat requirements are not met or its normal distribution range does not coincide with the locality. Despite this, the matter may be present in rare circumstances.
No	There is no potential for the species to occur within the locality.

Table 5.2 Threatened and Migratory Species and Communities Recorded or with Potential to Occur within the Referral Area

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
Wetlands of International Importance				
Banrock station wetland complex	-	Ramsar	**Not present** – occurs in South Australia, approximately 1000 km to the south-west of the Referral Area. The Proposed Action will not have any impact on the Banrock station wetland complex.	No
Hunter Estuary Wetlands	-	Ramsar	**Not present** – occurs approximately 260 km to the southeast of the Referral Area. The Proposed Action will not have any impact on the Hunter Estuary Wetlands Ramsar Site.	No
Riverland	-	Ramsar	**Not present** – occurs in South Australia, approximately 1000 km to the south-west of the Referral Area. The Proposed Action will not have any impact on the Riverland wetland.	No
The Coorong, and lakes Alexandria and Albert Wetland	-	Ramsar	**Not present** – occurs in South Australia, approximately 1100 km to the south-west of the Referral Area. The Proposed Action will not have any impact on the Coorong, Lakes Alexandria or Albert Wetland.	No
The Macquarie Marshes	-	Ramsar	**Not present** – occurs approximately 370 km to the north-west of the Referral Area. The Proposed Action will not have any impact on the Macquarie Marshes.	No
Threatened Ecological Communities				
Central Hunter Valley Eucalypt Forest and Woodland	EEC	CEEC	**Not present** – the Referral Area does not occur in the Hunter Valley Catchment Area in which this CEEC is documented to occur.	No
Coolibah – Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions	EEC	EEC	**Not present –** not recorded within the Referral Area and unlikely to occur based on habitat requirements and known distribution.	No
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	EEC	EEC	**Not present** – not recorded within the Referral Area.	No
Natural Grasslands on Basalt and fine-Textured Alluvial Plains of Northern NSW and Southern Queensland	-	CEEC	**Not present** – not recorded within the Referral Area and unlikely to occur based on habitat requirements and known distribution.	No
Weeping Myall woodlands	-	EEC	**Not present** - the Referral Area does not occur in the Hunter Valley Catchment Area in which this EEC is documented to occur.	No
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC	CEEC	**Recorded** – known occurrences in the Referral Area identified through targeted floristic surveys (**Figure 2.2** to **Figure 2.5**). Vegetation mapped as PCT 481, PCT 281 and PCT 618 is considered to conform to the White Box Woodland CEEC. Both Woodland and Derived Native Grassland variants are present.	Yes
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	-	EEC	**Not present**. This EEC occurs on volcanic soils, at altitudes above 650m and with high rainfall. These geophysical characters are not consistent with those of the Referral Area.	No

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
Threatened Flora Species				
Androcalva procumbens	V	V	**No** – this species was not recorded despite extensive threatened species searches. This species is mainly confined to areas to the west of the Referral Area in the Dubbo-Mendooran-Gilgandra region and the Pilliga and Nymagee areas.	No
bluegrass *Dichanthium setosum*	V	V	**No** – not recorded within the Referral Area. It is predominantly located in the northern tablelands in the Saumarez area, west of Armidale and east of Guyra and was not recorded during detailed floristic surveys and targeted threatened species surveys.	No
Euphrasia arguta	CE	CE	**No** - not recorded within the Referral Area and the Referral Area does not provide suitable habitat for this species.	No
Homoranthus darwinioides	V	V	**Potential** - previously recorded within the UCC (1996) (refer to Figure 3.10), however was not recorded within the current Referral Area despite extensive survey in the appropriate season. A known record is approximately 1 km south-west of the southern-most proposed infrastructure area (Area 4) for the current Proposed Action (BioNet Atlas, sighting date 1996). While not recorded, an assessment of significance has been prepared as a precautionary measure.	Yes
hoary sunray *Leucochrysum albicans subsp. tricolor*	-	E	**Potential** - previously recorded within the UCC, approximately 10 km south of Area 4 (BioNet Atlas, sighting dates 2005 and 2008) (refer to **Figure 3.10**), however was not recorded within the current Referral Area despite extensive survey in the appropriate season. The nearest record of this species is 5 km to the south of the southern-most proposed infrastructure area. While not recorded, an assessment of significance has been prepared as a precautionary measure.	Yes
Tarengo leek orchid *Prasophyllum petilum*	E	E	**Unlikely** – not recorded within the Referral Area, and outside known range for the species. The nearest known records are near Ilford, approximately 100 km south of the Referral Area. Note, the NSW Herbarium considers *Prasophyllum petilum* and *Prasophyllum* sp. Wybong to be synonyms however the taxonomic revision is yet to be published.	No
leek orchid *Prasophyllum sp Wybong*	-	CE	**No** – not recorded within the Referral Area, and outside known range for the species. The nearest known records are near Ilford, approximately 100 km south of the Referral Area. Note, the NSW Herbarium considers *Prasophyllum petilum* and *Prasophyllum* sp. Wybong to be synonyms however the taxonomic revision is yet to be published.	No

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
small purple-pea *Swainsona recta*	E	E	**Unlikely** – not recorded within the Referral Area, despite extensive surveys in the known flowering time for the species. There are records of this species approximately 30 km south of the Referral Area, around Mudgee, however has not been recorded in the UCC.	No
austral toadflax *Thesium australe*	V	V	**Unlikely** - not recorded within the Referral Area despite targeted floristic surveys and is unlikely to occur based on a lack of preferred *Themeda triandra* habitat.	No
Tylophora linearis	V	E	**Unlikely** - not recorded within the Referral Area despite targeted floristic surveys. While broad habitat requirements are present in the Referral Area, this species is unlikely to occur based on known distribution. Furthermore, it is not known to be present where there has not been a recent fire or other disturbance.	No
Smooth Bush-pea *Pultenaea glabra*	V	V	**Unlikely** – not recorded within the Referral Area despite targeted floristic surveys. Referral Area is outside the known range for this species. While there is an outlying record in Munghorn Gap Nature Reserve, approximately 60km south-east of the Referral Area (BioNet Atlas, sighting date 2004) the majority of records occur within Wollemi and Blue Mountains National Parks, a substantial distance south of the Referral Area.	No
Spiny Pepper-cress *Lepidium aschersonii*	V	V	**Unlikely** – not recorded within the Referral Area despite targeted floristic surveys and suitable habitats are not present. Nearest known record near Balladoran, approximately 150 km west of the Referral Area (BioNet Atlas, sighting date 2003). This species is known to occur on ridges of gilgai clays and is associated with *Acacia harpophylla*, *Casuarina cristata*, *Allocasuarina luehmannii* and *Eucalyptus microcarpa*. The Referral Area is not associated with Gilgai clays and none of these associated species were recoded.	No
Leionema lamprophyllum subsp. fractum	CE	-	**Unlikely** – not recorded within the Referral Area despite targeted floristic surveys and suitable habitats not present. This species is currently known only from the Broken Back Range near Cessnock, over 200 km east of the Referral Area, (BioNet Atlas, sighting date 2014). Also a historical collection from Munghorn Gap Nature Reserve near Wollar (approximately 60 km west of the Referral Area). It has been recorded from sparse heathland on skeletal soils. Such habitat is not present within the Referral Area.	No

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
Commersonia procumbens	V	V	**Potential** – A single record near Ulan Road (2018). More recently, 15 individuals recorded ~4 km from the project locality (Eco Logical 2022) (**Figure 3.10**). The species is often found as a pioneer species of disturbed habitats. It has been recorded colonising disturbed areas such as roadsides, the edges of quarries and gravel stockpiles and cleared easements under power lines. Many records occur to the west of the Referral Area in Goonoo SCA.	Yes
Threatened Fauna Species				
Birds				
regent honeyeater *Anthochaera phrygia*	CE	CE	**Potential** – the species has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs. The regent honeyeater has not been recorded in the UCC despite many years of extensive surveys. The Referral Area contains low to moderate quality potential habitat for this species and is within the likely distribution of the species.	Yes
curlew sandpiper *Calidris ferruginea*	E	CE	**No** - not recorded within the Referral Area and no potential to occur based on known distribution in mainly coastal wetland environments and lack of suitable habitat.	No
grey falcon *Falco hypoleucos*	E	V	**Unlikely** – this species has not been recorded within the Referral Area, and the nearest record from BioNet is approximately 130 km to the north-west. This species is largely restricted to arid and semi-arid regions, although may occasionally be found in open woodlands near the coast.	No
painted honeyeater *Grantiella picta*	V	V	**Recorded** - a painted honeyeater was recorded by call during the October 2020 field survey, in the south of the Referral Area (Area 4), shown on **Figure 3.10.** There are numerous records within the wider UCC.	Yes
white-throated needletail *Hirundapus caudacutus*	-	V MIG	**Potential** – the species has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs. The species has previously been recorded nearby in the UCC, with a record approximately 3 km east of Area 4, and three records approximately 4 km south and south-east of Area 2 (BioNet Atlas, sighting dates 2016-2018) (refer to **Figure 3.10**).	Yes
swift parrot *Lathamus discolor*	E	CE	**Potential** – the species has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs and the species has previously been recorded in the UCC, approximately 100 m east of the Referral Area (BioNet Atlas, sighting date 2005) (refer to **Figure 3.10**). Eco Logical (2021c) state that the species has been recorded on three occasions, in 2005 and 2007, however no locational information is available for those records (other than the one BioNet record from 2005).	Yes
malleefowl *Leipoa ocellata*	E	V	**Unlikely** – the species has not been recorded and is unlikely to occur based on distribution and habitat. This species is found in arid and semi-arid habitats and is typically not found as far east as the Referral Area.	No

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
eastern curlew *Numenius madagascariensis*	-	CE	**Unlikely** - not recorded within the Referral Area or the surrounds and unlikely to occur based on known distribution in mainly coastal wetland environments and lack of suitable habitat in the Referral Area.	No
superb parrot *Polytelis swainsonii*	V	V	**Unlikely** - the species has not been recorded in the Referral Area despite surveys and there are no records in the UCC and the Referral Area is a significant distance from core breeding areas. The Referral Area broadly meets foraging habitat requirements, however the species is considered unlikely to occur.	No
Australian painted snipe *Rostratula australis*	E	E	**Unlikely** - not recorded within the Referral Area or the surrounds and unlikely to occur based on known distribution in mainly shallow wetlands.	No
Australasian bittern *Botaurus poiciloptilus*	E	E	**Unlikely** – not recorded within the Referral Area or surrounds. Australasian bittern habitat comprises permanent, freshwater wetlands. There are no suitable habitats for this species within the Referral Area.	No
Mammals				
large-eared pied bat *Chalinolobus dwyeri*	V	V	**Likely** – this species has been recorded throughout the UCC previously (refer to **Figure 3.10**), with records largely in the Ulan West Area, south of the Referral Area (BioNet Atlas, sighting dates ranging from 2008-2018). Two records of male large-eared pied-bat were trapped during harp trap surveys in Jan-Feb 2022. No evidence of maternity roosts was recorded. Mapped cliff lines that potentially support breeding habitat for the species (caves, crevices, overhangs etc) occur throughout the proposed longwall areas, however no cliff lines suitable for breeding habitat occur within the Proposed Direct Impact Area.	Yes
spotted-tailed quoll *Dasyurus maculatus maculatus*	V	E	**Potential** – not recorded within the Referral Area and has not been recorded in the UCC despite extensive surveys over many years. Recent individual sightings have been recorded along Ulan Road in the wider locality. The Referral Area does contain areas of suitable foraging and movement habitat for the species as the species' preferred habitat is highly variable.	Yes
Corben's long-eared bat *Nyctophilus corbeni*	V	V	**Likely** –seven records of this species have been recorded throughout the UCC previously (Mt King 2008 and Hoye 2009), the locations of which are shown on **Figure 3.10**. More recently, Eco Logical (2021) documented potential records of this species at four monitoring sites within the UCC. Potential foraging and roosting habitat (tree hollows, crevices, loose bark etc) for this occurs throughout the Referral Area.	Yes
brush-tailed rock-wallaby *Petrogale penicillata*	E	V	**Potential** – the species was not recorded within the Referral Area, however it has been recorded in the UCC, approximately 6.5 km south-east of the Referral Area (BioNet Atlas, sighting date 2001) (refer to **Figure 3.10**). Areas of rocky escarpment provide potential habitat for this species.	Yes

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
koala *Phascolarctos cinereus (Combined Populations of Qld, NSW and ACT)*	V	E	**Potential** –UCC there are three BioNet Atlas records of the koala within the UCC (refer to **Figure 3.10**), however no records within the Referral Area. A record from 1986 occurs approximately 3 km east of Area 2, a 2014 record occurs approximately 1.5 km to the east of Area 4 and a 2015 record occurs approximately 9 km east of Area 4. Note that the 2015 record is from scratchings rather than a confirmed sighting. No records were recorded in the Referral Area during the current study, despite adequate survey effort. Potential foraging habitat occurs throughout the Referral Area.	Yes
New Holland mouse *Pseudomys novaehollandiae*	-	V	**Unlikely** - not recorded within the Referral Area or the UCC despite many years of surveys. Unlikely to occur based on known distribution in contiguous wet eucalypt forests and coastal heaths.	No
grey-headed flying-fox *Pteropus poliocephalus*	V	V	**Potential** – not recorded within the Referral Area however foraging habitat is present. There are no BioNet Atlas records within the UCC, however Umwelt (2015) reported one record approximately 2 km east of the Referral Area (refer to **Figure 3.10**). A known camp is located at Mudgee, approximately 60 km from the Referral Area.	Yes
greater glider *Petauroides volans*	-	V	**Unlikely** – The Referral Area is at or beyond the western limit of the distribution of the greater glider. The species has not been recorded in the UCC or nearby area despite extensive surveys over several years. As this species is readily detected if present - it is unlikely that an undetected population would be present.	No
Herpetofauna				
pink-tailed worm lizard *Aprasia parapulchella*	V	V	**Unlikely** - not recorded within the Referral Area despite targeted seasonal searches in likely habitat. Not recorded in the UCC or nearby area.	No
striped legless lizard *Delma impar*	V	V	**Unlikely** - not recorded within the Referral Area despite targeted seasonal searches in likely habitat. Not recorded in the UCC or nearby area. Nearest known records are in the Muswellbrook-Denman area, approximately 130 km to the east of the Project Site.	No
Booroolong Frog *Litoria booroolongensis*	E	E	**Unlikely** - there are no permanent streams providing suitable habitat for this species within the Referral Area.	No
Fish				
flathead galaxis *Galaxias rostratus*	-	CE	**No** - there is no potential aquatic habitat for this species in the Referral Area. There is no potential for indirect impacts on nearby aquatic habitats such as those in the Talbragar River.	No
trout cod *Maccullochella macquariensis*	-	E	**No** - there is no potential aquatic habitat for this species in the Referral Area. There is no potential for indirect impacts on nearby aquatic habitats such as those in the Talbragar River.	No

MNES Name	Status		Likelihood to Occur within the Referral Area	Assessment of Significance
	BC Act	EPBC Act		
Murray cod *Maccullochella peelii*	-	V	**No** - there is no potential aquatic habitat for this species in the Referral Area. There is no potential for indirect impacts on nearby aquatic habitats such as those in the Talbragar River.	No
Macquarie perch *Macquaria australasica*	-	E	**No** - there is no potential aquatic habitat for this species in the Referral Area. There is no potential for indirect impacts on nearby aquatic habitats such as those in the Talbragar River.	No
Migratory Species				
fork-tailed swift *Apus pacificus*	-	C,J,K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
white-throated needletail *Hirundapus caudacutus*	-	C,J,K	**Potential** - the species has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs. The species has previously been recorded nearby in the UCC, with a record approximately 3 km east of Area 4, and three records approximately 4 km south and south-east of Area 2 (BioNet Atlas, sighting dates 2016-2018) (refer to **Figure 3.10**).	Yes
yellow wagtail *Motacilla flava*	-	C,J,K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
satin flycatcher *Myiagra cyanoleuca*	-	B	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
rufous fantail *Rhipidura rufifrons*	-	B	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
common sandpiper *Actitis hypoleucos*	-	B,C,J,K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
sharp-tailed sandpiper *Calidris acuminata*	-	B,C,J,K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
pectoral sandpiper *Calidris melanotos*		B, J, K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
Latham's snipe *Gallinago hardwickii*	-	B,J,K	**Unlikely** – the species has not been recorded in the Referral Area and suitable habitats are not present.	No
Caspian Tern *Hydroprogne caspia*	-	J	**Unlikely** - single species record (2004) within the Referral Area, located Rowan's Dam, Ulan Coal Mine. This is a rare, vagrant record for the area. This species typically occurs around Australia's coastline, and in major inland rivers. There is no potential for a resident population of the species to occur within the Referral Area. There is no potential for habitat for a population of the Caspian Tern to be impacted by The Project.	No

6.0 Assessments of Significance

The information in this section relates to relevant portions of Section 2.0 of the referral form and provides a detailed assessment of the impact of the Proposed Action on MNES that are known or are predicted to occur within the Referral Area.

The EPBC Act requires an Assessment of Significance relating to the potential impacts of a proposed action on listed MNES. These assessments have been conducted in accordance with the *Significant Impact Guidelines 1.1* (DoE 2013), based on the current mine plan.

As outlined in **Table 5.2**, the following EPBC Act listed species and communities are considered to have the potential to occur or be impacted by the Proposed Action, based on previous records or suitable habitat, and are subject to an Assessment of Significance below:

Critically Endangered or Endangered Ecological Communities:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC.

Critically Endangered and Endangered Species:

- hoary sunray (*Leucochrysum albicans* subsp. *tricolor*)
- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) (SE mainland population)
- koala (*Phascolarctos cinereus*) (combined Populations of Qld, NSW and ACT).

Vulnerable Species:

- *Homoranthus darwinoides*
- *Commersonia procumbens*
- painted honeyeater (*Grantiella picta*)
- white-throated needletail (*Hirundapus caudacutus*)
- large-eared pied bat (*Chalinolobus dwyeri*)
- Corben's long-eared bat (*Nytophilus corbeni*)
- brush-tailed rock-wallaby (*Petrogale penicillata*)
- grey-headed flying fox (*Pteropus poliocephalus*).

Migratory Species under International Conventions:

- white-throated needletail (*Hirundapus caudacutus*).

The Assessments of Significance have been prepared with consideration to the maximum parameters approach to ensure that if any of the Infrastructure Contingency Footprint options are required to be utilised, then the maximum extent of potential impacts on threatened species and TECs has been assessed. While this maximum parameters approach has been adopted to allow flexibility and avoid the requirement for a project modification in the future, all efforts will be made during the planning of final infrastructure footprints to ensure that impacts on native vegetation and habitats is minimised, particularly those relating to important ecological values such as threatened species and TECs and their habitats (such as hollow trees).

As described in **Section 4.2**, the relevant maximum parameters Areas as utilised for this assessment are:

- **Total Maximum Disturbance Footprint (disturbance to native vegetation and habitats): 37.1 ha** (compared with 27.4ha for the Direct Impact Area presented in this Referral)

- **Total Maximum Disturbance to White Box Woodland CEEC: 24.1 ha** (compared with 9.5 ha for the Direct Impact Area presented in this Referral).

Some other calculations have been used for the following assessment of significance for species for which potential habitat is restricted to particular vegetation zones. These are as follows:

- Fairy bells (*Homoranthus darwinoides*) potential habitat comprises PCTs 476, 478 and 479. The maximum potential area of impact on these PCTs (from the Maximum Parameter areas shown in **Table 4.1**) is **30.3 ha.**

- Swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*) potential habitat comprises woodland condition of PCT 281 and 618. The maximum potential area of impact on these PCTS (from the Maximum Parameter areas shown in **Table 4.1**) is **4.8 ha.**

- The **37.1 ha** maximum footprint area has been utilised for species for which potential habitat covers the majority of the vegetation zones.

Direct Impacts of the Proposed Action will disturb up to 37.1 ha of native vegetation (which is known or potential habitat for threatened species) and disturbance to up to 24.1 hectares of vegetation that comprises the White Box – Yellow Box – Blakely's Red Gum Woodland CEEC. This is not an insubstantial area of disturbance, however, given there are significant areas of similar condition native vegetation in the local area, there will not be any material fragmentation or isolation of habitats, and once mining has progressed a significant portion of the final Direct Impact Area will be revegetated, the Proposed Action is not likely to result in a significant impact on any threatened species or ecological communities.

The potential indirect impacts of the Proposed Action (associated with subsidence) are not expected to impact on surface vegetation and habitats in any material way. There is some risk of subsidence affecting cave-roosting microbat species habitats, however evidence from a long history of microbat monitoring studies in the UCC indicates that threatened microbat species, large-eared pied-bat and large bent-winged bat continue to persist in longwall mining areas and there is continued evidence of breeding through capture of lactating females. However, a 41 m length of sandstone overhang collapsed in the area off Ulan West Longwall 5 in 2020, following the progress of mining in that area, and therefore the potential risk of damage to potential breeding habitats has been considered in this assessment.

6.1 Critically Endangered or Endangered Ecological Communities

6.1.1 White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

The distribution of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC is from the western slopes and tablelands of the Great Dividing Range from southern Queensland to central Victoria (DECCW, 2011). It occurs in the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions (TSSC, 2006).

Detailed assessment of the vegetation communities described and mapped within the Referral Area was undertaken to determine whether the vegetation present met the condition class thresholds identified in the Listing Advice (TSSC 2006). As a result of detailed analysis, the following PCTs in the Referral Area were identified as having (or likely to previously have had) Blakely's red gum (*Eucalyptus blakelyi*), yellow box (*Eucalyptus melliodora*) or white box – grey box intergrades (*Eucalyptus albens x Eucalyptus moluccana*) as the dominant overstorey species:

- 281 Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- 481 - Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on the southern Brigalow Belt South Bioregion and Upper Hunter region
- 618 - White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley.

These PCTs all exhibited a predominantly native understorey and exceeded the minimum patch size of 0.1 ha that is specified in the Listing Advice (TSSC 2006). These PCTs also met the Listing Advice criteria of containing at least 12 or more native understorey species.

Approximately 452.3 ha of *White Box – Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland* CEEC has been mapped within the Referral Area, of which 9.5 ha occurs in the Direct Impact Area. Under the maximum parameters assessment approach, up to 24.1 ha (16.2 ha woodland and 7.9 ha derived native grassland) could be directly impacted (as a result of direct clearing) by the Proposed Action (**Table 6.1**). Approximately 409.2 ha of the CEEC occurs within the Potential Indirect Impact Area, where there would only be potential indirect impacts resulting from subsidence. A review of historical subsidence areas and impacts on vegetation (Eco Logical, 2015a) and an assessment of subsidence monitoring within White Box Woodland (Eco Logical, 2015b) were undertaken for the EPBC Referral for EPBC 2015/7511, in 2015. The studies assessed woodland condition parameters including canopy health, vegetation structure and habitat features within specific vegetation communities (for valid comparison) in areas that were subsided 1, 10 and 20 years previously against the same vegetation communities remote from mining and found no statistically significant differences (Eco Logical, 2015a). Monitoring of floristic-based subsidence (FBS) plots located within White Box Woodland has also not identified any discernible difference between subsided and un-subsided White Box Woodland CEEC floristic plots (Eco Logical, 2015b). Therefore, subsidence impacts to vegetation are expected to be negligible. Consequently, there would be negligible, if any, impacts on the CEEC as a result of the proposed underground mining as part of the Proposed Action.

Table 6.1 provides a summary of the relevant impact areas for White Box Woodland CEEC and the Proposed Action.

Table 6.1 Summary of Relevant Impact Areas of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (woodland component)	284.8	6.5	16.2
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (grassland component)	167.5	3.0	7.9
Total	**452.3**	**9.5**	**24.1**

^As per Maximum Parameters Assessment Approach.

As such, the following assessment of significance considers the direct impacts associated with the surface infrastructure, which would remove up to 16.2 ha woodland and up to 7.9 ha derived native grassland that conforms to the CEEC (up to 24.1 ha total).

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:

- **reduce the extent of an ecological community;**

Up to 16.2 ha of woodland and 7.9 ha of derived native grassland that conforms to the CEEC will be directly impacted as a result of the Proposed Action. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls in the UCC, there would be negligible, if any, impacts on the CEEC as a result of the proposed underground mining as part of the Proposed Action.

The estimated total current national extent of White Box Yellow Box – Blakely's Red Gum Woodland and Derived Native Grassland is estimated to be approximately 416,000 ha (TSSC 2006), of which approximately 250,729 ha is known to occur in NSW. The permanent loss of up to 16.2 ha woodland and 7.9 ha of derived native grassland CEEC as a result of the Proposed Action represents a negligible reduction in the estimated current extent of the community across its national range, estimated to be approximately 0.006 % of the current extent of the community in NSW.

- **fragment or increase fragmentation of an ecological community;**

This ecological community has been heavily cleared across most of its range. The remaining extent of the ecological community is highly fragmented, occurring in small isolated patches within a cleared environment, or within a landscape of other disturbed woodlands (TSSC, 2006).

Vegetation occurring within the Referral Area currently has relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. The direct impact to up to 16.2 ha woodland and 7.9 ha of derived native grassland conforming to White Box CEEC will be spread across four small, linear areas and will not result in a material increase in the level of fragmentation of this CEEC in the local area or across its range.

- **adversely affect habitat critical to the survival of an ecological community;**

The National Recovery Plan for the CEEC identifies habitat critical to the survival of White Box Woodland CEEC is on the moderate to highly fertile soils of the western slopes of NSW and Queensland, the northern slopes of Victoria, and the tablelands of the Great Dividing Range from southern Queensland through NSW

and the ACT. Given the current highly fragmented and degraded state of this ecological community, all areas of White Box Woodland CEEC which meet the minimum condition criteria outlined in the National Recovery plan are critical to the survival of this ecological community.

The approximately 452 ha of White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC within the Referral Area would be critical to the survival of the CEEC, in accordance with the criteria prescribed in the National Recovery Plan for the CEEC (DECCW 2011).

The Proposed Action would result in the removal of habitat critical to the survival of the White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC, however the extent of proposed clearing represents a small area in the context of the broader range of the community both in NSW and in Australia.

- **modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;**

While up to 16.2 ha woodland and 7.9 ha of derived native grassland that conforms to the CEEC will be removed from the Referral Area, the Proposed Action is not expected to adversely affect retained areas of the CEEC occurring outside the Referral Area as the Proposed Action is not predicted to result in significant offsite impacts such that it would affect vegetation. The Proposed Action will include detailed consideration of the effect of the Proposed Action on groundwater regimes and surface water flows. There will not be substantial alteration to surface water patterns associated with the White Box CEEC as a result of the Proposed Action. The Proposed Action will result in changes to groundwater, however, these changes are not expected to have a material effect on the White Box CEEC, as evidenced by the Review of Historical Subsidence Areas and Impacts on Vegetation (Eco Logical, 2015a) and Assessment of Subsidence Monitoring within White Box Woodland (Eco Logical, 2015b).

- **cause substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species; or**

It is well documented that the invasion and establishment of exotic species contributes to a reduction in ecological function of this ecological community. Weeds compete with locally indigenous flora for available resources and often limit the diversity and regenerative capacity of a native ecosystem. A number of perennial and annual weeds pose a serious threat to the CEEC, amongst the most serious threats are Coolatai grass (*Hyparhhenia hirta*), African lovegrass (*Eragrostis curvula*), Phalaris (*Phalaris aquatica*), St John's wort (*Hypericum perforatum*), African boxthorn (*Lycium ferocissimum*) and African olive (*Olea europaea* subsp. *cuspidata*) (DECCW 2011).

The Proposed Action will result in the direct removal (and therefore substantial change) of up to 16.2 ha of woodland and 7.9 ha of derived native grassland that conforms to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. The maximum of 24.1 ha of White Box CEEC to be removed represents a relatively small proportion of the CEEC which occurs widely throughout the wider UCC and broader locality. The Proposed Action will not result in a change to the composition of species in adjacent areas of CEEC.

- **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**
    - **assisting invasive species that are harmful to the listed ecological community to become established, or**

The Listing Advice for this community states that there has been an overall reduction in the integrity of this ecological community compared with its pre-1750 state. There are essentially no areas remaining that could be considered fully intact, as most patches have at least some degree of weed invasion.

The majority of the remaining extent has lost its native understorey, lost whole suites of species, been invaded by exotic species or lost structural integrity in terms of the loss of shrub, tree or ground layers. Further invasion by exotic species and landscape-scale effects such as salinity, nutrient enrichment, soil structural decline and altered fire regimes are likely to detrimentally effect the integrity of the remaining ecological community in the future (TSSC 2006).

The Proposed Action will result in the removal of up to 16.2 ha woodland and 7.9 ha of derived native grassland that conforms to the CEEC. The remaining woodland areas of the CEEC within the Referral Area currently support relatively low weed cover, while the DNG examples are more disturbed and support higher weed cover. Evidence of pest species such as pigs, rabbit and deer were observed throughout the Referral Area including within the CEEC. The Proposed Action is not likely to result in any substantial increase or spread of invasive species that are harmful to the CEEC.

- **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**

The Proposed Action will not cause regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the surrounding extent of the CEEC.

- **interfere with the recovery of an ecological community;**

A National Recovery Plan has been prepared for White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC (DECCW, 2011). The objectives of this plan includes achieving no net loss in the extent and condition of the CEEC, increasing protection of sites with high recovery potential, increasing landscape functionality through management and restoration of degraded sites and increasing transitional areas around remnants and linkages between remnants.

Any impacts to known occurrences of the White Box-Yellow Box-Blakely's Red Gum Woodland and Derived Native Grassland CEEC will likely be inconsistent with the objectives of the recovery plan. Recovery recommendations includes avoiding clearance and fragmentation of the CEEC. The Proposed Action includes the removal of up to 16.2 ha woodland and 7.9 ha of derived native grassland that conforms to the CEEC and would therefore, under this definition, interfere with the recovery of this CEEC, although only in a minor way. Final surface infrastructure footprints will be micro sited to avoid and limit disturbance to the CEEC as far as practicable and, on completion of operations, the majority of surface infrastructure areas will be revegetated. A comprehensive Offset Strategy will be developed to compensate for the direct impacts to up to 24.1 ha of the CEEC. This will likely involve strategies for the restoration and management of remnants of the CEEC. Given the small area of disturbance to the CEEC resulting from the Proposed Action, and the implementation of minimisation and offset strategies, any interference to the recovery of the CEEC would be minor and is unlikely to constitute a significant impact.

Conclusion

The Proposed Action would include the removal of up to 16.2 ha of woodland and up to 7.9 ha of derived native grassland that conforms to the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. The Proposed Action is not considered to result in a significant impact on the CEEC as the Proposed Action will result in the clearing of approximately 0.006% of the current extent the community across its NSW range; it will not materially increase fragmentation, and will not cause the further degradation of adjacent retained examples of the CEEC in proximity to the Referral Area.

The Proposed Action is **unlikely** to result in a significant impact on the CEEC.

6.2 Critically Endangered and Endangered Species

The following critically endangered and endangered species are considered in this assessment:

- hoary sunray (*Leucochrysum albicans* subsp. *tricolor*)
- swift parrot (*Lathamus discolor*)
- regent honeyeater (*Anthochaera phrygia*)
- spotted-tailed quoll (*Dasyurus maculatus maculatus*) (SE mainland population)
- koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and ACT).

Species descriptions, in the Assessments of Significance below, are referenced from the OEH online species profiles, unless otherwise noted (OEH 2020).

6.2.1 Leucochrysum albicans var. *tricolor*

The hoary sunray *Leucochrysum albicans* var. *tricolor* is a small (up to 15 cm), perennial paper daisy endemic to south-eastern Australia (Sinclair 2010). The species is perennial, however dies back over summer, the plant surviving as a perennial rootstock. The *albicans* flower heads are yellow, 2-5 cm in diameter, surrounded by white over-lapping papery bracts. In NSW, the species occurs in the Southern Tablelands and some adjacent areas, in the South Eastern Highlands, Australian Alps and Sydney Basin bioregions. The species occupies a range of habitats from grasslands to forests, typically on heavy soils.

The National Recovery Plan for the species (Sinclair 2010), lists significant populations of the hoary sunray. There are no listed significant populations of the hoary sunray within proximity to the Referral Area, the majority of these being situated in the south of NSW and into ACT, Victoria and Tasmania.

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The hoary sunray currently exists in numerous populations in NSW, likely to total >200,000 plants (Sinclair 2010). There are a small number of known records nearby to the UCC, at the Ulan township. These records represent the northern known geographical limit of the species. The species has not been recorded within the Referral Area. Based on the maximum parameters approach, up to 37.1 ha of potential habitat for the hoary sunray would be directly disturbed by the Proposed Action for construction of surface infrastructure

(refer to **Table 6.2**). There are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.2 Summary of Relevant Impact Areas for Hoary Sunray

Potential Hoary Sunray Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and grassland	1088.6	27.4	37.1
Total	**1088.6**	**27.4**	**37.1**

^As per Maximum Parameters Assessment Approach.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

A *population* of the hoary sunray has not been recorded within the Referral Area, however the species has been recorded in the UCC previously (Umwelt 2009 and Umwelt 2015), near the township of Ulan, south of the current Referral Area. The Referral Area broadly supports potential habitat for the hoary sunray. A maximum of 37.1 ha of potential habitat for the hoary sunray would be directly disturbed by the Proposed Action for construction of surface infrastructure. Given that the Direct Impact Area has been extensively surveyed with no records of the hoary sunray, it is considered unlikely that the species would occur, and therefore an impact on a population of the species is unlikely. There are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

The Proposed Action is unlikely to lead to a long-term decrease in the size of a population of hoary sunray.

- **reduce the area of occupancy of the species; or**

A maximum of 37.1 ha of potential habitat for the hoary sunray would be directly disturbed by the Proposed Action for construction of surface infrastructure. Given that the Proposed Direct Impact Area has been extensively surveyed with no records of the hoary sunray, it is considered unlikely that the species would occur, and therefore an impact on a population of the species is unlikely.

It is considered unlikely that the Proposed Action would impact on any individuals of the hoary sunray and any potential reduction in the area of occupancy of the species would be minor.

- **fragment an existing *population* into two or more populations; or**

Records of the hoary sunray have not been recorded within the Referral Area, however the species has been recorded in the UCC previously, approximately 10 km south of the Referral Area (BioNet Atlas, sighting dates 2005 and 2008). Given the extensive surveys undertaken within the Proposed Direct Impact Area, the species is unlikely to occur. The location and scale of clearing required for the Proposed Action would not result in the fragmentation of any potentially occurring population.

It is unlikely that the Proposed Action would result in the fragmentation of any potentially existing *population* of hoary sunray into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

The Proposed Action will result in the loss of 37.1 ha of this potential habitat for the hoary sunray. The habitats of the Referral Area are not considered to be critical to the survival of the hoary sunray.

The Proposed Action will not adversely affect habitat critical to the survival of the hoary sunray.

- **disrupt the breeding cycle of a *population*; or**

There are no known records of the hoary sunray within the Referral Area. Potential habitat does occur, however the species is considered unlikely to occur. Any potential records of the species within Proposed Direct Impact Area would be subject to direct disturbance and subsequently the breeding cycle would be disrupted for any individual affected. Given that the species has not been recorded despite extensive survey, any potentially occurring individuals would be in low numbers, and any disturbance would not lead to a significant disruption to the breeding cycle of the population.

The Proposed Action will not disrupt the breeding cycle of any known *population* of the hoary sunray.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The Proposed Action does not comprise known habitat for the hoary sunray, however up to 37.1 ha of potential habitat will be disturbed. Given that the species has not been recorded despite extensive survey, any potentially occurring population would be in low numbers, and any disturbance would not lead to a significant decline in the species.

The Proposed Action is unlikely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that a *population* of the hoary sunray would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to a *population* of the hoary sunray becoming established in this species habitat.

- **introduce disease that may cause the species to decline; or**

The Proposed Action is not expected to introduce any disease that may cause the hoary sunray to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared: National Recovery Plan for the Hoary Sunray (*Leucochrysum albicans* var. *tricolor*) (Sinclair 2010).

The Proposed Action does not interfere with any conservation measures or recovery objectives as outlined in the Recovery Plan.

Conclusion

The hoary sunray has not been recorded within the Referral Area, however has been recorded at the UCC previously. The Proposed Action will directly disturb a maximum of 37.1 ha of vegetation that broadly meets the habitat requirements of the hoary sunray. It is considered unlikely that the species would occur in the area of disturbance due to the substantial surveys that have been undertaken.

Based on the above assessment, the Proposed Action is **unlikely** to result in a significant impact on a *population* of the hoary sunray.

6.2.2 Swift Parrot

The swift parrot is listed as critically endangered under the EPBC Act. The species breeds in Tasmania and moves to mainland Australia for the non-breeding season (usually arriving between February and March) (Saunders and Tzaros 2011). Most of the population winters in Victoria and NSW where it disperses across broad landscapes foraging on nectar and lerps in eucalypts. Until recently it was believed that in NSW, swift parrots forage mostly in the coastal and western slopes region along the inland slopes of the Great Dividing Range but are patchily distributed along the north and south coasts including the Sydney region (Saunders and Tzaros 2011). However, evidence is gathering that the forests on the coastal plains from southern to northern NSW are also important. They return to Tasmania in spring (September-October). The movements of this species on the mainland are poorly understood, but it is considered to be nomadic and irruptive, moving in response to food supply.

Upon reaching their core non-breeding range there is no known geographical pattern of movement. During the non-breeding season, the home-range varies tremendously between individuals and between years.

Priority sites for this species have been identified within the National Recovery Plan for the species (Saunders and Tzaros 2011). This species is likely to utilise coastal forest and river-flat vegetation associations within the coastal natural resource management region (which includes the Hunter-Central Rivers), in communities dominated by swamp mahogany (*Eucalyptus robusta*), blackbutt (*Eucalyptus pilularis*), forest red gum (*Eucalyptus tereticornis*) and spotted gum (*Corymbia maculata*) (Saunders and Tzaros 2011).

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The swift parrot occurs as a single *population* that migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders and Tzaros 2011). The total swift parrot population is estimated to be no more than 1000 pairs (Saunders et al 2010).

As the species occurs as a single population in Australia, any record of the species would constitute a part of a *population* as described above. This species has the potential to make use of the open forest and woodland habitats of the Referral Area, particularly where there are prolific flowering eucalypts as this migratory species is likely to move throughout the area in response to mass flowering events. This species does not breed on mainland Australia, and as such the Referral Area only represents potential foraging habitat for this species.

There is one BioNet record of the swift parrot just east of the Referral Area (**Figure 3.10**) from 2005. The 2020 fauna monitoring report indicates the species has been recorded on three occasions in 2005 and 2007 (Eco Logical 2021c), however no further locational data is given. Ongoing targeted monitoring for the swift parrot has been undertaken for at least ten years, with no records documented since 2007.

The Referral Area contains moderate quality potential foraging habitat for this species. The Swift Parrot Recovery Plan (Saunders and Tzaros 2011) recognises the White Box – Yellow Box – Blakely's Red Gum Woodland CEEC as potential habitat for the species and also lists a number of key foraging tree species that are important for the species.

The following vegetation communities are identified as potential foraging habitat for the swift parrot in the Referral Area, based on the presence of white box (*Eucalyptus albens*) (in this case the *E albens x moluccana* intergrade, which is precautionarily assumed to also comprise a key feed species) and yellow box (*Eucalyptus melliodora*) which are identified as key foraging resources for the swift parrot (as per Saunders and Tzaros 2011):

- PCT 281 - Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion – Intact and Thinned.

- PCT 618 - White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley - Thinned.

Note that while PCT 481 also comprises the Box-Gum Woodland CEEC, it does not contain any of the key foraging tree species.**Table 6.3** outlines the relevant potential impact areas for swift parrot as a result of the Proposed Action.

Table 6.3 Summary of Relevant Potential Impact Areas for Swift Parrot

Potential Foraging Habitats	Foraging Resources as per Recovery Plan	Area (ha)		
		Referral Area	Direct Impact Area	Maximum Disturbance^
PCT 281 - Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Intact and Thinned*	*Eucalyptus melliodora*	47.5	1.0	2.7
PCT 618 - White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley *Thinned*	*Eucalyptus albens x moluccana*	3.8	2.1	2.1
Total Potential Foraging Resources		**51.3**	**3.1**	**4.8**

^As per Maximum Parameters Assessment Approach.

Approximately 51.3 ha of potential woodland foraging habitat occurs within the Referral Area. Up to 4.8 ha of potential habitat may be directly impacted for surface infrastructure. The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

The Referral Area and broader local area is not mapped on the Swift Parrot Important Habitat map under the NSW BAM 2020 (DPIE 2020d).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a *population*; or**

The *population* of the swift parrot has not been recorded within the Referral Area, however has been recorded at the UCC previously (Umwelt 2015).

The Proposed Action may result in the loss of up to 4.8 ha of open forest and woodland containing key feed trees white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*) for the swift parrot (Saunders et al. 2011). The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the Proposed Action will lead to a decrease in the size of the *population* of swift parrot.

- **reduce the area of occupancy of the species; or**

The *population* of the swift parrot has not been recorded within the Referral Area, however has been recorded at the UCC approximately 100 m east of the Referral Area previously (BioNet Atlas, sighting date 2005).

The Proposed Action may result in the direct loss of up to 4.8 ha of open forest and woodland containing key feed trees white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*) for the swift parrot (Saunders and Tzaros 2011). The Referral Area is not known as a historical or important foraging site for this species.

While the Proposed Action will remove potential habitat for the swift parrot, it is not likely to lead to a significant reduction in foraging habitat in the local area or region.

The Proposed Action may result in a reduction of the potential area of foraging habitat for the swift parrot in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region for a *population* of the swift parrot.

- **fragment an existing *population* into two or more populations; or**

The *population* of the swift parrot has not been recorded within the Referral Area, however has been recorded within the UCC approximately 100 m east of the Referral Area previously (BioNet Atlas, 2005). The swift parrot is highly dispersive and it is unlikely that the Proposed Action would create a significant change to the species' dispersal capacity or create a significant barrier the movement of the species.

It is unlikely that the Proposed Action would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the species has a level of site fidelity or possess phenological characteristics likely to be of importance to the swift parrot (Saunders and Tzaros 2011). The swift parrot has not been recorded within the Referral Area and has not shown site fidelity to the habitats of the Referral Area. The Referral Area does include vegetation containing white box and yellow box which are key feed tree species for the swift parrot (Saunders and Tzaros 2011). The Proposed Action will result in the loss of up to 4.8 ha of this potential foraging habitat for the swift parrot.

Breeding habitat, which is restricted to Tasmania, will not be affected by the Proposed Action.

The Proposed Action is unlikely to adversely affect habitat that is critical to the survival of the species.

- **disrupt the breeding cycle of a *population*; or**

The swift parrot breeds and nests exclusively in Tasmania and migrates to mainland Australia during the non-breeding season. There is no potential for breeding habitat to occur in the Referral Area.

The Proposed Action will not disrupt the breeding cycle of the *population* of swift parrot.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The swift parrot has been recorded UCC approximately 100 m west of the Referral Area previously (BioNet Atlas, sighting date 2005). Up to 4.8 ha of potential foraging habitat for the swift parrot may be directly impacted as a result of the Proposed Action.

It is considered unlikely that the Proposed Action would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that a *population* of the swift parrot would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to a *population* of the swift parrot becoming established in this species habitat.

- **introduce disease that may cause the species to decline; or**

Psittacine beak and feather disease is a common and potentially deadly disease of parrots caused by a circovirus named beak and feather disease virus. The disease appears to have originated in Australia and is widespread and continuously present in wild populations of Australian parrots. Beak and feather disease affecting endangered psittacine species (parrots and related species) was listed in April 2001 as a key threatening process under the EPBC Act.

It is considered highly unlikely that the Proposed Action will introduce or otherwise contribute to beak and feather disease or any other disease that may cause the swift parrot to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Swift Parrot (*Lathamus discolor*) (Saunders and Tzaros 2011).

Any impacts to known habitat of the swift parrot will likely contravene the objectives of the recovery plan. The swift parrot has not been recorded within the Referral Area , however potential foraging habitat has been identified. It is considered unlikely that the Proposed Action will interfere with the recovery of a *population* of the swift parrot throughout Australia.

Conclusion

The swift parrot has not been recorded within the Referral Area, however has been recorded at the UCC previously, approximately 100 m east of the Referral Area (BioNet Atlas, sighting date 2005). Despite ongoing targeted monitoring for the species, there have been no records documented since 2007 (Eco Logical 2021c). Up to 4.8 ha of potential foraging for the swift parrot will be directly impacted by the Proposed Action Based on the above assessment, the Proposed Action is **unlikely** to result in a significant impact on the *population* of the swift parrot.

6.2.3 Regent Honeyeater

The regent honeyeater is listed as critically endangered under the EPBC Act and has a patchy distribution extending from south-east Queensland, into NSW and the Australian Capital Territory, to central Victoria (CoA, 2016b). The species is highly mobile, capable of travelling large distances and occurs only irregularly at most sites in varying numbers. Adding further difficulty to the survey and study of this species is its ability to often go long periods without being observed anywhere (CoA 2016b). Its primary habitat is box-ironbark eucalypt woodland and dry sclerophyll forest, however it does utilise riparian vegetation and lowland coastal forest. Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations.

The species is known to undertake a complex series of movements, which are thought to be governed mainly by the flowering of a select number of Eucalyptus species. It is likely the species use different areas within its range in different years depending on food resources (CoA 2016b).

The Referral Area does not occur within the four known breeding areas for the species where it is regularly recorded, namely Bundarra-Barraba area of NSW, the Capertee Valley in NSW, the lower Hunter Valley in NSW and the Chiltern area of north-east Victoria. It does, however, occur within approximately 130 km of the Capertee Valley breeding area.

The regent honeyeater was not recorded within the Referral Area despite thorough fauna surveys undertaken in accordance with the seasonal requirements for this species. The regent honeyeater has not previously been recorded at the UCC despite extensive surveys being undertaken over a long period of time, including annual, targeted monitoring for over 10 years. The Referral Area and broader local area is not mapped on the Regent Honeyeater Important Habitat map under the NSW BAM 2020 (DPIE 2020d).

The Referral Area contains moderate quality potential foraging habitat for this species. The Regent Honeyeater Recovery Plan (CoA 2016b) recognises the White Box – Yellow Box – Blakely's Red Gum Woodland CEEC as potential habitat for the species and also lists a number of key foraging tree species that are important for the species. The following vegetation communities are identified as potential foraging habitat for the regent honeyeater in the Referral Area, based on the presence of white box (*Eucalyptus albens*) (in this case the *E. albens x moluccana* intergrade, which is precautionarily assumed to also comprise a key feed species) and yellow box (*Eucalyptus melliodora*) which are identified as key foraging resources for the regent honeyeater (as per CoA 2016b):

- PCT 281 - Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- PCT 618 - White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley.

Note that while PCT 481 also comprises the Box-Gum Woodland CEEC, it does not contain any of the key foraging tree species.

Approximately 51.3 ha of potential woodland foraging habitat for the Regent Honeyeater occurs within the Referral Area. Up to 4.8 ha of potential habitat will be directly impacted for surface infrastructure. The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.4 outlines the relevant potential impact areas for regent honeyeater as a result of the Proposed Action.

Table 6.4 Summary of Relevant Potential Impact Areas for Regent Honeyeater

Potential Foraging Habitat	Foraging Resources as per Recovery Plan	Area (ha)		
		Referral Area	Direct Impact Area	Maximum Disturbance^
PCT 281 - Rough-barked Apple - red gum - yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion *Intact and Thinned*	*Eucalyptus melliodora*	47.5	1.0	2.7
PCT 618 - White Box x Grey Box - Red Gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley *Thinned*	*Eucalyptus albens x moluccana*	3.8	2.1	2.1
Total Potential Foraging Resources		**51.3**	**3.1**	**4.8**

^As per Maximum Parameters Assessment Approach.

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**
- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The regent honeyeater is endemic to mainland south-eastern Australia and mostly inhabits inland slopes of the Great Dividing Range (TSSC, 2015a). The regent honeyeater comprises a single population, with some exchange of individuals between regularly used areas (CoA, 2016b). As at 2010, the total population size is estimated at 350–400 mature individuals (CoA, 2016b).

As the species occurs as a single population in Australia, any record of the species would constitute part of a *population* as described above. The *population* of regent honeyeater has not been recorded within the Referral Area however it has been recorded south of Cope Road, approximately 30 km south of the of the Referral Area (however these are historic records from 1996-1999) (BioNet, DPIE 2020c).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

The *population* of the regent honeyeater has not been recorded within the Referral Area however has been recorded historically in the broader locality approximately 30 km south of the Referral Area (BioNet records, sighting dates 1996 and 1999). The Proposed Action may result in the loss of up to 4.8 ha of vegetation containing potential foraging habitat for the regent honeyeater. The Referral Area is not known as a historical or important foraging site for this species.

It is considered unlikely that the Proposed Action will lead to a decrease in the size of the *population* of regent honeyeater.

- **reduce the area of occupancy of the species; or**

The *population* of the regent honeyeater has not been recorded within the Referral Area however has been recorded historically in the broader locality approximately 30 km south of the Referral Area. The Proposed Action may result in the loss of up to 4.8 ha of potential foraging habitat for the regent honeyeater. While the Proposed Action will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region.

The Proposed Action may result in a reduction of the potential area of occupancy for the regent honeyeater in the Referral Area, however this is unlikely to substantially reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

The decline of the population of the regent honeyeater is attributed to clearing, fragmentation and degradation of its habitat (TSSC, 2015a).

The *population* of the regent honeyeater has not been recorded within the Referral Area however has been recorded historically in the broader locality and up to 4.8 ha of suitable potential foraging habitat may be impacted. The regent honeyeater is highly dispersive and it is unlikely that the Proposed Action would create a significant change to the species' dispersal capacity or create a significant barrier to the movement of the species.

It is unlikely that the Proposed Action would result in the fragmentation of the existing *population* into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the regent honeyeater includes any breeding or foraging areas where the species is likely to occur and any newly discovered breeding or foraging locations (CoA, 2016b). The species has not been recorded breeding in the Referral Area. The Proposed Action may result in direct impacts to approximately 4.8 ha of potential foraging habitat.

The disturbance of up to 4.8 ha of potential foraging habitat as a result of the Proposed Action is unlikely to adversely affect habitat that is critical to the survival of a *population* of the regent honeyeater.

- **disrupt the breeding cycle of a population; or**

The regent honeyeater mainly breeds in three key sites in NSW being the Bundarra-Barraba area, the Capertee Valley, and the Lower Hunter Valley (CoA, 2016b & OEH, 2020). Other breeding areas are known in the Pilliga woodlands and the Mudgee-Wollar areas of NSW. The regent honeyeater has not been recorded in the Referral Area and it is unlikely to contain breeding or nesting habitat for the species.

The Proposed Action is not expected to disrupt the breeding cycle of the *population* of regent honeyeater.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

A *population* of the regent honeyeater has not been recorded within the Referral Area however the species has been recorded historically in the broader locality approximately 30 km south of the Referral Area and up to 4.8 ha of suitable foraging habitat will be directly impacted.

The Proposed Action will involve the removal of up to 4.8 ha of vegetation that contains areas of key feed tree species for the regent honeyeater, as described by the National Recovery Plan for the species. This extent of removal of potential foraging as a result of the Proposed Action is considered unlikely to result in the decline in a *population* of the regent honeyeater.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the regent honeyeater becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The Proposed Action is not expected to introduce any disease that may cause the regent honeyeater to decline.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Regent Honeyeater (*Anthochaera phrygia*) (CoA, 2016b).

Any impacts to known habitat for the regent honeyeater will likely contravene the objectives of the recovery plan. The regent honeyeater has not been recorded within the Referral Area, however it has been recorded in the broader locality historically approximately 30 km south of the Referral Area, and up to 4.8 ha of potential foraging habitat will be impacted. It is considered unlikely that the Proposed Action will interfere with the recovery of the regent honeyeater throughout Australia.

Conclusion

The Proposed Action is **unlikely** to result in a significant impact on the *population* of the regent honeyeater. Although the Referral Area provides potential foraging habitat for this species, there are no known records, despite repeated targeted monitoring for the species in the UCC for over 10 years. The area proposed to be disturbed is relatively minor (up to 4.8 ha) and the regent honeyeater has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

6.2.4 Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)

The spotted-tailed quoll (*Dasyurus maculatus maculatus*) occurs in a variety of habitats including forests, woodlands, coastal heathlands and rainforest. The distribution of this species is on both the inland and coastal sides of the Great Dividing Range from the Victorian to the Queensland borders, with a number of unconfirmed records also being reported in scattered occurrences of western NSW (OEH, 2017).

The spotted-tailed quoll is a highly mobile marsupial moving several kilometres in one night and occupying large territories ranging from 750 ha to 3,500 ha (OEH, 2017).

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**

- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

There is very little research-based literature that allows confident definition of population size or population boundaries of the spotted-tailed quoll. Spotted-tailed quoll records are generally confined to within 200 km of the NSW coast and ranges from the Queensland border to Kosciuszko National Park. According to the National Recovery Plan for the species (DELWP, 2016) it is considered likely that the total number of mature adult spotted-tailed quolls is probably greater than 2,000 but fewer than 10,000 individuals in Australia. Home range estimates vary considerably according to location and habitat quality, however females can occupy home ranges up to 750 ha and males up to 3,500 ha and both sexes usually traverse their ranges along densely vegetated creek lines. Extant populations are highly fragmented and declining. The geographic distribution of the species is contracting and its subpopulations are becoming increasingly fragmented.

The spotted-tailed quoll typically occurs at low densities, as adults are solitary and occupy large home ranges. The population of spotted-tail quoll has not been recorded within the Referral Area. A search of the Atlas has identified the nearest record of the spotted tail quoll being at Ulan Road, near Bobadeen Road, approximately 10 km from the Referral Area, which was recorded in 2010. Another recorded in this general location on Ulan Road was noted in 2021, being a roadkill record of a female quoll (DPIE 2022). It is possible a population of the species occurs in association with Goulburn River National Park and individuals are occasionally recorded moving through other connected habitat north of Ulan.

Approximately 918 ha of potential habitat for the spotted-tail quoll occurs within the Referral Area, which includes all woodland or open forest vegetation types. Based on the maximum parameters approach, up to 37.1 ha of potential habitat will be directly impacted for surface infrastructure (refer to **Table 6.5**). The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there is not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.5 Summary of Relevant Impact Areas for Spotted-tailed Quoll

Potential Spotted-tailed Quoll Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and forest vegetation	918.7	24.5	37.1
Total	**918.7**	**24.5**	**37.1**

^As per Maximum Parameters Assessment Approach.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

The spotted-tailed quoll has not been recorded within the Referral Area, however, approximately up to a maximum of 37.1 ha of potential habitat for the species will be directly impacted. If used, the Referral Area is likely to represent a very small portion of any spotted-tailed quoll home range area. No evidence of the quoll has been recorded including no latrines or dens. The loss of up to 37.1 ha of potential woodland foraging habitat is not considered likely to result in a long-term decrease in the *population* of the spotted-tailed quoll.

- **reduce the area of occupancy of the species; or**

While not recorded within the Referral Area, up to 37.1 ha of potential habitat would be removed by the Proposed Action. Significant areas of similar quality habitat surround the Referral Area. While potential habitat will be removed, given the comparatively small area of impact relative to the size of an average spotted-tailed quoll home range area the potential reduction in the area of occupancy of the species is not considered significant for the species.

- **fragment an existing *population* into two or more populations; or**

While not recorded within the Referral Area, a maximum of approximately 37.1 ha of potential habitat would be removed by the Proposed Action. Significant areas of similar quality habitat surround the Referral Area. If the species occurs within the Referral Area, the proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the spotted-tailed quoll into two or more populations.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the spotted-tailed quoll includes large patches of forest with denning resources and relatively high densities of prey (medium-sized mammals). However the National Recovery Plan notes it is not possible to define or map habitat critical to populations of the spotted-tail quoll, therefore all habitats within its current distribution are considered important habitat for this species (DELWP, 2016).

The Proposed Action would directly remove a maximum of approximately 37.1 ha of moderate quality habitat for the species, however there are no known records. It is not considered that these habitats are critical to the survival of the spotted-tail quoll.

The Proposed Action will not adversely affect habitat critical to the survival of the *population* of the spotted-tail quoll.

- **disrupt the breeding cycle of a population; or**

The spotted-tailed quoll generally dens in rock shelters, small caves, hollow logs or tree hollows and utilises numerous dens within its home range (OEH, 2017). No potential den sites were recorded during surveys and the spotted-tailed quoll has not been recorded within the Referral Area. However, the Proposed Action would directly remove up to 37.1 ha of moderate quality habitat for the species.

If the species occurs within the Referral Area, considering the proposed area of disturbance relative to the mobility of the species it is considered unlikely that the Proposed Action would disrupt the breeding cycle of any population of the spotted-tailed quoll.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

It is considered likely that the total number of mature adult spotted-tailed quolls is probably greater than 2,000 but fewer than 10,000 individuals in Australia (DELWP, 2016). Extant populations are highly fragmented and declining. The spotted-tail quoll has not been recorded in the Referral Area, however the Project will involve the removal of up to 37.1 ha of potential woodland habitat for the species.

Considering the context and intensity of disturbance to potential habitats for the spotted-tail quoll, the Proposed Action will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the population of this species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the spotted-tailed quoll becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The spotted-tailed quoll is not known to be affected by diseases that are causing the population to decline. Therefore, the Proposed Action is not likely to result in the introduction of disease.

- **interfere with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus* (DELWP, 2016).

Any impacts to known habitat for the spotted-tailed quoll will likely contravene the objectives of the recovery plan. The spotted-tailed quoll has not been recorded within the Referral Area, however potential habitat has been identified. It is considered unlikely that the removal of up to 37.1 ha of potential habit as a result of the Proposed Action will interfere with the recovery of the spotted-tailed quoll throughout Australia.

Conclusion

Although the Referral Area provides potential habitat for this species, the area proposed to be removed is relatively small considering the home ranges of the species. The spotted-tailed quoll has not been recorded utilising the potential habitat within the Referral Area or in the immediate surrounds.

The Proposed Action is **unlikely** to result in a significant impact on the *population* of the spotted-tailed quoll.

6.2.5 Koala (*Phascolarctos cinereus)* (combined populations of Qld, NSW and ACT)

In this case, a *population* means:

- **a geographically distinct regional population, or collection of local populations; or**

- **a regional population, or collection of local populations, that occurs within a particular bioregion.**

The koala is known to occur in eucalypt woodlands and forests from the north-eastern Queensland, along the eastern coast of NSW, to the south-east corner of South Australia. The species has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. During the 2019-2020 bushfire season an estimated 9 percent (>36,800 km^2) of the koala's distribution was impacted by fire (DAWE 2022).

The koala has not been recorded in the Referral Area, however there are three BioNet Atlas records at the UCC (refer to **Figure 3.10**). One record, from 1986, occurs approximately 3 km east of Area 2. There is one record, from 2014, approximately 1.5 km to the east of Area 4 and one record from 2015 occurs 9 km east of Area 4.

The Referral Area contains areas of eucalypt woodlands and forests which support a number of koala tree feed species that range from irregular or low use ranking to high preferred use (as listed in the *State Environmental Planning Policy (Koala Habitat Protection)* 2021). These koala feed trees, along with their ranking are listed in **Appendix G**. Koala food trees listed under the Approved Recovery Plan for the Koala (DECC 2008) were also considered. No primary feed trees (based on the list for the Central and Southern Tablelands management areas, DECC 2008) have been recorded within the Referral Area. However, three secondary feed tree species were recorded, being Blakely's red gum (*Eucalyptus blakelyi*) white box (*Eucalyptus albens*) and yellow box (*Eucalyptus melliodora*).

Given the paucity of nearby recent (in last 10 years) records and the absence of primary feed trees, the Referral Area or the locality is unlikely to support key source koala populations for breeding or dispersal. The Referral Area is unlikely to comprise populations necessary for maintaining genetic diversity given the small area to be cleared and the fact that despite targeted surveys the koala has not been recorded. The Referral Area is also not near the limit of the known range of this species. The Referral Area is unlikely to contain an *important population* of the koala.

The Assessment of Significance for the koala has been prepared in consideration of the EPBC Act Referral Guidelines for the Vulnerable Koala (DoE 2014). It is acknowledged that the species was escalated to Endangered status on 12th February 2022 and therefore these guidelines may no longer be relevant in all aspects, however is still appropriate to consider until a new assessment guideline is released. An assessment of koala habitat in the Referral Area has been undertaken and is detailed in **Appendix G**.

Approximately 869.2 ha of potential woodland habitat (containing secondary feed trees) occurs within the Referral Area (**Table 6.6**). Up to 37.1 ha will be directly impacted for surface infrastructure. The remaining areas of potential habitat relate to the proposed underground longwall areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts

Table 6.6 Summary of Relevant Impact Areas for Koala

Potential Koala Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Koala food tree habitat (vegetation zones containing trees listed in the SEPP or Recovery Plan)	869.2	19.6	37.1
Total	**869.2**	**19.6**	**37.1**

^As per Maximum Parameters Assessment Approach.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population; or**

No populations of the koala have been recorded within the Referral Area or the immediate locality and no primary feed trees were recorded. The Proposed Action will result in the loss of up to a maximum of 37.1 ha of vegetation containing secondary feed trees as listed in **Table 6.6** above.

It is considered unlikely that the Proposed Action will lead to a decrease in the size of an population of koala:

- **reduce the area of occupancy of the species; or**

The Proposed Action will result in the loss of up to 37.1 ha of vegetation containing secondary feed trees for the koala. While the Proposed Action will remove potential habitat for this species, it is not likely to lead to a significant reduction in known habitat in the region. Substantial areas of higher quality habitats for this species occur in surrounding localities to the Referral Area, including in the nearby Goulburn River National Park and Munghorn Gap Nature Reserve.

The Proposed Action may result in a reduction of the potential area of occupancy for the koala in the Referral Area, however this is unlikely to substantially reduce the area of occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations; or**

While not recorded within the Referral Area, up to 37.1 ha of potential feeding habitat would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

The Proposed Action will result in the disturbance of up to 37.1 ha of potential feeding habitat for the koala. If the species occurs within the Referral Area, the proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the koala into two or more populations.

Regardless, the Referral Area does not support a population of koala and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species; or**

Habitat critical to the survival of the koala is not specifically identified in the Approved Conservation Advice for the Koala (DAWE 2022). This is because there is insufficient knowledge and data to unambiguously identify and spatially delineate habitat critical to the survival of the koala. The Approved Conservation Advice (DAWE 2022) refers to the superseded EPBC Act Referral Guidelines for impact assessments to navigate the complexity of koala habitat to identify significant impacts (DoE 2014). An assessment of koala habitat within the context of the koala referral guidelines is provided in **Appendix G** and indicates that the Referral Area does comprise habitat critical to the survival of the species.

There are few and infrequent records of the koala nearby to the Referral Area indicating the habitats are only currently being used as a stepping stone or corridor to other important habitats. The removal of approximately 37.1 ha of critical koala habitat is considered a small area in the context of substantial areas of similar surrounding remnant vegetation, including in Goulburn River National Park and Munghorn Gap Nature Reserve, and the intact vegetation surrounding the Referral Area. Additionally, potential habitat in the Referral Area does not contain primary koala feed trees, however does contain secondary feed trees. There are a low number of recent records of the koala in the local area and this species was not recorded as part of targeted surveys.

The Proposed Action will impact on habitat which has been assessed under the Referral Guidelines and found to be critical habitat. However, the scale of removal of that critical habitat relative to the local availability of similar habitat is unlikely to adversely impact on the survival of the koala.

- **disrupt the breeding cycle of a population; or**

No permanent populations of the koala have been identified within the Referral Area, nor have any breeding populations of this species been recorded in the locality.

The Proposed Action is therefore unlikely to disrupt the breeding cycle of a population of this species.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

Considering the context and intensity of disturbance to potential habitats for the koala, the Proposed Action will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the population of this species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the koala becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The koala is known to contract strains of *Chlamydia* and the koala retrovirus. Chlamydia infections are known to cause reduced female fertility and are expected to reduce the reproductive potential of koala populations. It has been predicted that up to half of the koalas in south-east Queensland have reproductive disease likely to result in infertility (TSSC 2012a,b). The koala retrovirus can cause a range of conditions including leukaemia and immunodeficiency syndrome. It is estimated that up to 100 % of koala populations in Queensland and NSW have the koala retrovirus (TSSC 2012a,b).

The Proposed Action does not involve any processes that are likely to introduce a disease for the koala that may cause this species to decline.

- **interfere with the recovery of the species.**

An assessment was undertaken to determine the impacts which are likely to substantially interfere with the recovery of the koala. The Referral Guidelines (DoE 2014) identifies impacts likely to substantially interfere with the recovery of the koala (refer to Table B3 of **Appendix G**).

The Proposed Action is not expected to:

- increase koala fatalities due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities
- result in the creation of substantial additional barriers to koala movement in the local area
- introduce or increase dogs to the local area and therefore is unlikely to increase the threat of dog attacks to any local koala population
- facilitate the introduction or spread of pathogens as *Phytophthora cinnamomi* or Chlamydia, or
- result in hydrological changes to the surrounding environment such that the function and integrity of the existing habitat for the koala is jeopardized.

Based on the above, it is considered unlikely that the Proposed Action will interfere with the recovery of the koala throughout its range in Qld, NSW and the ACT.

Conclusion

The koala has not been recorded within the Referral Area, however potential habitat (supporting secondary feed trees) occurs. Three records have been recorded at the UCC previously, however the distribution and frequency of these records despite extensive survey and monitoring across the UCC over decades, indicates there is very unlikely to be a resident population or that the foraging habitats are important for the species. Based on the maximum parameters approach, up to 37.1 ha of potential habitat for the koala would be directly disturbed as a result of the Proposed Action. The koala habitat assessment tool (**Appendix G**) indicates that the habitats of the Referral Area would constitute critical habitat for the koala.

The Referral Area is unlikely to support a permanent population of the koala. The disturbance to up to 37.1 ha of potential habitat for the koala would be directly impacted by the Proposed Action. Given the low and infrequent records of koala within the locality, and the extensive areas of potential habitat at the UCC and wider locality, this extent of disturbance to habitats is not considered to be significant. The Proposed Action is unlikely to result in a significant impact on a population of koala.

6.3 Vulnerable Species

The following vulnerable species is considered in this assessment:

- fairy bells (*Homoranthus darwinoides*)
- *Commersonia procumbens*
- painted honeyeater (*Grantiella picta*)
- white-throated needletail (*Hirundapus caudacutus*)
- large-eared pied bat (*Chalinolobus dwyeri*)
- Corben's long-eared bat (*Nytophilus corbeni*)
- brush-tailed rock-wallaby (*Petrogale penicillata*)
- grey-headed flying fox (*Pteropus poliocephalus*).

6.3.1 Fairy bells (*Homoranthus darwinoides*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

Fairy bells (*Homoranthus darwinoides*) is a slender, spreading shrub in the Myrtaceae family that grows to 1.5 m. The species has a restricted distribution between Dubbo to west of Denman where it occurs in

woodland habitats with a shrubby understorey on deep sandy soils over sandstone (OEH 2020). Individual populations may include only one plant, or the species can be a dominant understorey species at some sites. Vegetation associations include *Eucalyptus – Callitris* woodland, consisting of *Eucalyptus crebra, E. fibrosa, E. trachyphloia, E. beyeri, E. dwyeri, E. rossii, Leptospermum divaricatum, Melaleuca uncinata, Calytrix tetratgona, Allocasuarina* spp., *Micromyrtus* spp. and *Acacia* spp. (TSSC 2008).

Homoranthus darwinoides has been previously recorded within the UCC approximately 1km south of Area 4 (BioNet Atlas, sighting date 1996) (refer to **Figure 3.10**), however was not recorded within the Referral Area despite extensive survey in the appropriate season. A known record is approximately 1 km south-west of the southern-most proposed infrastructure area (Area 4).

Within the Referral Area, the woodland areas on rocky sandy soils (PCTs 476, 478 and 479) provide potential habitat for *Homoranthus darwinoides*. Approximately 628.4 ha of these PCTs comprising potential habitat occur within the Referral Area (**Table 6.7**). Under the maximum parameters approach, up to 30.3 ha of these three PCTs may be directly impacted for surface infrastructure. The remaining areas of suitable habitat occurs over proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there would be negligible impacts on native vegetation and habitats as a result of the proposed underground longwall mining.

Table 6.7 Summary of Relevant Impact Areas for Fairy Bells

Potential Fairy Bells Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
PCTs 476, 478 and 479 (woodland components)	628.4	18.0	30.3
Total	**628.4**	**18.0**	**30.3**

^As per Maximum Parameters Assessment Approach.

The Referral Area is considered to comprise areas of potential habitat for this species however does not comprise a key source population for dispersal and any potentially occurring records are unlikely to be important for maintaining genetic diversity. The Referral Area is also not near the limit of the known range of this species. Therefore, the Referral Area is unlikely to contain an *important population* of *Homoranthus darwinoides*.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of *Homoranthus darwinoides* present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in the loss of up to a maximum of 30.3 ha of potential habitat for *Homoranthus darwinoides*. However, since the Referral Area does not contain an important population of the species, the Proposed Action will not reduce the area of occupancy of an *important population* of *Homoranthus darwinoides*.

- **fragment an existing *important population* into two or more populations, or;**

While not recorded within the Referral Area, up to a maximum of 30.3 ha of potential habitat for *Homoranthus darwinoides* would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

The Proposed Action will result in the disturbance to up to a maximum of 30.3 ha of potential habitat for *Homoranthus darwinoides*. If the species was found within the Referral Area, the proposed area of disturbance is considered unlikely to result in the fragmentation of an existing population of the species into two or more populations.

Regardless, the Referral Area does not support an *important population* of *Homoranthus darwinoides* and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

The potential habitats of the Referral Area that will be impacted are not considered critical to the survival of the species.

Therefore the Proposed Action will not adversely affect habitat that is critical to the survival of *Homoranthus darwinoides*.

- **disrupt the breeding cycle of an *important population*, or;**

No populations of *Homoranthus darwinoides* have been identified in the Referral Area, and the Referral Area does not support an *important population* of the species. The Proposed Action is not expected to disrupt the breeding cycle of an *important population* of *Homoranthus darwinoides*.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to a maximum of 30.3 ha of potential habitat for *Homoranthus darwinoides*. Large areas of similar and/or higher quality habitats occur within the broader locality.

It is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that any local population of *Homoranthus darwinoides* would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to *Homoranthus darwinoides* becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause any potentially occurring records of *Homoranthus darwinoides* to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for *Homoranthus darwinoides*. The Proposed Action will not impact on any known populations of the species.

No significant effect on the recovery of *Homoranthus darwinoides* is expected to occur as a result of the Proposed Action as the areas of potential habitat that will be impacted as a result of the Proposed Action are not expected to impact an *important population* of this species.

Conclusion

Homoranthus darwinoides has not been recorded within the Referral Area, however it has been recorded previously in the wider the UCC and potential habitat occurs. Up to 30.3 ha of potential habitat for *Homoranthus darwinoides* would be directly disturbed as a result of the Proposed Action.

The Referral Area is not considered to support an *important population* of *Homoranthus darwinoides*. The Proposed Action is **unlikely** to result in a significant impact on an *important population* of *Homoranthus darwinoides*.

6.3.2 Commersonia procumbens

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

Commersonia procumbens is a small, prostrate shrub which mainly occurs around the Dubbo-Mendooran-Gilgandra region, with outlying populations in the Pilliga, Mount Kaputar National Park, north-east of Gulgong and near Denman. The species is typically a pioneer of disturbed sites (either disturbed through fire or mechanical disturbance such as clearing or slashing). *Commersonia procumbens* occurs on sandy soils in heathy communities associated with species such as *Eucalyptus dealbata, Eucalyptus sideroxylon, Melaleuca uncinata* and *Calytrix tetragona.*

Commersonia procumbens has been recently recorded within the UCC, when 15 individuals were recorded in one location in 2021 during annual monitoring (Eco Logical 2022) (refer to **Figure 3.10**). The species was not recorded within the Referral Area despite extensive survey in the appropriate season.

Within the Referral Area, PCTs 478 and 479 and 481) broadly provide potential habitat for *Commersonia procumbens*, although there are no specific areas that have been subject to mechanical or fire disturbance (this species usually requires a disturbance trigger to emerge). Approximately 955.5 ha of these PCTs comprising potential habitat occur within the Referral Area (**Table 6.8**). Under the maximum parameters approach, up to 37.1 ha of these three PCTs may be directly impacted for surface infrastructure. The remaining areas of suitable habitat occurs over proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there would be negligible impacts on native vegetation and habitats as a result of the proposed underground longwall mining.

Table 6.8 Summary of Relevant Impact Areas for *Commersonia procumbens*

Potential *Commersonia procumbens* Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
PCTs 476, 478 and 479	955.5	19.2	37.1
Total	**955.5**	**19.2**	**37.1**

^As per Maximum Parameters Assessment Approach.

The Referral Area is considered to comprise areas of potential habitat for this species however does not comprise a key source population for dispersal and any potentially occurring records are unlikely to be important for maintaining genetic diversity. The Referral Area is also not near the limit of the known range of this species. Therefore, the Referral Area is unlikely to contain an *important population* of *Commersonia procumbens*.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of *Commersonia procumbens* present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in the loss of up to a maximum of 37.1 ha of potential habitat for *Commersonia procumbens*. However, since the Referral Area does not contain an important population of the species, the Proposed Action will not reduce the area of occupancy of an *important population* of *Commersonia procumbens*.

- **fragment an existing *important population* into two or more populations, or;**

While not recorded within the Referral Area, up to a maximum of 37.1 ha of potential habitat for *Commersonia procumbens* would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

The Proposed Action will result in the disturbance to up to a maximum of 37.1 ha of potential habitat for *Commersonia procumbens*. If the species was found within the Referral Area, the proposed area of disturbance is considered unlikely to result in the fragmentation of an existing population of the species into two or more populations.

Regardless, the Referral Area does not support an *important population* of *Commersonia procumbens* and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

The potential habitats of the Referral Area that will be impacted are not considered critical to the survival of the species.

Therefore the Proposed Action will not adversely affect habitat that is critical to the survival of *Commersonia procumbens*.

- **disrupt the breeding cycle of an *important population*, or;**

No populations of *Commersonia procumbens* have been identified in the Referral Area, and the Referral Area does not support an *important population* of the species. The Proposed Action is not expected to disrupt the breeding cycle of an *important population* of *Commersonia procumbens*.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to a maximum of 37.1 ha of potential habitat for *Commersonia procumbens*. Large areas of similar and/or higher quality habitats occur within the broader locality. The species has not been recorded in the Referral Area.

It is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that any local population of *Commersonia procumbens* would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to *Commersonia procumbens* becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause any potentially occurring records of *Commersonia procumbens* to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for *Commersonia procumbens*. The Proposed Action will not impact on any known populations of the species.

No significant effect on the recovery of *Commersonia procumbens* is expected to occur as a result of the Proposed Action as the areas of potential habitat that will be impacted as a result of the Proposed Action are not expected to impact an *important population* of this species.

Conclusion

Commersonia procumbens has not been recorded within the Referral Area, however it has been recorded previously in the wider the UCC and potential habitat occurs. Up to 37.1 ha of potential habitat for *Commersonia procumbens* would be directly disturbed as a result of the Proposed Action.

The Referral Area is not considered to support an *important population* of *Commersonia procumbens*. The Proposed Action is **unlikely** to result in a significant impact on an *important population* of *Commersonia procumbens*.

6.3.3 Painted honeyeater (*Grantiella picta*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The painted honeyeater is a small to medium honeyeater that largely feeds on mistletoes growing on eucalypts and acacias (OEH 2020). The species may seasonally travel north-south in response to the fruiting of mistletoe (TSSC 2008). The population of the species is concentrated on inland slopes of the Great Dividing Range between the Grampians (Victoria) and Roma (Queensland) and almost all records of breeding occur in this area (TSSC 2008). Habitats include Boree/weeping myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and White Box Woodlands and Box-Ironbark Forests.

A painted honeyeater was recorded by call during the October 2020 field survey, in the south of the Referral Area (Area 4), shown on **Figure 2.9**. There are numerous records within the wider UCC.

Approximately 918.7 ha of potential woodland foraging habitat for the painted honeyeater occurs within the Referral Area (**Table 6.9**). A maximum of up to 37.1 ha will be directly impacted for surface infrastructure. The remaining areas of potential habitat relate to the proposed longwall areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there would be negligible impacts on native vegetation and habitats as a result of the proposed underground longwall mining.

Table 6.9 Summary of Relevant Impact Areas for Painted Honeyeater

Painted Honeyeater Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and forest vegetation	918.7	24.5	37.1
Total	**918.7**	**24.5**	**37.1**

^As per Maximum Parameters Assessment Approach.

The Referral Area is considered to comprise areas of known habitat for this species however is not considered to contain significant breeding habitat necessary for maintaining genetic diversity. The Referral Area is also not near the limit of the known range of this species. Therefore the Referral Area is unlikely to contain an *important population* of the painted honeyeater.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of the painted honeyeater present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in the loss of up to 37.1 ha of known habitat for painted honeyeater. However, since the Referral Area does not contain an important population of the painted honeyeater, the Proposed Action will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

Up to a maximum of 37.1 ha of known habitat for the painted honeyeater would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area. The proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the painted honeyeater into two or more populations.

Regardless, the Referral Area does not support an *important population* of painted honeyeater and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

The known habitats of the Referral Area that will be impacted are not considered critical to the survival of the painted honeyeater.

The Proposed Action is unlikely to adversely affect habitat that is critical to the survival of the painted honeyeater.

- **disrupt the breeding cycle of an *important population*, or;**

The painted honeyeater has been recorded within the Referral Area. Up to a maximum of 37.1 ha of known habitat will be directly impacted as a result of the Proposed Action. Given the presence of extensive habitats of similar value at the UCC, this scale of disturbance is unlikely to disrupt the breeding cycle of the species. Regardless, the Referral Area is not likely to support an *important population* and therefore the Proposed Action will not disrupt the breeding cycle of an *important population* of the painted honeyeater.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to a maximum of 37.1 ha of known habitat for painted honeyeater. Large areas of similar and/or higher quality habitats occur within the broader locality. Given the regionally small area of habitat to be removed, the disturbance to these habitats would not cause the species to decline.

It is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the painted honeyeater would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the painted honeyeater becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the painted honeyeater to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for the painted honeyeater.

No significant impact on the recovery of the painted honeyeater is expected to occur as a result of the Proposed Action as the habitats that will be impacted as a result of the Proposed Action are not expected to impact an *important population* of this species.

Conclusion

The painted honeyeater has been recorded within the Referral Area and up to a maximum of 37.1 ha of habitat for the species would be directly disturbed as a result of the Proposed Action.

The Referral Area is not considered to support an *important population* of the painted honeyeater. The Proposed Action is **unlikely** to result in a significant impact on an *important population* of painted honeyeater.

6.3.4 White-throated needletail (*Hirundapus caudacutus*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**

- **populations that are necessary for maintaining genetic diversity, and/or**

- **populations that are near the limit of the species range.**

The white-throated needletail is a large, insectivorous swift that is widespread in eastern and south-eastern Australia. The species can generally be found up to 1 km above ground over a wide range of habitats, preferring wooded areas (TSSC 2008). The species roosts in the tree canopy or in hollows, among dense foliage. The white-throated needletail breeds in areas of Asia including Japan, Siberia, China and Pakistan (TSSC 2008). The species is almost exclusively aerial, from heights of less than 1 m up to more than 1,000 m above the ground. White-throated needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats.

Important habitat for the species is outlined in the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015b) and states that large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. They are found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. The white-throated needletail has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs. The species has previously been recorded, with

a record at the UCC approximately 3 km east of Area 4 and three records approximately 3 km south and south-east of Area 2 (BioNet Atlas, sighting dates 2016-2018) (refer to **Figure 3.10**). The species is known to be widespread across eastern NSW.

Approximately 918.7 ha of potential woodland foraging habitat for the white-throated needletail occurs within the Referral Area. Based on the maximum parameters approach up to a maximum of 37.1 ha will be directly impacted for surface infrastructure (refer to **Table 6.10**). The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.10 Summary of Relevant Impact Areas for White-throated Needletail

Potential White-throated Needletail Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and forest vegetation	918.7	24.5	37.1
Total	**918.7**	**24.5**	**37.1**

^As per Maximum Parameters Assessment Approach.

The Referral Area is considered to comprise areas of potential habitat for this species however is not considered to contain significant roosting habitat necessary for maintaining genetic diversity. The species breeds in the northern hemisphere. The Referral Area is also not near the limit of the known range of this species. The Referral Area is unlikely to contain an *important population* of the white-throated needletail.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of the white-throated needletail present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in the loss of up to 37.1 ha of potential habitat for the white-throated needletail. Since the Referral Area does not contain an important population of the white-throated needletail, the Proposed Action will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

While not recorded within the Referral Area, up to a maximum of 37.1 ha of potential habitat for the white-throated needletail would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area. The proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the white-throated needletail into two or more populations.

Regardless, the Referral Area does not support an *important population* of white-throated needletail and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

Important habitat for the species is outlined in the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015b) and states that large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. They are found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. The potential habitats of the Referral Area that will be impacted are not considered critical to the survival of the white-throated needletail.

Therefore the Proposed Action is unlikely to adversely affect habitat that is critical to the survival of the white-throated needletail.

- **disrupt the breeding cycle of an *important population*, or;**

The white-throated needletail has not been recorded within the Referral Area, however it has been recorded at the UCC and potential habitat occurs. Up to a maximum of 37.1 ha of potential habitat will be directly impacted as a result of the Proposed Action. Given the presence of extensive habitats of similar value at the UCC, this scale of disturbance is unlikely to disrupt the breeding cycle of the species. Regardless, the Referral Area does not support an *important population* and therefore the Proposed Action will not disrupt the breeding cycle of an *important population* of the white-throated needletail.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to a maximum of 37.1 ha of potential habitat for white-throated needletail. Large areas of similar and/or higher quality habitats occur within the broader locality. Given the regionally small area of habitat to be removed, the disturbance to these habitats would not cause the species to decline.

It is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the white-throated needletail would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the white-throated needletail becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the white-throated needletail to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

There is currently no approved recovery plan for the white-throated needletail. The Approved Conservation Advice (TSSC 2019) for the species includes the following conservation priorities for recovery:

  - Work with governments in East Asia to minimise destruction of key breeding habitats.
  - Important habitats in Australia are identified and protected.

No significant impact on the recovery of the white-throated needletail is expected to occur as a result of the Proposed Action as the habitats that will be impacted as a result of the Proposed Action are not expected to impact an *important population* of this species.

Conclusion

The Referral Area is not considered to support an *important population* of the white-throated needletail. The Proposed Action is **unlikely** to result in a significant impact on an *important population* of white-throated needletail.

6.3.5 Large-eared Pied Bat (*Chalinolobus dwyeri*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The large-eared pied-bat (*Chalinolobus dwyeri*) has a range from Rockhampton in Queensland to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. The majority of records of the species occur within several kilometres of cliff lines or caves, in which it is known to roost.

The large-eared pied-bat has been recorded throughout the UCC previously, and breeding females have been recorded within the UCC (Hoye 2020). The species has been recorded during most monitoring survey events within the UCC since 2012. There is evidence of two confirmed maternity roost caves for the large-eared pied bat in the UCC (Umwelt 2015). No known maternity caves occur within the Referral Area.

Harp trap and Anabat surveys were undertaken within the Referral Area during the surveys undertaken for this assessment, along with inspections of rocky habitats and cliff lines to assess potential for micro-bat usage, in particular any potential for maternity roosts. Individuals of large-eared pied-bat were captured at three of the harp trap sites within the Potential Indirect Impact Area, all of which were male. The species are evidently foraging in the area, however the surveys did not detect any evidence of maternity roosts or breeding in either the Proposed Direct Impact Area or the cliff line habitats of the Potential Indirect Impact Area.

Given that the large-eared pied bat has been recorded previously nearby, it is assumed that foraging habitat for the species occurs throughout the Referral Area in both the Direct and Potential Indirect Impact Areas.

There is limited available information regarding what constitutes an important population of the large-eared pied bat. However, the National Recovery Plan identifies one record of this species at Shoalwater Bay, QLD and recognises this record as an important population (DERM, 2011). It also recognises populations in National Park reserves as important populations. Following careful consideration of the above definition of an *important population*, it is possible that the population(s) of large-eared pied-bat that breed and forage throughout the UCC would be an *important population*. The National Recovery Plan for the species (DERM 2011) recognises that 'lactating females have been recorded adjacent to sandstone cliffs near Ulan', and state that any known maternity sites are considered to be 'habitat critical to the survival of the species'. Looking at the above criteria (from the Significant Impact Guidelines (DoE 2013)), it is possible that the population of large-eared pied-bat within the UCC is a *key source population for*

breeding or dispersal and may be *necessary for maintaining genetic diversity*. While no maternity roosts/breeding habitat was recorded within the Referral Area, there is potential for breeding habitat to be present, and there is potential for the individuals that form the wider UCC population (which may be an *important population*) to forage within the woodland habitats of the Referral Area. As such, any impacts within the Referral Area may impact on a potential *important population* of large-eared pied-bat.

Based on available cliff line mapping, review of topography and observations during field surveys, the Referral Area supports cliff line areas that potentially support breeding habitat (caves, crevices, overhangs etc) for the large-eared pied-bat, however, there are no known maternity roosts in the Referral Area and no evidence of potential maternity roosts was recorded in the areas inspected. Predicted subsidence may result in impacts on these potential breeding habitats, ranging from minor rockfall and cracking, with the rare potential for cave collapse. There has been one instance of cave collapse at UCC, however this did not impact a known maternity roost of this species.

No cliff lines are mapped within the Proposed Direct Impact Area, and no areas of suitable breeding habitat for the large-eared pied-bat were observed during surveys. However, low sandstone outcropping occurs in the Direct Impact Area that may provide short-term roost opportunities for small numbers of bats. There will be no direct impacts to breeding habitats within the Direct Impact Area, however, potential foraging habitat for the large-eared pied-bat will be disturbed.

Approximately 918.7 ha of potential woodland (foraging) habitat for the large-eared pied-bat occurs within the Referral Area. Up to 37.1 ha will be directly impacted for surface infrastructure (refer to **Table 6.11**). The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from long term ecological monitoring of previously mined longwalls at the UCC, impacts on native vegetation and habitats for the large-eared pied-bat as a result of the proposed underground longwall mining would be similar to other underground mining areas at the UCC.

Table 6.11 Summary of Relevant Impact Areas for Large-eared Pied Bat

Large-eared Pied Bat Habitat	Area (ha)			
	Referral Area	Direct Impact Area	Indirect Impact Area	Maximum Disturbance^
Native woodland and forest foraging habitat	918.7	24.5	850.9	37.1
Cliff line habitats	464 m	0.0	464 m	464 m
Total	**918.7**	**24.5**	**850.9**	**37.1**

^As per Maximum Parameters Assessment Approach.

Experience indicates that the potential for impacts to sandstone cliff formations is dependent on a range of factors that include location relative to the longwall panels, overburden depth, the nature and geometry of the formation and the size of any overhangs. In general, the frequency, height and length of outcrop formations above the Referral Area are much less than that located within areas previously mined at the UCC. Given that the subsidence for the current modification is expected to be similar to predictions for previous Ulan modifications, the approach for assessing cliff line impacts as documented in Eco Logical (2017) has been used here. Eco Logical (2017), referencing SCT (2017) state that rock falls are generally observed on approximately 20 % of the length of sandstone formations located directly over extracted longwall panels and intermediate chain pillars between longwall panels, however are unlikely to occur outside the footprint of longwall extraction. Perceptible cracking impacts may occur on 50-70 % of the length of sandstone formations located directly over longwall panel extraction areas. Of the approximately 464 m of cliff lines that are mapped within the Proposed Indirect Impact Area, approximately 20 % (93 m) of cliff line may experience rock fall and 50-70 % (up to 325 m) of cliff line may experience cracking.

Previous years of microbat monitoring have not detected notable change in bat activity in areas subject to potential subsidence, and target threatened species continue to be recorded, including evidence of breeding (such as lactating females). However, declines in activity level of some bat species, including the large-eared pied-bat, were reported during the 2019 Annual Bat monitoring (Hoye 2020). Furthermore, cave collapse has occurred on one occasion in 2020, over Ulan West Longwall 5, when a 41 m section of sandstone overhang collapsed. While possible, the potential for impacts to breeding habitat for the large-eared pied bat would be very low.

Subsidence performance indicators applicable to the microbat monitoring program are established in the UCC Biodiversity Management Plan (BMP) (UCMPL 2020) and if not met would result in the Trigger Action Response Plan (TARP) being implemented:

- *Analysis of micro-bat monitoring data identifies decreasing activity levels (> 10 % decline) of endangered micro-bat species during cliff line monitoring (within the Application Area (LW1-6) or within the mined area) over two or more monitoring periods, outside of seasonal variations.*

The 2019 results were assessed against the above performance measure and were found to comprise a decline of > 10 % over two or more monitoring seasons. Subsequently, to understand these results, an expanded monitoring program was undertaken in 2020 (Eco Logical 2021b).

In response to the 2019 microbat monitoring results, a comprehensive review of the monitoring program and monitoring data was undertaken by Eco Logical (2021). The microbat monitoring in 2020 was undertaken generally in accordance with previous monitoring, however, the methodology was modified to increase survey effort and therefore the robustness of the resulting dataset. During the 2020 monitoring program, 29 impact sites and eight control sites across the UCMPL complex were surveyed in December 2020, with a combination of Anabat recording and harp trapping being used. A summary of some of the key results from the 2020 monitoring program, as reported in Eco Logical (2020), are provided below:

- *Overall large-eared pied-bat and large bent-winged bat activity (definite calls per night) recorded in 2020 was the highest to date.*
- *Large-eared pied-bat call activity at both control and impact sites increased from 2019 to 2020.*
- *Large bent-winged bat call activity increased at control sites and decreased at impact sites from 2019 to 2020. While there was a decline in activity of >10% in 2020 compared with 2019, this decline has not been recorded across two or more survey years and as such the microbat subsidence performance indicator for this species was achieved.*

The 2019 monitoring report (Hoye 2020) states that there were some monitoring sites where declines in activity levels of the large-eared pied-bat or large bent-winged bat were reported for two consecutive years. Eco Logical (2020) did not document any concerns or declines in relation to micro-bat activity levels. No explanation or elaboration of the decline in activity level documented in the previous year (Hoye 2020) was provided.

The 2020 monitoring results (Eco Logical 2021b) suggest that threatened cave-dependant microbat species large-eared pied-bat and large bent-winged bat continue to persist across the UCC. However, Eco Logical (2021) state in their report that activity levels may be an unreliable performance measure to assess subsidence impacts due to the wide variation in activity levels recorded across all monitoring events since 2011.

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

- **lead to a long-term decrease in the size of an important population of a species;**

The Proposed Action would result in direct impacts up to a maximum of 37.1 ha of potential woodland and forest foraging habitat for the large-eared pied-bat. There are no cliff line habitats within the Proposed Direct Impact Area, however cliff lines that potentially support breeding habitat for the species occur throughout the Potential Indirect Impact Area. No areas of suitable breeding habitat for the large-eared pied-bat were observed in the Proposed Direct Impact Area during surveys. Subsidence predictions indicate that impacts on cliff line habitats that support potential breeding habitat for the large-eared pied-bat would be similar to other underground mining areas at the UCC. Up to 93 m of the 464 m of mapped cliff line may experience rock fall and up to 325 m may experience cracking. Long term monitoring at the UCC in longwall mining areas demonstrates that populations of large-eared pied-bat are persisting and evidence of breeding has been recently recorded, despite existing subsidence impacts. While 2019 monitoring results flagged a potential decline in activity levels of large-eared pied-bat, the 2020 monitoring results (Eco Logical 2021b) confirm that the species is still persisting in mined areas with strong activity levels (further details provided above).

The large-eared pied-bat population that occurs in the wider UCC is potentially an *important population* of the species. Given the high mobility of the species, the lack of known maternity/roost sites in the impact area, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to a maximum of 37.1 ha of foraging habitat is unlikely to lead to a long-term decrease in size of a population of the species (regardless of it being an *important population* or not).

Based on the existing subsidence impacts on cliff line habitats that may contain maternity roosts for the species (although this has not been confirmed), the subsidence as a result of longwall mining has not shown long term decreases in the size of the potentially important population of large-eared pied bat. No maternity roosts have been confirmed in the Proposed Indirect Impact Area.

The Proposed Action is not considered likely to lead to a long-term decrease in the size of an *important population* of this species as the area of habitat proposed to be directly impacted is minor compared to its known range and mobility.

- **reduce the area of occupancy of an important population, or;**

The Proposed Action would result in direct impact to up to a maximum of 37.1 ha of potential foraging habitat for the large-eared pied-bat. There are no cliff line habitats within the Proposed Direct Impact Area, however cliff lines that potentially support breeding habitat for the species occur throughout the Potential Indirect Impact Area. No known maternity/roost sites occur within the Referral Area, however breeding habitat may be present. Subsidence predictions indicate that impacts on cliff line habitats that support potential breeding habitat for the large-eared pied-bat would be similar to other underground mining areas at the UCC. Up to 93 m of the 464 m of mapped cliff line may experience rock fall and up to 325 m may experience cracking.

While the Proposed Action will reduce habitat for the large-eared pied-bat, given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to a maximum of 37.1 ha of foraging habitat (which may be utilised by an *important population* of large-eared pied-bat) would not substantially reduce the area of occupancy of the species.

Rockfall impacts to approximately 93 m of clifflines and cracking impacts to 325 m of cliff lines may result in a reduction in the area of potential roosting occupancy for the species.

- **fragment an existing important population into two or more populations, or;**

Up to a maximum of 37.1 ha of potential habitat for the large-eared pied-bat would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

The proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the species (which may be associated with an *important population* of the species) into two or more populations.

The Proposed Action is unlikely to result in the fragmentation of an *important population* of the large-eared pied-bat.

- **adversely affect habitat critical to the survival of a species, or;**

The National Recovery Plan for the large-eared pied bat (DERM, 2011) states that habitat critical for the survival of the species requires the presence of diurnal roosts and shelter habitat, usually in the form of sandstone cliffs and adjacent fertile woodland valley foraging habitat. The Referral Area does support habitats that would meet these requirements of critical habitat for the large-eared pied-bat.

The cliff line habitats would not be directly impacted by the Proposed Action, however up to 93 m of the 464 m of mapped cliff line may experience rock fall and up to 325 m may experience cracking. The Proposed Action will adversely affect up 37.1 ha of habitat critical to the survival of the large-eared pied-bat, which in this case constitutes 'adjacent fertile woodland valley foraging habitat' and indirectly impact up to 325 m of potential cliff line habitat.

- **disrupt the breeding cycle of an important population, or;**

Over most of its range, the large-eared pied bat appears to roost predominantly in caves and overhangs in sandstone cliffs and forage in nearby high-fertility forest or woodland near watercourses. The Referral Area does support potential breeding habitat for the large-eared pied-bat, however these potential breeding habitats will not be directly impacted by the Proposed Action. There is potential that subsidence may result in impacts to cliff line areas that support potential breeding habitat for the species (such as cracking and rockfall). There are no known maternity/roost sites within the Referral Area. The predicted subsidence and evidence from previous longwall mining in the area, indicates that potential breeding habitats, should they exist in the Potential Indirect Impact Area, would be unlikely to be disturbed in any material way. However, there has been one instance of cave collapse at UCC, and therefore there is some risk, albeit low, that this may occur in other areas.

The Referral Area does contain potential suitable breeding/roosting habitat for this species. While no maternity roost is currently known, there is some risk of a potential breeding roost being damaged as a result of subsidence, however the likelihood of that occurring is low based on the evidence from many years of underground mining at UCC. There is a very low possibility that the Proposed Action could impact on potential breeding habitat to such an extent that the breeding cycle of an *important population* of this species would be interrupted.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action would result in direct impact to up to a maximum of 37.1 ha of potential foraging habitat for the large-eared pied-bat. There are no cliff line habitats within the area of direct impact, however cliff lines that potentially support breeding habitat for the species occur throughout the Potential Indirect Impact Area. There are no known maternity/roost sites within the Referral Area.

Subsidence predictions indicate that impacts on cliff line habitats that support potential breeding habitat for the large-eared pied-bat would be similar to other underground mining areas at the UCC. Up to 325 m of the 464 m of mapped cliff line may experience rock fall or cracking. Long term monitoring at the UCC in longwall mining areas demonstrates that populations of large-eared pied-bat are persisting and recent evidence of breeding has been recorded. While 2019 monitoring results flagged a potential decline in activity levels of large-eared pied-bat, the 2020 monitoring results (Eco Logical 2021b) confirm that the species is still persisting in mined areas with strong activity levels (further details provided above). Evidence from monitoring indicates that previous longwall mining in the area has not appeared to significantly impact potential micro-bat breeding habitats with ongoing activity and evidence of breeding individuals. There has been one instance of cave collapse at UCC, and therefore there is some risk, albeit low, that this may occur in other areas.

While the Proposed Action will reduce habitat for this species, given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to a maximum of 37.1 ha of foraging and indirect impacts to cliff line is not expected to substantially reduce habitat for the species to the extent of decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to large-eared-pied bat becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

The large-eared pied-bat is not known to be affected by diseases that are causing the species to decline. The Proposed Action is not likely to result in the introduction of disease.

- **interfere substantially with the recovery of the species.**

The following recovery plan has been prepared:

- National Recovery Plan for the Large-eared Pied-Bat *Chalinolobus dwyeri* (DERM, 2011).

Any impacts to potential habitat for the large-eared pied-bat will likely contravene the objectives of the recovery plan. Breeding and foraging habitat may occur within the Referral Area, however only foraging habitats will be directly impacted. It is considered unlikely that the Proposed Action will interfere with the recovery of an *important population* of the large-eared pied-bat.

Conclusion

Given the presence of known maternity roosts, the population of large-eared pied-bat within the wider UCC has potential to be an *important population,* and therefore any individuals utilising the habitats of the Referral Area may be part of that important population. As a result of the Proposed Action, there will be direct disturbance of up to a maximum of 37.1 ha of foraging habitat for the large-eared pied-bat, and

potential indirect impacts associated with subsidence across the Referral Area. Potential indirect impacts on potential roosting/breeding habitats are expected to be minimal and may include cracking or rockfall on cliff lines that provide potential roosting/breeding habitat for the species. Evidence from monitoring indicates that activity and evidence of breeding individuals continue to be recorded in previous longwall mining areas. There has been one instance of cave collapse at UCC (not a known breeding roost), and therefore there is some risk, albeit low, that this may occur in other areas.

While the Proposed Action will result in impacts to foraging and potential breeding habitats for the large-eared pied-bat, given the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality and the lack of confirmed maternity roosts in the Referral Area, the Proposed Action is **unlikely** to result in a significant impact to an important population of the species.

6.3.6 Corben's long-eared bat (*Nytophilus corbeni*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The Corben's long-eared bat is also referred to as the south-eastern long-eared bat, and was previously included as a distinct form of the greater long-eared bat (*Nyctophilus timorensis*) until it was formally described as a separate species in 2009. In NSW, the distribution of the species is largely concentrated in the Murray Darling Basin, with the Pilliga scrub being the stronghold. Due to the taxonomic changes, the historic distribution is unclear. Habitat for the Corben's long-eared bat includes a range of inland woodland vegetation types. The species roosts primarily in tree hollows.

Seven records of this species have been recorded throughout the UCC previously (Mt King 2008 and Hoye 2009), the locations of which are shown on **Figure 3.10**. More recently, Eco Logical (2021) documented potential records of this species at four monitoring sites within the UCC. Three breeding females were captured in a monitoring site in 2011 (Eco Logical 2012), which indicates the UCC may support breeding habitat. Given that breeding habitat for this species comprises tree hollows, crevices and loose bark, it is more difficult to identify specific locations of breeding habitat than for cave-roosting species such as the large-eared pied-bat. Harp trap and Anabat surveys were undertaken within the Referral Area during the surveys undertaken for this assessment. These surveys did not record any individuals of the Corben's long-eared bat.

There is limited available information regarding what constitutes an important population of the Corben's long-eared bat and no detailed demographic studies have been conducted (TSSC 2015b). The Pilliga scrub region, approximately 200 km north of the Referral Area is considered a stronghold for the species. Following careful consideration of the above definition of an *important population*, it is considered unlikely that the population(s) of Corben's long-eared bat that breed and forage throughout the UCC would be an *important population*. It is unlikely that the UCC or Referral Area supports a population that is a key source for breeding/dispersal or that is necessary for maintaining genetic diversity. The Referral Area is not at the limit of the species' range.

Approximately 918.7 ha of potential woodland habitat for the Corben's long-eared bat occurs within the Referral Area. Up to a maximum of 37.1 ha of potential habitat will be directly impacted for surface infrastructure (refer to **Table 6.12**). Numerous tree hollows were recorded across the Referral Area during surveys undertaken for this assessment, however only one was recorded in the Direct Impact Area (in Area 1). The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from long term ecological monitoring of previously mined longwalls at the UCC, impacts on native vegetation and habitats as a result of the proposed underground longwall mining would be similar to other underground mining areas at the UCC. There are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.12 Summary of Relevant Impact Areas for Corben's Long-eared Bat

Corben's Long-eared Bat Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and forest habitat	918.7	24.5	37.1
Total	**918.7**	**24.5**	**37.1**

^As per Maximum Parameters Assessment Approach.

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

- **lead to a long-term decrease in the size of an important population of a species;**

The Proposed Action would result in direct impact to up to a maximum of 37.1 ha of potential foraging and roosting habitat for the Corben's long-eared bat. Given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, including Goulburn River National Park, the removal of a maximum of 37.1 ha is unlikely to lead to a long-term decrease in size of a population of the species. Furthermore, it is considered unlikely that the Referral Area supports an *important population* of this species.

The Proposed Action is not considered likely to lead to a long-term decrease in the size of an *important population* of this species as the area of habitat proposed to be directly impacted is minimal compared to its known range and mobility.

- **reduce the area of occupancy of an important population, or;**

The Proposed Action would result in direct impact to up to a maximum of 37.1 ha of potential habitat for the Corben's long-eared bat.

While the Proposed Action will reduce habitat for this species, given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of 37.1 ha would not substantially reduce the area of occupancy of the species. Furthermore, it is considered unlikely that the Referral Area supports an *important population* of this species.

- **fragment an existing important population into two or more populations, or;**

Up to 37.1 ha of potential habitat for the Corben's long-eared bat would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile

floodplain environments. Significant areas of similar quality habitat surround the Referral Area. If the species occurs within the Referral Area, the proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the species into two or more populations.

The Proposed Action is unlikely to result in the fragmentation of an *important population* of the Corben's long-eared bat.

- **adversely affect habitat critical to the survival of a species, or;**

In NSW, the stronghold for the species is the Pilliga scrub region, which is approximately 200 km to the north of the Referral Area (TSSC 2015b). There is no other known documented guidance on what constitutes critical habitat for this species.

The Proposed Action will adversely affect up to 37.1 ha of potential habitat for the Corben's long-eared bat, however it is not considered that these habitats are critical to the survival of the species. Extensive areas of good quality habitat occur within the wider UCC and the local area, including the nearby Goulburn River National Park. The Proposed Action is unlikely to adversely affect habitat critical to the survival of the Corben's long-eared bat.

- **disrupt the breeding cycle of an important population, or;**

The Corben's long-eared bat largely roosts in tree hollows. Tree hollows were found to occur throughout the Referral Area in moderate density. Up to 37.1 ha of habitat that supports potential breeding habitat in the form of tree hollows would be directly impacted as a result of the Proposed Action.

The Referral Area does support suitable breeding habitat for this species that will be disturbed. However, the Referral Area is considered unlikely to support an important population of the Corben's long-eared bat. As such, the Proposed Action is not expected disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action would result in direct impact to up to 37.1 ha of potential habitat for the Corben's long-eared bat.

While the Proposed Action will reduce habitat for this species, given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to 37.1 ha would not substantially reduce habitat for the species to the extent of decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to Corben's long-eared bat becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

Corben's long-eared bat is not known to be affected by diseases that are causing the species to decline. The Proposed Action is not likely to result in the introduction of disease.

- **interfere substantially with the recovery of the species.**

There is no recovery plan published for the Corben's long-eared bat. The Proposed Action would result in direct disturbance to up to 37.1 ha of potential habitat for the species. However, given the high mobility of the species, the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to 37.1 ha would not substantially interfere with the recovery of the species.

Conclusion

The Corben's long-eared bat has been recorded at the UCC previously, however it has not been recorded in the Referral Area. The Proposed Action will remove up to 37.1 ha of potential foraging and roosting habitat for this species.

While the Proposed Action will result in impacts to potential foraging and roosting habitat for this species, given the very large foraging range and the availability of extensive areas of similar quality habitat at the UCC and surrounding locality, the removal of up to 37.1 ha is **unlikely** to constitute a significant impact to the species.

6.3.7 Grey-headed Flying Fox (*Pteropus poliocephalus*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

According to the Referral Guideline for Management Actions in Grey-headed and Spectacled Flying-Fox Camps (DoE 2015a) nationally important grey-headed flying-fox camps are recognised as any camps that have contained 10,000 individuals or greater in the last 10 years or have been occupied by 2,500 individuals or greater permanently or seasonally every year for the last 10 years.

The grey-headed flying-fox has not been recorded in the Referral Area, however has been recorded at the UCC. There are no BioNet Atlas records of this species within the UCC, however Umwelt (2015) reported one record approximately 2.5 km to the east of the Referral Area. There is a known seasonal camp in Mudgee, approximately 60 km south of the Referral Area (DAWE 2022). Camp sites (breeding habitat) have not been identified within the Referral Area and are not expected to occur. No nationally important grey-headed flying-fox camps have been identified within 50 km of the Referral Area according to the National Flying-Fox Monitoring Viewer (DAWE 2022).

Approximately 918.7 ha of potential habitat for the grey-headed flying-fox occurs within the Referral Area, which includes all woodland or open forest vegetation types. Up to 37.1 ha will be directly impacted for surface infrastructure (refer to **Table 6.13**). The remaining areas of potential habitat relate to the proposed underground longwall areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not expected to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

Table 6.13 Summary of Relevant Impact Areas for Grey-headed Flying-fox

Grey-headed Flying Fox Foraging Habitat	Area (ha)		
	Referral Area	Direct Impact Area	Maximum Disturbance^
Native woodland and forest habitat	918.7	24.5	37.1
Total	**918.7**	**24.5**	**37.1**

^As per Maximum Parameters Assessment Approach.

The Referral Area is considered to comprise areas of potentially suitable foraging habitat for this species however is unlikely to contain significant breeding and roosting habitat necessary for maintaining genetic diversity. The Referral Area is also not near the limit of the known range of this species. The Referral Area is unlikely to contain an *important population* of the grey-headed flying-fox.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of the grey-headed flying-fox present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in the loss of up to 37.1 ha of potential foraging habitat for grey-headed flying-fox. However, since the Referral Area does not contain an important population of the grey-headed flying-fox, the Proposed Action will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

While not recorded within the Referral Area, up to 37.1 ha of potential habitat for the grey-headed flying-fox would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

The Proposed Action will result in the disturbance of up to 37.1 ha of potential habitat for the grey-headed flying-fox. If the species occurs within the Referral Area, the proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the grey-headed flying-fox into two or more populations.

Regardless, the Referral Area does not support an *important population* of grey-headed flying-fox and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

According to the National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021), foraging habitat that contains important winter and spring flowering vegetation is considered habitat critical to the survival of the species. Relevant to the Referral Area, this includes vegetation that contains *Eucalyptus albens, E. crebra, E. fibrosa* and *E. melliodora.*

The Referral Area is considered to comprise up to 918.7 ha of potentially suitable foraging habitat for this species and may be productive during winter and spring according to the above criteria. The Proposed Action will result in the disturbance to up to 37.1 ha of potential foraging habitat for the grey-headed flying-fox, however the Referral Area does not support an *important population*.

It is considered that the Proposed Action is unlikely to substantially adversely affect foraging habitat critical to the survival of the species.

- **disrupt the breeding cycle of an *important population*, or;**

No grey-headed flying-fox breeding populations or camps have been identified in the Referral Area, and the Referral Area does not support an *important population*. The Proposed Action is not expected to disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to 37.1 ha of potential foraging habitat for grey-headed flying-fox. Large areas of similar and/or higher quality habitats occur within the broader locality. Given the regionally small area of potential foraging habitat to be removed, the habitats of the Referral Area are unlikely to be depended on by local grey-headed flying-fox colonies.

It is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the grey-headed flying-fox would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the grey-headed flying-fox becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the grey-headed flying-fox to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

The key objectives of the National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021) include:

- improving the national population trend
- identifying, protecting and increasing key foraging and roosting habitat
- improve the community's capacity to coexist with flying-foxes; and increase awareness about flying-foxes, the threats they face and the important ecosystem services they provide as seed dispersers and pollinators.

No significant impact on the recovery of the grey-headed flying-fox is expected to occur as a result of the Proposed Action as the potential areas of foraging habitat that will be impacted as a result of the Proposed Action are not expected to impact an *important population* of this species.

Conclusion

The grey-headed flying-fox has not been recorded within the Referral Area, however it has been recorded in the UCC and potential foraging habitat occurs. Up to 37.1 ha of potential foraging habitat for the grey-headed flying-fox would be directly disturbed as a result of the Proposed Action.

The Referral Area is not considered to support an *important population* of the grey-headed flying -fox. The Proposed Action is **unlikely** to result in a significant impact on an *important population* of grey-headed flying-fox.

6.3.8 Brush-tailed rock-wallaby (*Petrogale penicillata*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- **key source populations either for breeding or dispersal; or**
- **populations that are necessary for maintaining genetic diversity, and/or**
- **populations that are near the limit of the species range.**

The brush-tailed rock-wallaby was not recorded in the Referral Area, however has been recorded previously (in 2001) at the UCC, approximately 6.5 km south-east of the Referral Area (BioNet Atlas, sighting date 2001). The rocky/cliffline habitats of the Referral Area provide potential habitat for this species.

Approximately 918.7 ha of potential habitat for the brush-tailed rock-wallaby occur within the Referral Area, which includes all woodland or open forest vegetation types. Up to 37.1 ha will be directly impacted for surface infrastructure (refer to **Table 6.14**). The remaining areas of potential habitat relate to the proposed longwall areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there would be negligible impacts on native vegetation and habitats as a result of the proposed longwall mining.

Table 6.14 Summary of Relevant Impact Areas for Brush-tailed Rock-wallaby

Brush-tailed Rock-wallaby Habitat	Area (ha)			
	Referral Area	Direct Impact Area	Indirect Impact Area	Maximum Disturbance^
Native woodland and forest foraging habitat	918.7	24.5	850.9	37.1
Cliff line habitats	464 m	0.0	464 m	464 m
Total	**918.7**	**24.5**	**-**	**37.1**

^As per Maximum Parameters Assessment Approach.

The Referral Area does support areas of potential breeding habitat for this species however there are no known significant breeding habitats that may be important for maintaining genetic diversity of a population. The Referral Area is also not near the limit of the known range of this species.

The national recovery Plan for the brush-tailed Rock-Wallaby (Menkhorst and Hynes 2010) identifies the following *important populations* in NSW:

• Warrumbungle Range

• Mt Kaputar

• Wollemi National Park and Jenolan Caves

• Nattai National Park population

• Shoalhaven, and

• Macleay Gorges region.

Therefore any records of the brush-tailed rock-wallaby within the Referral Area would not comprise an important population of the species.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species;**

Given that there is not considered to be an *important population* of the brush-tailed rock-wallaby present within the Referral Area, the Proposed Action will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population*, or;**

The Proposed Action will result in direct disturbance of up to 37.1 ha of potentially suitable foraging habitat for the brush-tailed rock-wallaby. Evidence from ecological monitoring of previously mined longwalls at the UCC, suggests that there would be negligible impacts on native vegetation and habitats as a result of the proposed longwall mining. Cliff line habitats in the Indirect Impact Area may be subject to cracking and rockfall, however this is unlikely to be substantial enough to result in the loss of the potential habitat in this area.

The Referral Area does not contain an important population of the brush-tailed rock-wallaby, and therefore the Proposed Action will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations, or;**

While not recorded within the Referral Area, up to 37.1 ha of potential habitat for the brush-tailed rock-wallaby would be removed by the Proposed Action. The habitats occurring within the Referral Area currently support relatively good connectivity, aside from some areas of derived native grassland historically cleared for agriculture in the more fertile floodplain environments. Significant areas of similar quality habitat surround the Referral Area.

If the species occurs within the Referral Area, the proposed area of disturbance relative to the mobility of the species is considered unlikely to result in the fragmentation of an existing population of the Brush-Tailed Rock Wallaby into two or more populations.

Regardless, the Referral Area does not support an *important population* of brush-tailed rock-wallaby and therefore would not result in the fragmentation of an important population.

- **adversely affect habitat critical to the survival of a species, or;**

The Approved Conservation Advice (TSSC 2021) and Recovery Plan (Menkhorst and Hynes 2010) do not define habitat critical for the survival of the species. The Referral Area is considered to comprise up to 918.7 ha of potentially suitable foraging habitat for this species, of which the Proposed Action will directly impact up to 37.1 ha. Cliff line habitats in the Indirect Impact Area may be subject to cracking and rockfall, however this is unlikely to be substantial enough to result in the loss of the potential habitat in this area.

It is considered that the Proposed Action is unlikely to substantially adversely affect foraging habitat critical to the survival of the species.

- **disrupt the breeding cycle of an *important population*, or;**

No records of the brush-tailed rock-wallaby were recorded within the Referral Area, and the Referral Area does not support an *important population*. The Proposed Action will not disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or;**

The Proposed Action will result in the loss of up to 37.1 ha of potentially suitable habitat for the brush-tailed rock-wallaby. Large areas of similar and/or higher quality habitats occur within the broader locality. Cliff line habitats in the Indirect Impact Area may be subject to cracking and rockfall, however this is unlikely to be substantial enough to result in the loss of the potential habitat in this area.

Given the relatively small area of disturbance, it is considered unlikely that the Proposed Action will modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the brush-tailed rock-wallaby would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**

The Proposed Action is not expected to result in invasive species that are harmful to the brush-tailed rock-wallaby becoming established in the species habitat.

- **introduce disease that may cause the species to decline; or**

No diseases that may cause the brush-tailed rock-wallaby to decline are likely to be introduced as a result of the Proposed Action.

- **interfere substantially with the recovery of the species.**

No significant effect on the recovery of the brush-tailed rock-wallaby is expected to occur as a result of the Proposed Action as suitable cliff line/rocky habitats will not be directly impacted.

Conclusion

The brush-tailed rock-wallaby has not been recorded within the Referral Area, however it has been recorded at the UCC and potential foraging habitat occurs. Potential cliff line habitat occurs in the wider Indirect Impact Area, however no suitable rocky habitats occur in the Direct Impact Area. The Referral Area

is not considered to support an *important population* of the brush-tailed rock-wallaby. Up to 37.1 ha of potentially suitable habitat for the species would be directly disturbed as a result of the Proposed Action.

The Proposed Action is **unlikely** to result in a significant impact on an *important population* of the brush-tailed rock-wallaby.

6.4 Migratory Species listed under International Conventions

The following migratory species are considered in this assessment:

- white-throated needletail (*Hirundapus caudacutus*)

The white-throated needletail is a large, insectivorous swift that is widespread in eastern and south-eastern Australia. The species can generally be found up to 1 km above ground over a wide range of habitats, preferring wooded areas (TSSC 2008). The species roosts in the tree canopy or in hollows, among dense foliage. The white-throated needletail breeds in areas of Asia including Japan, Siberia, China and Pakistan (TSSC 2008). The species is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. White-throated needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats.

Important habitat for the species is outlined in the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015b) and states that large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. They are found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. The white-throated needletail has not been recorded in the Referral Area despite surveys however potential foraging habitat occurs. The species has previously been recorded, with a record at the UCC approximately 3 km east of Area 4 and three records approximately 3 km south and south-east of Area 2 (BioNet Atlas, sighting dates 2016-2018) (refer to **Figure 3.10**). The species is known to be widespread across eastern NSW.

Approximately 9 ha of potential woodland foraging habitat for the white-throated needletail occurs within the Referral Area. Up to a maximum of 37.1 ha will be directly impacted for surface infrastructure. The remaining areas of potential habitat relate to the proposed underground longwall mining areas, where there would only be potential indirect impacts resulting from subsidence. Based on the current subsidence predictions, and evidence from ecological monitoring of previously mined longwalls at the UCC, there are not predicted to be any material indirect impacts on this species as a result of the predicted subsidence impacts.

The Project is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- ***substantially modify and/or destroy an area of important habitat for a migratory species;***
- ***seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species; and/or***
- ***result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.***

The Referral Area contains potential foraging habitat for the white-throated needletail, however the species has not been recorded utilising the habitats of the Referral Area and this habitat is unlikely to be *important habitat* for the species. The Project is not likely to substantially modify or destroy important migratory species habitat. Similarly, the Project will not seriously disrupt the lifecycle of an ecologically

significant proportion of the population of a migratory species; or result in an invasive species that is harmful to migratory species becoming established within the Referral Area.

Conclusion

The Project is **unlikely** to result in a significant impact on any migratory species listed under the EPBC Act or international conventions.

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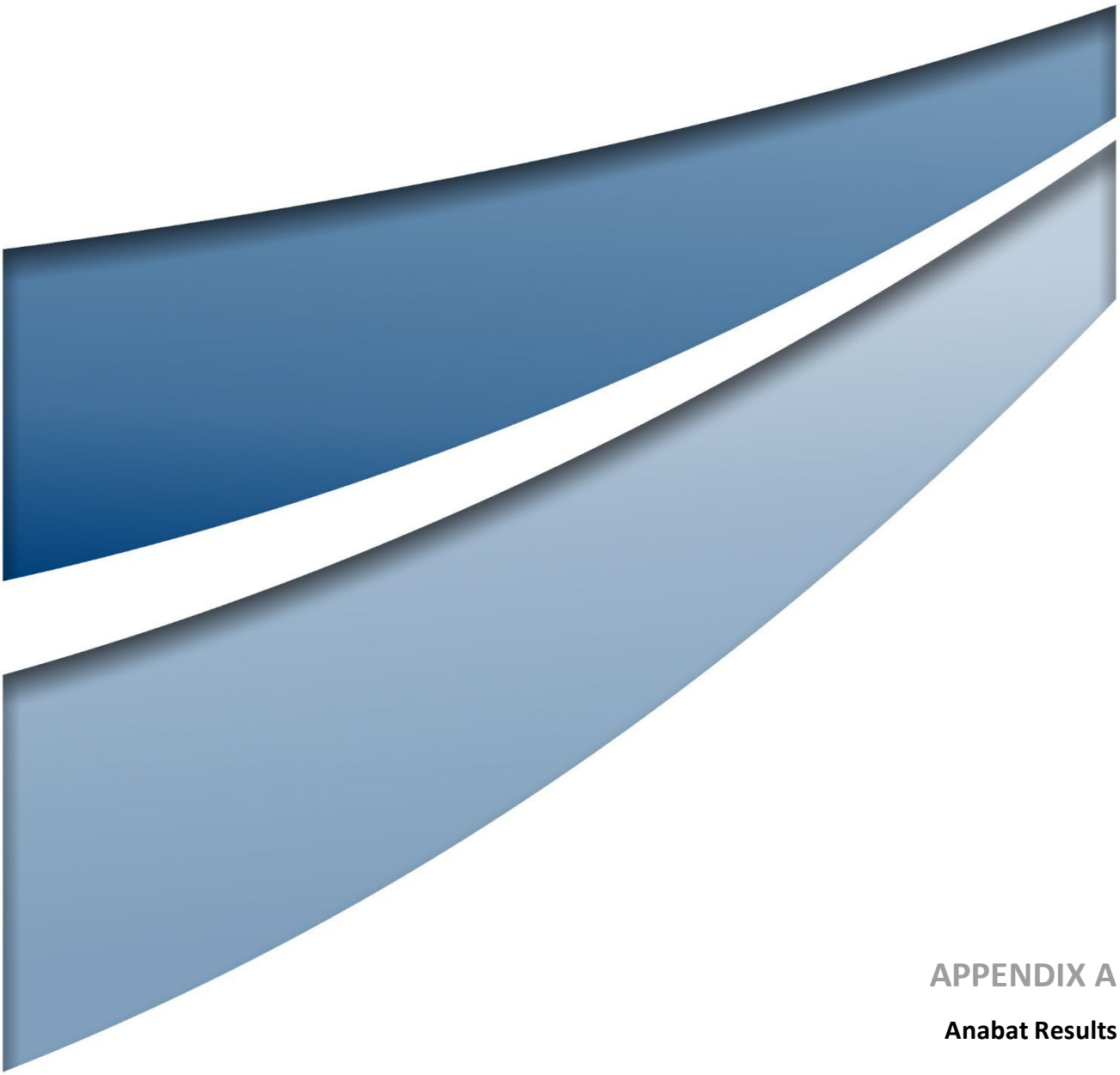

APPENDIX A

Anabat Results

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Umwelt (Australia) Pty Ltd

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15th March 2022

Hi Will,

Following are the results for the files you sent for the sites at Ulan, NSW. One folder was missing, but since you stated it had 14 call passes in the summary sheet, this may have been intentional. If Anabat 2 and Anabat 7 were not placed at obviously poor sites, and they are older units (SD1, SD2, ZCAIM/Anabat II), then the small number of files on each device could indicate they are not working as well as more modern devices and should be considered for retirement or sensitivity testing. Care should be taken when comparing activity data between these and newer devices.

After quality control (QC) checking of threatened species call passes, the following threatened species were found: Large-eared Pied Bat (confident at 5 sites), Little Pied Bat (confident at 1, possible at 2 sites), Large Bent-winged Bat (confident at 6, possible at 2 sites), and Greater Broad-nosed Bat (confident at 4, possible at 2 sites). This is assuming each pair of

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detector nights is one site (site data not supplied). The regionally significant Eastern Horseshoe Bat was recorded confidently at 7 sites, with large numbers of calls at Anabat 17 site warranting further investigation to classify roost status. Possible calls from Southern Myotis, Corben's Long-eared Bat, Yellow-bellied Sheathtail-bat and Eastern Cave Bat were deemed to be incorrect after QC.

It should be noted that in this region Greater Broad-nosed Bat, Inland Broad-nosed Bat and Gould's Wattled Bat all overlap in call frequency and shape, so there can be some uncertainty around identification of those calls. By the same token, Little Forest Bat and Large Bent-winged Bat overlap in call frequency, so there can be some uncertainty around identification of those calls. There can also be false positives for White-stiped Freetail-bat when a lot of noise is recorded around their frequency band. The auto analysis programme cannot identify multiple species from a single file, so only the first species will be recorded in this scenario. Recognition is poorer for species with low numbers of reference calls, particularly when the species have regionally varying call frequencies. For this reason the QC process is considered an important part of the analytical process. QC has been conducted to the best of our ability, but without habitat descriptions of site, there can be uncertainty around the species identifications when call pulses differ between open and closed areas. Please consider supplying this data in future.

If you have any questions about the results give me a call.

Glenn Hoye

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Table 1a

Date	Unit	Site	A.aus	C.dwy	C.gou	C.mor	C.pic	Mi.ori	Mo.pet	Mo.pla	Mo.rid	My.mac	Ny.geo	Ny.gou	Ny.cor
01/02/2022	Anabat 2 QC	Bat7	20(11)	0	1(0)	9(8)	0	0	0	0	1(0)	0	2(1)	0	0
02/02/2022	Anabat 2 QC	Bat7	1(0)	0	2(0)	5(3)	0	0	0	0	0	0	1(0)	0	0
01/02/2022	Anabat 7 QC	Bat6	38(28)	0	0	1(1)	0	0	0	0	0	1(0)**	3(0)	0	0
02/02/2022	Anabat 7 QC	Bat6	0	0	0	4(3)	0	1(0)	0	0	0	0	0	0	0
12/01/2022	Umbat 10 QC	Bat3	57(36)	4(2)	21(10)	33(24)	0	33(13)	1(0)	32(8)	3(2)	0	0	1(0)	0
13/01/2022	Umbat 10 QC	Bat3	46(24)	22(18)	35(22)	33(28)	1(1)	26(7)	2(0)	18(7)	7(0)	0	0	0	0
01/02/2022	Anabat 10 QC	Bat8	45(25)	0	7(4)	7(3)	4(2)*	12(4)	6(2)	1(0)	1(0)	0	1(0)	2(0)	1(0)**
02/02/2022	Anabat 10 QC	Bat8	5(0)	4(4)	8(2)	4(0)	1(0)**	8(4)*	1(0)	0	5(1)	0	1(0)	0	0
01/02/2022	Anabat 11 QC	Bat4	65(52)	4(0)	17(8)	14(6)	1(0)**	12(3)*	3(0)	4(1)	6(1)	0	1(1)	0	0
02/02/2022	Anabat 11 QC	Bat4	1(1)	6(3)*	12(2)	1(0)	0	3(2)*	1(0)	15(6)	7(0)	0	0	1(0)	0
01/02/2022	Anabat 17 QC	Bat5	26(9)	2(1)	6(4)	29(15)	0	14(5)	1(1)	4(0)	0	0	3(3)	1(0)	0
02/02/2022	Anabat 17	Bat5	0	9(7)	8(3)	69(37)	0	5(1)	2(0)	14(7)	3(0)	0	12(7)	0	0
10/01/2022	BAT5 QC	Bat1	195(177)	0	73(54)	32(22)	2(1)*	3(0)	62(22)	9(5)	15(1)	0	1(1)	0	0
11/01/2022	BAT5	Bat1													
12/01/2022	Umbat 11 QC	Bat2	4(2)	18(13)	10(4)	8(3)	0	6(3)*	1(0)	13(7)	2(1)	0	0	0	0
13/01/2022	Umbat 11 QC	Bat2	57(28)	8(4)	89(56)	11(1)	3(0)	8(2)	7(1)	14(2)	17(6)	0	1(0)	0	0
12/01/2022	Umbat 15 QC	Bat1	4(2)	0	1(0)	19(12)	0	29(6)	0	1(0)	0	0	2(0)	1(0)	0
13/01/2022	Umbat 15 QC	Bat1	16(6)	0	1(0)	20(12)	0	12(3)	0	1(0)	2(0)	0	1(0)	0	0

Table 1b

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Date	Unit	Site	R.meg	Sac.fla	Scote.ru	Scoto.bal	V.tro	V.vul	Total Passes
01/02/2022	Anabat 2 QC	Bat7	9(6)	0	0	0	0	23(9)	65
02/02/2022	Anabat 2 QC	Bat7	6(5)	0	0	0	0	21(13)	36
01/02/2022	Anabat 7 QC	Bat6	8(7)	0	0	0	0	3(2)	54
02/02/2022	Anabat 7 QC	Bat6	2(2)	0	0	0	0	15(9)	22
12/01/2022	Umbat 10 QC	Bat3	11(7)	0	2(0)**	1(1)	0	278(237)	477
13/01/2022	Umbat 10 QC	Bat3	4(4)	0	9(7)*	2(2)	0	281(243)	486
01/02/2022	Anabat 10 QC	Bat8	2(2)	0	7(4)	2(1)	0	74(48)	172
02/02/2022	Anabat 10 QC	Bat8	1(1)	0	2(1)**	2(0)	0	29(14)	71
01/02/2022	Anabat 11 QC	Bat4	6(4)	1(0)**	4(3)*	2(2)	0	72(43)	212
02/02/2022	Anabat 11 QC	Bat4	2(1)	0	2(0)	1(1)	0	20(10)	72
01/02/2022	Anabat 17 QC	Bat5	588(520)	2(0)**	7(5)	4(1)	2(0)**	275(231)	964
02/02/2022	Anabat 17	Bat5	36(34)	0	3(2)	1(0)	6(0)**	184(163)	352
10/01/2022	BAT5 QC	Bat1	0	0	95(49)	18(5)	0	66(47)	571
11/01/2022	BAT5	Bat1							
12/01/2022	Umbat 11 QC	Bat2	0	0	8(2)*	2(0)	0	87(72)	159
13/01/2022	Umbat 11 QC	Bat2	3(1)**	0	10(4)	0	0	149(125)	377
12/01/2022	Umbat 15 QC	Bat1	3(3)	0	0	0	0	353(233)	413
13/01/2022	Umbat 15 QC	Bat1	1(1)	2(0)**	0	0	0	189(118)	245

The number of echolocation calls identified to a high level of confidence to a species are marked in brackets. Species codes explained below, those in bold are listed as threatened.

**confident call found to be probable/possible under QC*
***possible call found to be erroneous under QC*
QC for threatened species results conducted by Andrew Lothian

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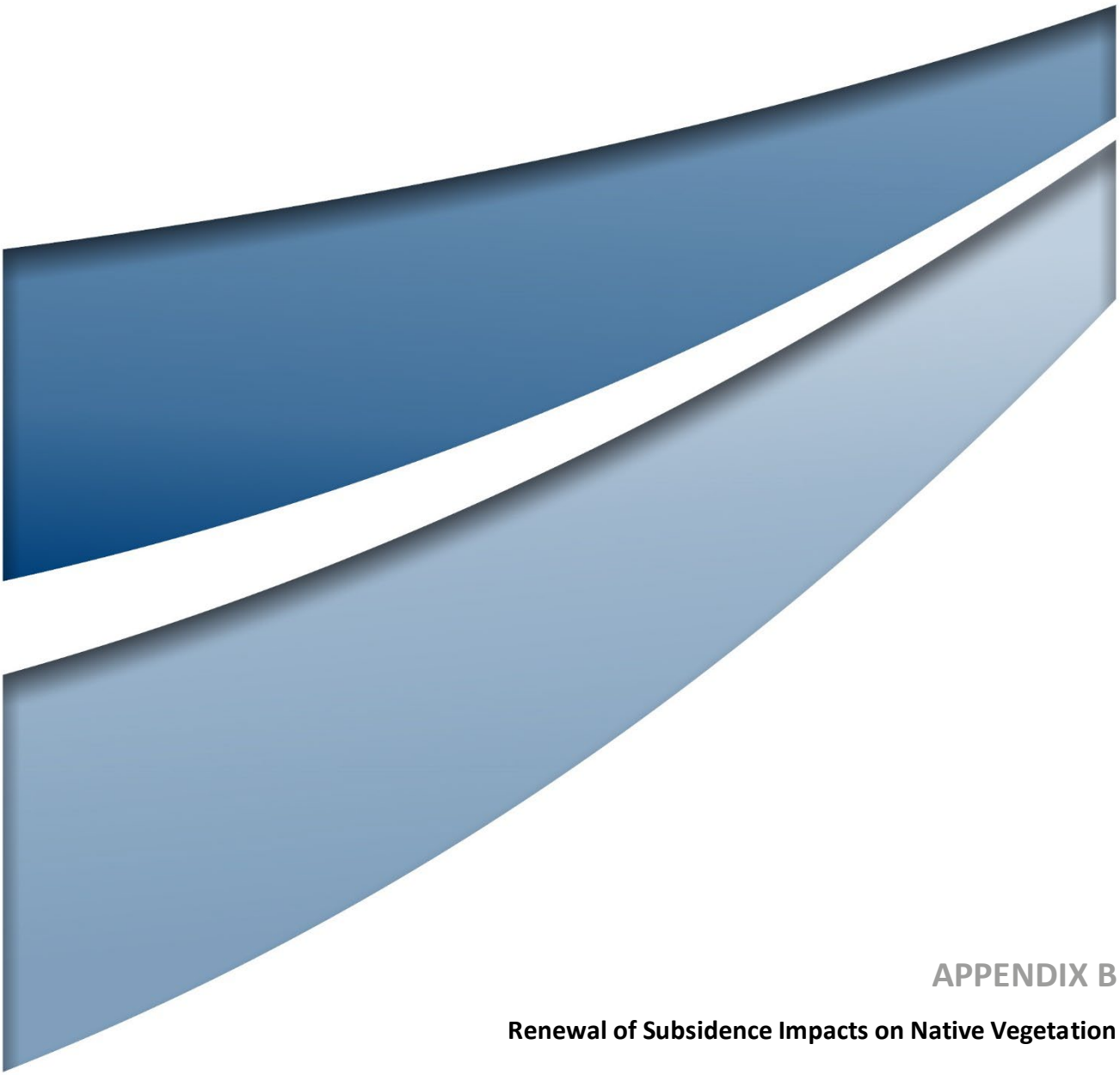
Species code	Scientific name	Common name	NSW status	C'th status
A.au	*Austronomus australis*	White-striped Free-tailed Bat	-	-
C.dw	***Chalinolobus dwyeri***	**Large-eared pied Bat**	**V**	**V**
C.go	*Chalinolobus gouldii*	Gould's Wattled Bat	-	-
C.mo	*Chalinolobus morio*	Chocolate Wattled bat	-	-
F.ta	***Falsistrellus tasmaniensis***	**Eastern False Pipistrelle**	**V**	**-**
K.pap	***Kerivoula papuensis***	**Golden-tipped Bat**	**V**	**-**
Mi.au	***Miniopterus australis***	**Little Bent-winged Bat**	**V**	**-**
Mi.or	***Miniopterus orianae oceanensis***	**Large Bent-winged Bat**	**V**	**-**
Mo.nor	***Mormopterus norfolkensis***	**Eastern Coastal Free-tailed Bat**	**V**	**-**
Mo.pet	*Mormopterus petersi*	Inland Free-tailed Bat (sp.3)	-	-
Mo.pla	*Mormopterus planiceps*	South Eastern Free-tailed Bat (sp.4)	-	-
Mo.rid	*Mormopterus ridei*	Eastern Free-tailed Bat (sp.2)	-	-
My.ma	***Myotis macropus***	**Southern Myotis**	**V**	**-**
Ny. spp.	Nyctophilus spp.	Long-eared Bat species (unidentifiable to species)	-	-
N.co	***Nyctophilus corbeni***	**Corben's Long-eared Bat**	**V**	**V**
N.ge	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	-	-
N.go	*Nyctophilus gouldii*	Gould's Long-eared Bat	-	-
R.meg	*Rhinolophus megaphyllus*	Eastern Horseshoe Bat	-	-
Sa.fl	***Saccolaimus flaviventris***	**Yellow-bellied Sheathtail-bat**	**V**	**-**
Scote.ru	***Scoteanax rueppellii***	**Greater Broad-nosed Bat**	**V**	**-**
Scoto.ba	*Scotorepens balstoni*	Inland Broad-nosed Bat	-	-
Scoto.gr	*Scotorepens greyii*	Little Broad-nosed Bat	-	-
Scoto.or	*Scotorepens orion*	Eastern Broad-nosed Bat	-	-
V.dar	*Vespadelus darlingtoni*	Large Forest Bat	-	-
V.pum	*Vespadelus pumilis*	Eastern Forest Bat	-	-
V.reg	*Vespadelus regulus*	Southern Forest Bat	-	-
V.tro	***Vespadelus troughtoni***	**Eastern Cave Bat**	**V**	**-**
V.vul	*Vespadelus vulturnus*	Little Forest Bat	-	-



APPENDIX B

Renewal of Subsidence Impacts on Native Vegetation

Review of historical subsidence areas and impacts on vegetation

Ulan West Extension EPBC Referral

Prepared for
Ulan Coal Mines Limited

October 2015

DOCUMENT TRACKING

Item	Detail
Project Name	Review of historical subsidence areas and impacts on vegetation
Project Number	2745
Project Manager	Rachel Murray 02 4302 1231 Unit 1, 79 Market Street, Mudgee NSW 2850
Prepared by	Rachel Murray, Linden Burch
Reviewed by	Daniel Magdi
Approved by	Paul Frazier
Status	Final
Version Number	4
Last saved on	28 October 2015
Cover photo	Clockwise from top: Ironbark Open Forest Complex (x 2); Ironbark Cypress canopy; E. dwyeri in flower. Photo credit: Sarah Dickson-Hoyle

This report should be cited as 'Eco Logical Australia 2015. *Review of historical subsidence areas and impacts on vegetation*. Prepared for Ulan Coal Mined Ltd.'

ACKNOWLEDGEMENTS

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Abbreviations

Abbreviation	Description
CEEC	Critically Endangered Ecological Community
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
ELA	Eco Logical Australia
HSD	Honest significant difference (Tukeys test)
UCML	Ulan Coal Mines Limited

1 Introduction

Eco Logical Australia (ELA) was engaged by Ulan Coal Mines Limited (UCML) to undertake a detailed study of remnant forest and woodland vegetation above previously mined longwalls.

This study was required in response to further information requested by the Department of the Environment (DotE) for the Ulan West Extension *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) Referral regarding potential degradation or destruction of the *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, a Critically Endangered Ecological Community (CEEC) listed under the EPBC Act.

This report presents the results of a study comparing vegetation structure, health and associated habitat values above three mined longwall panels and a related control (non-subsided area). The longwall panels were selected to represent a wide time span (1, 10 and 20 years) to help understand if there were any notable recovery or decline trajectories in vegetation condition following longwall mine subsidence.

The results of this study will inform an assessment of whether there is a difference in variables measured in vegetation communities and habitat values between subsided and non-subsided areas and over a range of timescales.

1.1 Previous Studies

ELA in collaboration with UCML developed a multi-temporal multi-data source method to quantify the impacts of longwall mine subsidence on native vegetation over the Ulan Underground No. 3 mine West 1 and West 2 longwall areas, north-east of Mudgee (Eco Logical Australia, 2011).

Analysis was conducted using a combination of remotely sensed data (LiDAR and satellite imagery), directed field survey and rigorous statistical analysis.

A multiple dataset approach was undertaken assessing key vegetation parameters available from LiDAR data, high resolution satellite imagery and field survey. Both the LiDAR data and satellite imagery were captured at two separate times permitting before and after subsidence comparison with the LiDAR data and post subsidence 'lag effect' comparisons with the satellite imagery. Impact zones were mapped using surveyed results to derive areas of maximum subsidence (longwall) and maximum change in slope (transition) as well as areas of little subsidence (pillar) and assumed no subsidence (control). For the remote sensing analysis variability from different vegetation communities was accounted for by comparing change in condition parameters between the two capture dates and by selecting proportionally based on the area of a particular vegetation community within each zone. Field survey was confined to three impact and one control zone within the Ironbark Open Forest Complex. All data were compared using robust statistical comparison techniques. In addition the remotely sensed data were assessed using visual assessment techniques.

Results showed that subsidence generally occurred as predicted with maximum subsidence up to 1.5 metres (m) occurring in the centre of the longwall panels, maximum change in slope occurring in the transition areas and greatly reduced or no subsidence in the pillar and control areas.

Field data from all zones were compared via single factor ANOVA. In general there were no significant differences between any of the samples with the exception of the percent foliar cover where the control sample had significantly less cover than the pillar sample. This result is considered an artefact of either

the relatively small sample size and/or natural variability within woodland communities as it is unlikely that subsidence had such as significant positive effect on the foliar density within the pillar impact area in the 2 year time period.

Comparison of all impact zones showed no significant negative differences in any zone at any time with any dataset. In no case did the vegetation condition in the control area exceed that shown within the impact zones. Visual assessment confirmed this statistical comparison as no trends in changed vegetation condition could be seen on any of the datasets.

2 Methods

2.1 Study area

The Ulan Coal Complex straddles the Great Dividing Range and is located at the headwaters of the Goulburn River catchment (draining to the east) and the Talbragar River catchment (draining to the west) (Umwelt 2009). The study area is located within the Goulburn River catchment and is characterised by transitional rocky uplands with gentle to medium slopes of less than 10 per cent.

The Ulan Coal Complex is at the western limit of the Sydney Basin geological formation and at the southern end of the Gunnedah Sub-basin. Ten coal seams occur within the Permian Coal Measures, ranging in thickness from approximately 0.4 to 10 m (Umwelt 2009).

Vegetation mapping of the Ulan Coal Complex has occurred previously as part of the Environmental Assessment undertaken for the Ulan Coal Continued Operations Project (Umwelt, 2009). Desktop analysis of this mapping indicated that while there is 413 ha (Umwelt 2009) of *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC present throughout the Ulan Coal Complex, the majority of this is located in areas that have not been subject to subsidence. No CEEC was present above 20 year longwalls. The limited areas of CEEC mapped above subsided longwalls occur as either highly fragmented patches, or in grassland formation; the latter of which would have precluded assessments of woodland condition, canopy health or habitat value. As such, it was determined that there was insufficient extent of CEEC above the targeted longwalls to allow for a statistically valid study to be undertaken as per the request of DotE.

Ironbark Open Forest Complex on Sandstone was found to be the most extensive vegetation community (4,160 ha of a total of 13,435 ha (Umwelt, 2009)), and is present across all target longwalls (**Table 2-1** to **Table 2-3; Figure 2** and **Figure 3**). Ironbark Open Forest Complex on Sandstone is also the dominant vegetation community in the referral area (48.7 % of referral area). Given this extent, and the limitations in assessing CEEC as described above and the similarity between potential impacts of subsidence upon on the CEEC and surrounding vegetation, Ironbark Open Forest Complex on Sandstone was identified as being the most appropriate vegetation community within which to assess the impacts of subsidence on native forest and woodland vegetation within the study area.

A description of the Ironbark Open Forest Complex on Sandstone is found in **Appendix A**.

Table 2-1: Vegetation communities and their corresponding areas above 1 year longwall (LW27)

Vegetation community	Area (ha)
Ironbark Open Forest Complex on Sandstone	29.94
Rough-barked Apple Open Forest on Alluvium/Colluvium	18.12
White Box Woodland Grassland	15.87
Unimproved Pasture	12.73
Derived Native Grassland	8.81
Improved Pasture	7.71
Modified White Box Woodland	5.65
Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating)	0.97
Yellow Box - Red Gum Woodland	0.00
Total area	**99.81**

Table 2-2: Vegetation communities and their corresponding areas above 10 year longwall (LW22)

Vegetation community	Area (ha)
Ironbark Open Forest Complex on Sandstone	28.64
Modified White Box Woodland	12.61
Stringybark-Ironbark Open Forest on Sandstone Slopes	7.80
Blakely's Red Gum Open Forest	7.70
Derived Native Grassland	7.64
Improved Pasture	2.82
Rough-barked Apple Open Forest on Alluvium/Colluvium	1.03
Ironbark Open Forest Complex Grassland	0.14
Derived Native Grassland	0.11
Box Woodland	0.02
Total area	**68.50**

Table 2-3: Vegetation communities and their corresponding areas above 20 year longwall (LW08)

Vegetation community	Area (ha)
Scribbly Gum Woodland – Heathland on Sand Plateaux	37.39
Ironbark Open Forest Complex on Sandstone	11.32
Stringybark-Ironbark Open Forest on Sandstone Slopes	4.32
Black Cypress Forest on Sandstone	2.91
Rough-barked Apple Open Forest on Alluvium/Colluvium	2.90
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium	2.22
Total area	**61.07**

2.2 Experimental design

The study was designed as a Control-Impact study to compare the control sites (areas not within the subsidence footprint) with impact sites (areas that have been previously subsided) subsided over a range of timescales. No Before-After comparisons were possible as before subsidence data of sufficient detail are not available.

2.2.1 Impact Hypothesis

The impact hypothesis used for this study was that subsidence as a result of longwall mining activities has a detrimental impact on the condition of native vegetation communities and habitat values.

2.2.2 Site stratification and sampling design

Longwalls that had been previously mined were targeted for field survey, in addition to control sites located within the targeted vegetation community outside of the subsidence areas (**Figure 1 to Figure 3**).

Original discussion with UCML placed impact sites above longwalls that had been mined 1, 5 and 10 years previously. Further discussion with DotE and UCML relocated these sites into longwall panels that had been mined 1, 10 and 20 years previously (**Figure 1**). The longwalls surveyed, years since mining and summary of subsidence are shown in **Table 2-4**.

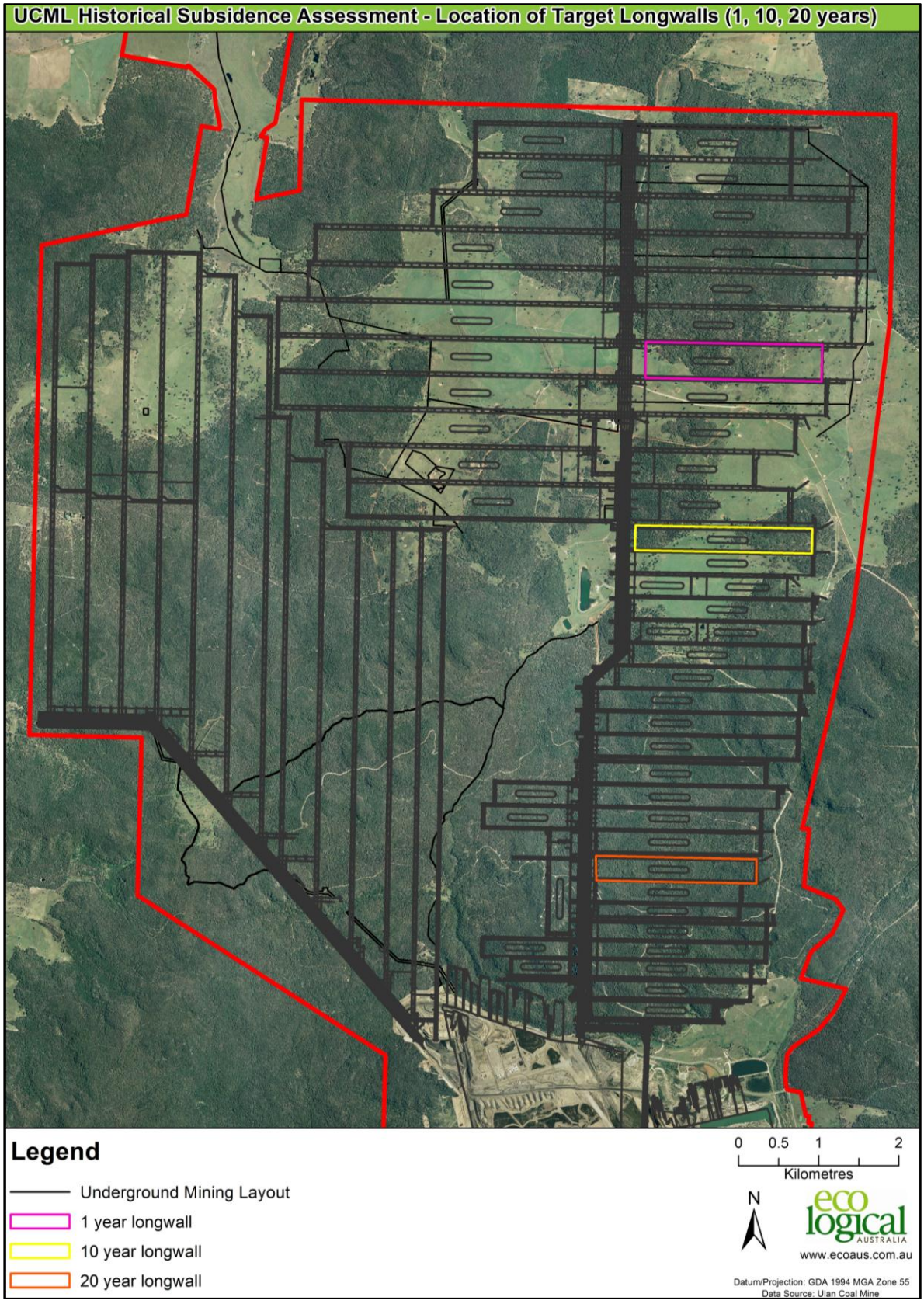

Figure 1: Overview of longwall panels studied

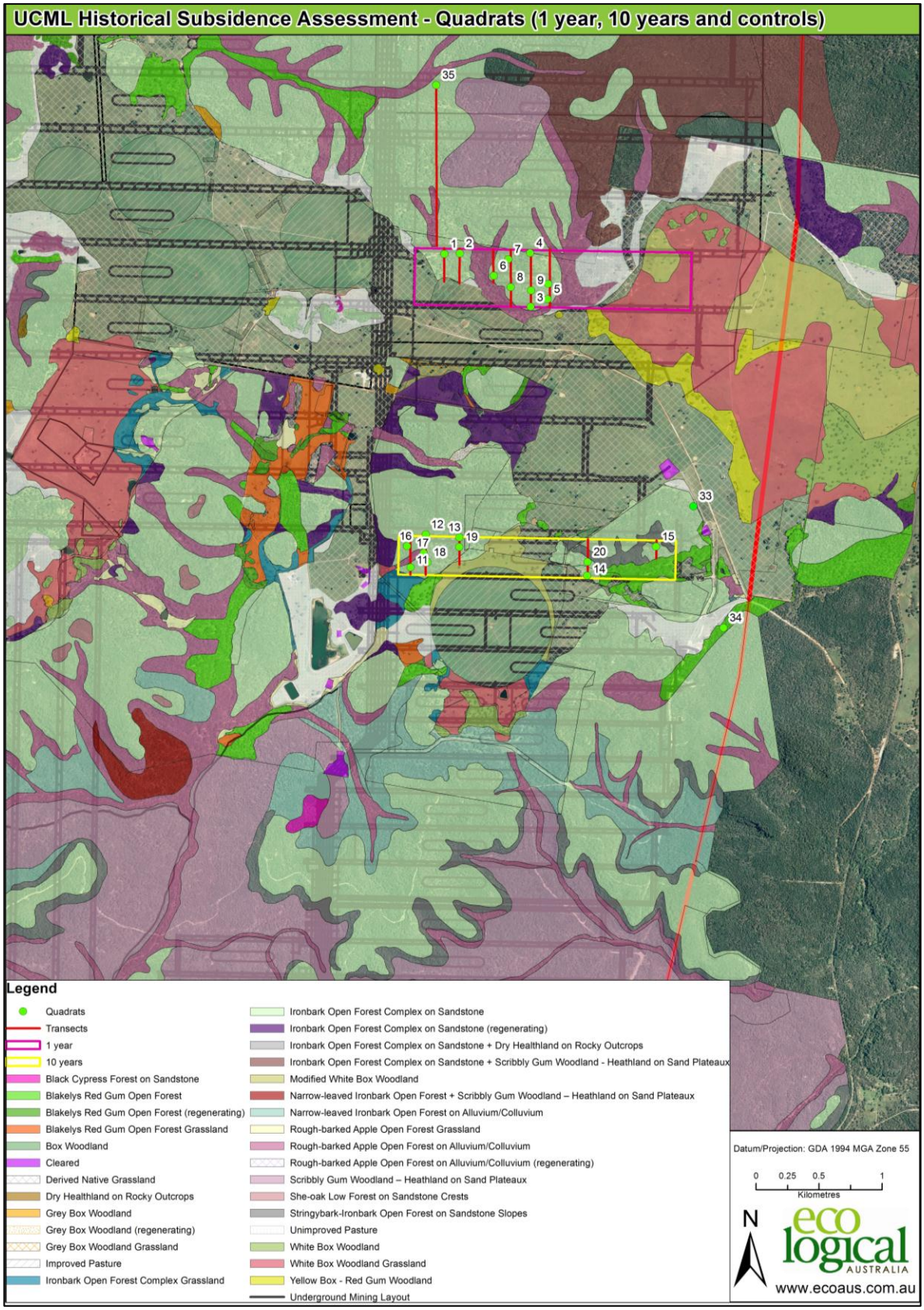

Figure 2: Location of quadrats & transects – Years 1 & 10

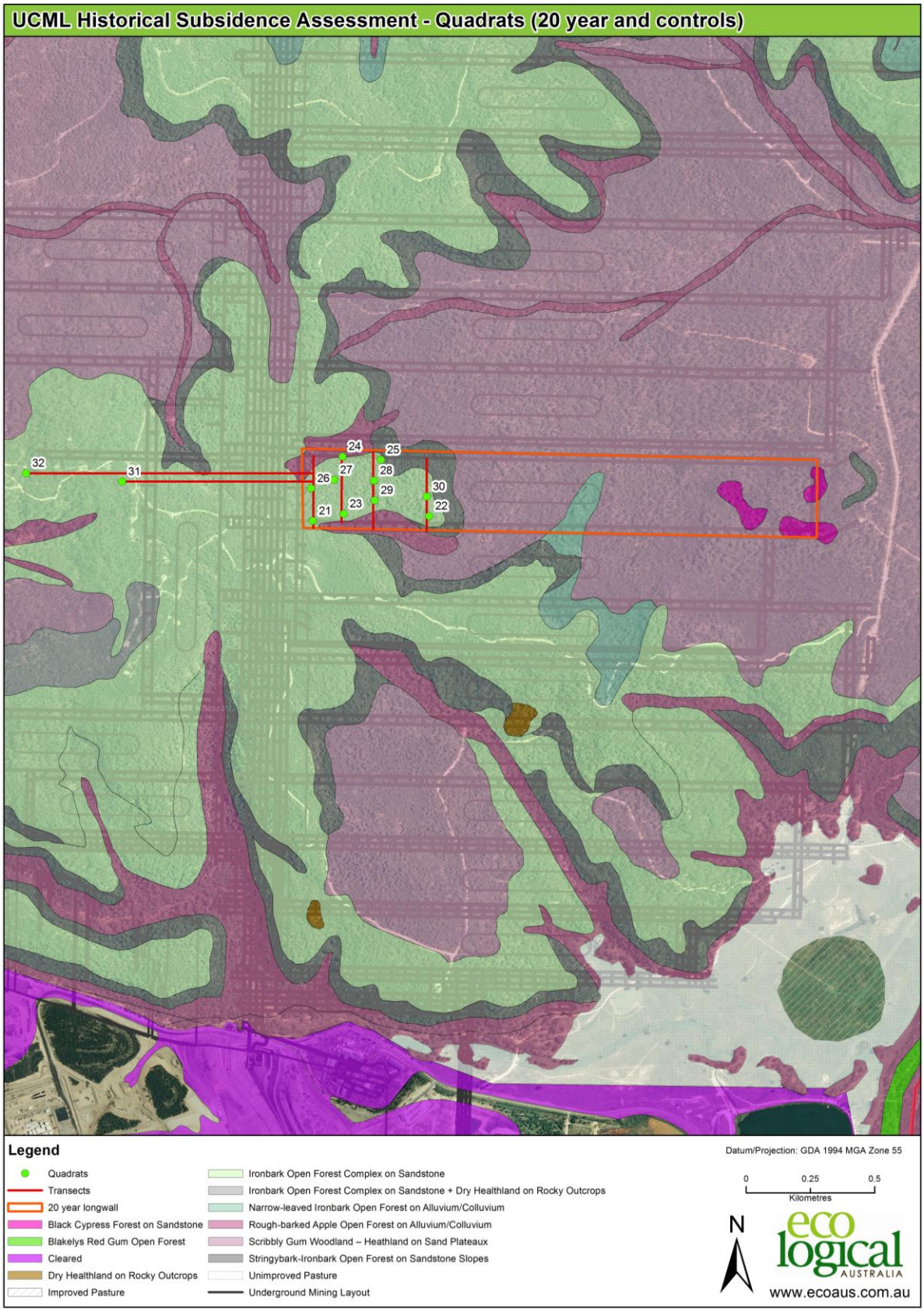

Figure 3: Location of quadrats & transects – Year 20

Table 2-4: Longwalls surveyed and summary of subsidence

Longwall	27	22	8
Years since mining	1	10	20
Depth (m)	253 to 276	220 to 285	160
Maximum subsidence (m)	1.47	0.8	1.0
Goaf edge subsidence (mm)	290	not known	87
Angle of draw (°)	45	not known	29
Maximum tilt (mm/m)	13	10	15
Maximum strain (mm/m)	3.1	3	9
Horizontal displacement (mm)	600	100	300

Each longwall panel surveyed varied in width and was separated into 3 'impact zones' (longwall, transition and pillar). The pillar zone is located between each longwall panel in an area where longwall mining does not occur, therefore with only minor subsidence occurring. The transition zone was determined to be from the centre of the pillar to approximately 75 m into the panel. The longwall zone is located within the centre of the panel and varies in width, depending on the width of the panel.

The location of transects were identified through desktop analysis of the Ulan Underground #3 mine plan and the mapped vegetation communities. Transect locations were identified in each zone at random sites.

Quadrat locations were designed to be randomly spaced along each transect, with a minimum of 50 m between each site and a minimum of 10 m from each site to the mapped boundary of the target vegetation community. A total of 35 quadrats were identified for survey in order to allow sufficient data to be collected to make a statistical interpretation of the results. These included:

- Five quadrats in each longwall zone
- Five quadrats in each transition zone
- Five quadrats in control sites.

There were no quadrats placed within the pillar zone due to the minor nature of subsidence that may occur in this zone.

2.3 Field survey

The field survey was undertaken over four days by ELA ecologists David Allworth and Sarah Dickson-Hoyle on the 24 to 29 September 2015, with one additional site surveyed on the 1 October 2015. Additional field survey assistance was provided by Tom Frankham of UCML. A summary of the ELA field staff qualifications and experience is outlined in **Appendix A**.

Weather conditions during the field survey showed temperatures ranging from 0.5 to 24.3 degrees Celsius (Bureau of Meteorology, 2015). There was no rainfall recorded during the period of the field survey.

In the field, the location of each quadrat (identified via desktop analysis) was validated to ensure sites were located within the appropriate vegetation communities and geological formations. Sites were located in areas with Triassic and Jurassic sandstone geology, and where vegetation was dominated by one or more of *Eucalyptus fibrosa* (Broad-leaved Ironbark)*, Eucalyptus agglomerata* (Blue-leaved Stringybark), *Eucalyptus crebra* (Ironbark) and/or *Eucalyptus sparsifolia* (Stringybark) in varying combinations.

At each site a 20 m x 20 m quadrat was established, with the north-west corner of the quadrat positioned at the intended site coordinates (locations adjusted in field where necessary, as outlined above).

Photographs were taken across each quadrat, and of the canopy at each corner. A general site description was recorded for each quadrat, including a description of the geology, soils, landscape position and vegetation community, as well as any observation of disturbance (historical or current) or evidence of management actions.

The following data were recorded for each quadrat:

Canopy health and defoliation (all in 5% increments) (adapted from DSE 2012):

- Percentage of epicormic foliage in relation to total tree foliage;
- Proportion of primary branches within canopy that have died back;
- Percentage of current canopy foliage as a proportion of the estimated canopy foliage volume/potential canopy; and
- Percentage of canopy foliage discoloured.

Vegetation structure:

- Projected foliage cover (PFC – 1-5% then 5% increments) of native grass/ground cover; native shrubs <1 m height; native shrubs/small trees >1 m height;
- PFC (5% increments) of upper canopy (assessed at each quadrat corner and averaged);
- Exotic species
- Number of stags, estimated time since and cause of death;
- Lower, estimated median and upper height of canopy (m);
- Lower, estimated median and upper diameter at breast height (DBH) over bark of canopy stems (cm); and
- Abundance of each canopy species (identified to species level); calculated total stems per hectare.

Habitat features:

- Length of fallen logs > 10cm diameter (0.5 m increments); and
- Number of hollow-bearing trees and stags (hollows > 5 cm diameter);

2.4 Data analysis

Data was analysed separately for health, structure and habitat, with health as key indicator of subsidence related impacts/overall vegetation community health.

Data was tested for normality using the Shapiro-Wilk test. Where data was not normally distributed, log transformations were used. A one way analysis of variables (ANOVA) design was used to assess whether there were significant changes between control and impact sites, and between longwall panel zones, as field data was collected at 1 point in time.

The null hypothesis for the comparison was that all sites and all longwall panel zones were the same and that any differences were the result of subsidence impacts. Where the P factor was <0.05, a Tukey's honest significant difference (HSD) Test was undertaken to determine the differences amongst means for the variable.

2.5 Limitations

The area has a history of multiple land use and disturbance types. Much of the area has undergone historical logging, clearing for agriculture or fire. These disturbances have resulted in changes to the structure of the vegetation surveyed, and present potential indirect effects on other variables examined within this study.

3 Results

3.1 Field Observations

Field-based expert evaluation showed no clear difference in tree health between control and impact sites

There was evidence of clearing, selective logging and/or fire in the majority of areas surveyed indicating that these areas have been subject to historical disturbances.

Across the entire study area the canopies of Stringybark individuals present within the survey area were seen to be healthier than Ironbark or *Angophora floribunda* species (the latter observed within the broader Ulan Coal Complex). Extensive branch dieback and sparse canopies were seen in Narrow-leaved Ironbark and Broad-leaved Ironbark individuals, as well as *Angophora floribunda*. Signs of tree stress have been observed within these species throughout the Mudgee region recently. Investigations have been undertaken in areas of *A. floribunda* dieback within the Ulan Coal Complex, however results of soil analysis show no evidence of fungal pathogens and the cause is still unknown. Signs of tree stress were considered to be more extensive and pronounced within all sites surveyed at UCML as part of this study. These signs of stress were found in both control and impact sites.

The canopies of Ironbark individuals were observed to have signs of dieback and evidence of defoliation with up to 50% canopy loss in some trees assessed. There was evidence of psyllids within vegetation surveyed in LW 8. However, these may not be the primary or sole cause of the decline in canopy health within these areas as trees are generally more susceptible to infestation when a tree is in a stressed condition. The canopies of Stringybark trees were largely considered to be at full health.

3.2 Statistical analysis of field data

Field data from all sites and zones was compared via single factor ANOVA. Data were compared between each longwall and the control area (**Table 3-1** and **Table 3-3**) and between each zone within each longwall and the control area (**Table 3-2**). In general there were no significant differences between any of the samples. Where a P-value was less than 0.05 a difference was considered to be significant.

A significant difference was observed between sites for the PFC of native shrubs <1 m and > 1 m between sites as shown in **Table 3-3** as a green highlight. A Tukey's HSD Test was undertaken for each of these variables. The results of the Tukey's HSD Test are shown as a superscript letter above each of the means for the variables tested. Where a result shares a superscript letter, the result is not considered to be significantly different. Where results do not share a superscript letter, the results are considered to be significantly different. The results for PFC for native shrubs < 1 metre showed that for the Control, Year 10 and Year 20 sites the results were not statistically different. The results also showed that for the Control, Year 1 and Year 20 sites the results were not statistically different. However, between Year 1 and Year 10 sites the results showed that the PFC for native shrubs < 1 m were statistically different.

The results for PFC for native shrubs > 1 m showed that the results for Year 20 were statistically different from all other years. The results for all other years were not statistically different.

Table 3-1 - Health results between years since mining, regardless of impact zone.

Health parameter (%)	Summary Statistic	Years since mining			
		Control	1	10	20
Epicormic foliage	Min	0.0	0.0	0.0	5.0
	Max	25.0	40.0	5.0	10.0
	Mean	8.0	8.0	4.5	5.5
	P-value	**0.3304**			
Branch dieback	Min	0.0	5.0	0.0	5.0
	Max	15.0	15.0	20.0	20.0
	Mean	6.0	6.0	9.0	9.0
	P-value	**0.0903**			
Canopy foliage	Min	70.0	50.0	65.0	50.0
	Max	95.0	95.0	95.0	95.0
	Mean	87.0	77.5	82.0	77.0
	P-value	**0.4837**			
Discolouration	Min	0.0	0.0	0.0	0.0
	Max	5.0	10.0	5.0	30.0
	Mean	2.0	4.0	3.0	8.0
	P-value	**0.1400**			

Table 3-2 - Health results between impact zones and years since mining.

Health parameter (%)	Summary Statistic	Years since mining								
		1			10			20		
		Control	Transition	Longwall	Control	Transition	Longwall	Control	Transition	Longwall
Epicormic foliage	Min	0.0	5.0	0.0	0.0	0.0	5.0	0.0	5.0	5.0
	Max	25.0	40.0	5.0	25.0	5.0	5.0	25.0	5.0	10.0
	Mean	8.0	13.0	3.0	8.0	4.0	5.0	8.0	5.0	6.0
	P-value	**0.6195**			**0.3541**			**0.4488**		
Branch dieback	Min	0.0	5.0	5.0	0.0	0.0	5.0	0.0	5.0	5.0
	Max	25.0	15.0	5.0	25.0	20.0	15.0	25.0	15.0	20.0
	Mean	6.0	7.0	5.0	6.0	7.0	11.0	6.0	8.0	10.0
	P-value	**0.1716**			**0.4687**			**0.8536**		
Canopy foliage	Min	70.0	50.0	60.0	70.0	75.0	65.0	70.0	75.0	50.0
	Max	95.0	95.0	90.0	95.0	95.0	85.0	95.0	95.0	95.0
	Mean	87.0	73.0	82.0	87.0	87.0	77.0	87.0	82.0	72.0
	P-value	**0.289**			**0.1886**			**0.2413**		
Discolouration	Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
	Max	5.0	10.0	5.0	5.0	5.0	5.0	5.0	10.0	30.0
	Mean	2.0	5.0	3.0	2.0	2.0	4.0	2.0	5.0	11.0
	P-value	**0.6007**			**0.3966**			**0.6404**		

Table 3-3 - Parameter results between years since mining, regardless of impact zone.

Parameter		Summary Statistic	Years since mining			
			Control	1	10	20
PFC - 1-5% then 5% increments	Native grass/groundcover	Min	1.00	1.00	1.00	1.00
		Max	15.00	15.00	75.00	4.00
		Mean	6.00	8.40	14.70	2.30
		P-value	**0.0967**			
	Native shrubs <1 m	Min	1.00	1.00	2.00	2.00
		Max	5.00	10.00	25.00	10.00
		Mean	2.60^{AB}	2.70^{B}	8.60^{A}	5.50^{AB}
		P-value	**0.0065**			
	Native shrubs >1 m	Min	1.00	1.00	0.00	3.00
		Max	10.00	10.00	10.00	25.00
		Mean	5.00^{B}	4.80^{B}	1.67^{B}	14.80^{A}
		P-value	**0.0000**			
	Exotics	Min	0.00	0.00	0.00	0.00
		Max	0.00	1.00	10.00	0.00
		Mean	0.00	0.20	1.90	0.00
		P-value	**0.4298**			
	Average Canopy	Min	1.00	1.00	1.25	3.00
		Max	5.75	8.75	22.25	7.50
		Mean	3.40	4.03	6.86	5.65
		P-value	**0.1727**			
Abundance	Canopy species stems/ha	Min	100.00	25.00	75.00	100.00
		Max	300.00	250.00	675.00	375.00
		Mean	175.00	147.50	225.00	212.50
		P-value	**0.3320**			
Height of canopy (m)	Upper	Min	15.00	17.00	15.50	13.00
		Max	23.00	24.00	24.00	22.00
		Mean	19.60	19.35	18.50	17.00
		P-value	**0.1840**			
	Lower	Min	9.00	11.00	11.00	10.00
		Max	18.00	21.00	18.00	16.00
		Mean	13.60	15.75	14.70	12.50
		P-value	**0.0664**			
	Median	Min	12.00	13.00	8.00	12.00
		Max	22.00	21.00	21.00	18.00
		Mean	16.20	17.00	15.20	14.90
		P-value	**0.4727**			
Diameter at breast height (cm)	Upper DBH	Min	20.20	37.50	26.80	29.50
		Max	67.00	73.00	56.00	52.70
		Mean	55.70	50.30	43.71	44.40
		P-value	**0.1686**			
	Lower DBH	Min	11.70	14.20	13.50	10.80

Parameter		Summary Statistic	Years since mining			
			Control	1	10	20
		Max	38.00	55.00	35.00	23.10
		Mean	22.36	26.29	22.16	16.38
		P-value	**0.1422**			
	Median DBH	Min	16.00	19.00	15.00	11.00
		Max	53.00	55.00	36.00	40.00
		Mean	37.80	31.48	26.95	25.82
		P-value	**0.1701**			

Note: P>0/0.05 indicates no significant difference; where there is a significant difference cells have been shaded green

Note: Common superscript in mean row indicative of no significant difference between sites (p>0.05). All other variables are significantly different.

Table 3-4 - Health results between impacts zones and years since mining.

Parameter		Summary Statistic	Years since mining								
			1			10			20		
			Control	Transition	Longwall	Control	Transition	Longwall	Control	Transition	Longwall
PFC - 1-5% then 5% increments	Native grass/ ground cover	Min	1.00	1.00	3.00	1.00	1.00	3.00	1.00	1.00	2.00
		Max	20.00	15.00	15.00	15.00	75.00	20.00	15.00	4.00	3.00
		Mean	7.00	6.20	10.60	6.00	16.80	12.60	6.00	2.20	2.40
		P-value	**0.4045**			**0.366**			**0.4351**		
	Native shrubs <1 m	Min	1.00	1.00	1.00	1.00	2.00	2.00	1.00	3.00	2.00
		Max	5.00	3.00	10.00	5.00	25.00	15.00	5.00	10.00	10.00
		Mean	2.40	1.80	3.60	2.60	8.80	8.40	2.60	5.20	5.80
		P-value	**0.6679**			**0.135**			**0.1341**		
	Native shrubs >1 m	Min	1.00	1.00	2.00	1.00	0.00	0.00	1.00	5.00	3.00
		Max	10.00	10.00	10.00	10.00	2.00	10.00	10.00	25.00	25.00
		Mean	4.60	3.60	6.00	5.00	0.60	3.00	5.00	15.00	14.60
		P-value	**0.4463**			**0.4421**			**0.0599**		
	Exotics	Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Max	2.00	1.00	0.00	0.00	10.00	5.00	0.00	0.00	0.00
		Mean	0.40	0.40	0.00	0.00	2.40	1.40	0.00	0.00	0.00
		P-value	**0.5034**			**0.4088**			**N/A**		
	Average Canopy	Min	0.00	0.00	0.00	1.00	1.25	5.75	1.00	3.00	3.75
		Max	2.00	1.00	0.00	5.75	22.25	7.33	5.75	7.50	7.50
		Mean	0.40	0.40	0.00	3.40	7.15	6.57	3.40	5.60	5.70
		P-value	**0.3443**			**0.2903**			**0.1191**		
Abundance	Canopy species stems/ha	Min	1.00	1.00	1.75	100.00	75.00	75.00	100.00	100.00	125.00
		Max	6.75	4.75	8.75	300.00	375.00	675.00	300.00	300.00	375.00
		Mean	3.60	3.00	5.05	175.00	190.00	260.00	175.00	175.00	250.00
		P-value	**0.7356**			**0.8845**			**0.2877**		

Parameter		Summary Statistic	Years since mining								
			1			10			20		
			Control	Transition	Longwall	Control	Transition	Longwall	Control	Transition	Longwall
Height of canopy (m)	Upper	Min	100.00	75.00	25.00	15.00	15.50	16.00	15.00	13.00	14.00
		Max	300.00	250.00	225.00	23.00	20.00	24.00	23.00	22.00	20.00
		Mean	175.00	160.00	135.00	19.60	17.50	19.50	19.60	17.00	17.00
		P-value	**0.894**			**0.4237**			**0.3183**		
	Lower	Min	15.00	17.00	0.00	9.00	13.00	11.00	9.00	10.00	10.00
		Max	23.00	24.00	0.00	18.00	18.00	18.00	18.00	15.00	16.00
		Mean	19.60	19.70	0.00	13.60	14.80	14.60	13.60	11.80	13.20
		P-value	**0.5081**			**0.7574**			**0.5408**		
	Median	Min	9.00	11.00	11.00	12.00	8.00	12.00	12.00	12.00	13.00
		Max	18.00	18.00	21.00	22.00	18.00	21.00	22.00	18.00	18.00
		Mean	13.60	16.00	15.50	16.20	13.40	17.00	16.20	14.80	15.00
		P-value	**0.7737**			**0.2984**			**0.7194**		
Diameter at breast height (cm)	Upper DBH	Min	12.00	13.00	15.00	20.20	26.80	39.00	20.20	29.50	35.50
		Max	22.00	20.00	21.00	67.00	56.00	54.00	67.00	52.50	52.70
		Mean	16.20	16.40	17.60	55.70	41.12	46.30	55.70	44.68	44.12
		P-value	**0.6494**			**0.2732**			**0.3361**		
	Lower DBH	Min	11.70	15.80	14.20	11.70	15.00	13.50	11.70	10.80	11.80
		Max	38.00	49.40	55.00	38.00	34.60	35.00	38.00	22.80	23.10
		Mean	22.36	25.00	27.58	22.36	23.48	20.84	22.36	16.20	16.56
		P-value	**0.8749**			**0.8927**			**0.3712**		
	Median DBH	Min	16.00	19.00	23.00	16.00	19.50	15.00	16.00	11.00	21.50
		Max	53.00	50.00	55.00	53.00	36.00	35.00	53.00	40.00	32.00
		Mean	37.80	28.86	34.10	37.80	27.50	26.40	37.80	26.30	25.34
		P-value	**0.581**			**0.2126**			**0.2017**		

Table 3-5 – Habitat value results between years since mining, regardless of impact zone.

Parameter	Summary Statistic	Years since mining			
		Control	1	10	20
Length LWD (m)	Min	17.00	0.00	3.00	3.00
	Max	38.00	45.00	38.00	65.00
	Mean	24.80	17.20	23.85	27.11
	P-value	**0.4721**			
Number of hollow bearing trees	Min	0.00	0.00	0.00	0.00
	Max	4.00	1.00	2.00	2.00
	Mean	1.40	0.30	1.10	0.80
	P-value	**0.0975**			

Table 3-6 - Habitat value results between impacts zones and years since mining.

Parameter	Summary Statistic	Years since mining								
		1			10			20		
		Control	Transition	Longwall	Control	Transition	Longwall	Control	Transition	Longwall
Length LWD (m)	Min	17	7	0	17	3	23	17	10	3
	Max	38	45	29	38	34	38	38	40	65
	Mean	24.8	19.4	15	24.8	19.4	28.3	24.8	27.5	26.8
	P-value	**0.4754**			**0.3737**			**0.9709**		
Number of hollow bearing trees	Min	0	0	0	0	0	0	0	0	0
	Max	4	1	1	4	2	2	4	2	1
	Mean	1.4	0.4	0.2	1.4	0.8	1.4	1.4	1	0.6
	P-value	**0.432**			**0.8626**			**0.2519**		

4 Discussion & Conclusion

This project aimed to determine whether longwall mine subsidence has had an impact upon the condition of vegetation communities within the Ulan Underground No. 3 mine area. The field survey occurred within 3 previously mined longwall areas, and within 2 impact zones within those longwalls. Control sites were established in areas where underground mining had not been undertaken and where subsidence was not expected to occur. All data were analysed using statistical comparisons and qualitative assessment from experienced ecologists.

For the majority of woodland condition parameters assessed there was no significant difference between the longwalls and the control area or the longwall zones and the control area. Only the PFC of native shrubs (<1 m and >1 m) showed any statistical differences and in these cases the control area was either lower or similar to the other values.

Examination of the field results for the sites surveyed for Year 20 showed that there was a higher PFC of native shrubs > 1 metre recorded at these sites in comparison to the other longwalls surveyed. The conditions present at these sites supported the increased PFC seen for shrub species as there was evidence of fire present which would encourage shrub regeneration, and the sites were predominantly located on ridges with shallow sandy soils; a landscape position and substrate observed within the region to be associated with higher densities of shrub species.

The results for habitat values included as part of this study showed that there was no statistical difference for the parameters studied, and therefore no difference between the control and impacts sites surveyed.

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Appendix A Vegetation Community Description

A.1 Ironbark Open Forest Complex on Sandstone

Ironbark Open Forest Complex is typically a dry, mid-high to tall open forest-woodland, generally 10 to 18 metres tall (however only 6 metres on rocky sites), with 20 to 30 per cent cover. The community occurs on a variety of substrates ranging from sandy-loams and conglomerates to sands. Dominant canopy species include broad-leaved ironbark (*Eucalyptus fibrosa*), narrow-leaved stringybark (*E. sparsifolia*) and narrow-leaved ironbark (*E. crebra*). Other common canopy trees include blue-leaved stringybark (*E. agglomerata*), Dwyer's red gum (*E. dwyeri*), red stringybark (*E. macrorhyncha subsp. macrorhyncha*) and occasionally inland scribbly gum (*E. rossii*). Grey gum (*E. punctata*) is common in this community in the southern part of the proposed Ulan West mining area. Black cypress pine (*Callitris endlichen*), narrow-leaved wattle (*Acacia linearifolia*), and Allocasuarina gymnanthera are widespread in the canopy and sub-canopy of Ironbark Open forest Complex.

The understorey typically comprises a sparse to mid-dense sclerophyllous shrub stratum generally up to 2 metres in height with between 5 and 40 per cent cover, which becomes dense in small patches often on skeletal soils where trees are less dominant. Common and dominant shrubs recorded were blunt beard-health (*Leucopogon muticus*), *L. attenuatus*, pink five-corners (*Styphelia triflora*), narrow-leaved geebung (*Persoonia linearis*), *Goodenia hederacea* subsp. *Hederacea*, prickly shaggy pea (*Podolobium ilicifolium*), *Pultenaea cinerascens*, sifton bush (*Cassinia arcuate*), *C.* species *D, C. quinquefaria*, common fringe-myrtle (*Calytrix tetragona*), *Leptospermum parvifolium*, tantoon (*L. polygalifolium*), urn heath (*Melichrus urceolatus*), ruby urn heath (*M. erubescens*), *Melaleuca erubescens*, *Pultenaea laxiflor*a, vanish wattle (*Acacia verniciflua*), box-leaved wattle (Acacia buxifolia), *Platysace enricoides* and *Harmogia densifolia*.

The ground cover is typically dry and sparse to very sparse, with generally up to 10 per cent cover. A range of forbs, ferns and grasses characterise the community including poison rock fern (*Cheilanthes sieberi* subsp. *Sieberi*), *Phyllanthus hirtellus*, pomax (*Pomax umbellata*), *Hydrocotyle peduncularis*, *Pseudanthus divaricatissimus*, silky purple-flag (*Patersonia sericea*), orchids (*Caladenia* spp. and *Pterostylis* spp), blue flax lily (*Dianella revolute var. revolute*), threeawn speargrass (*Aristida vagans*), weeping grass (*Microlaena stipoides var. stipoides*), forest hedgehog grass (*Echinopogon ovatus*), purple burr-daisy (*Calotis cuneifolia*), Poranthera microphylla, Oxalis exilis, hairy stinkweed (*Opercularia hispida*), rough saw-sedge (*Gahnia aspera*), Lepidosperma laterale, wattle mat-rush (*Lomandra filiformis*), mat-rush (*L. confertifolia subsp. Pallida*), pale mat-rush (*L. glauca*) and many flowered mat-rush (*L. multiflora subsp. Multiflora*).

Ironbark Open Forest Complex is closely related to Stringybark – Ironbark Open Forest, with which it intergrades, particularly in slope positions and on shallow soils with a high percentage of sandstone outcropping. Ironbark Open Forest Complex is also closely related to She Oak Low Forest, the latter of which develops in areas that are often on level, crest positions. In many cases, small stands of She Oak Low Forest occur in Ironbark Open Forest Complex that are too small to be mapped separately. Species that characterise She Oak Low Forest also commonly occur in Ironbark Open Forest Complex.

Both Black cypress forest and Acacia Forest are closely related to Ironbark Open Forest complex. These two communities are relatively common within the Ulan Coal Complex (Umwelt, 2009a), but were not recorded within the proposed Ulan West mining area. Black cypress pine (*Callitris endlicheri*) is a common tree in the Ironbark Open Forest complex that sometimes occurs in small, monospecific stands within the Ironbark Open Forest Complex, which are too small to be mapped separately. Similarly,

narrow-leaved wattle (*Acacia linearifolia*), which is characteristic and dominant tree in Acacia Forest, forms stands within Ironbark Open Forest Complex that are too small to be mapped separately as Acacia Forest.

Areas of sclerophyllous heath become dominant in the Ironbark Open Forest Complex where the tree stratum declines to a very sparse-absent level and, if present, are often in a mallee or stunted habit. These heaths are consistent with the Dry Heathland community but are too small and spatially entwined with Ironbark Open Forest Complex to be mapped separately.

Where the community occurs on low rises in the Bobadeen region which have been previously cleared and grazed, it occurs in a regenerating form. The floristic composition is similar to that of the mature and intact community however; the canopy is dominated by low trees or occasionally colonising shrub species.

Ironbark Open Forest Complex is the most widespread vegetation community in the proposed Ulan West mining area. It is a diverse community comprising a number of variants and a variety of structural forms such as dry open forests, low forests, woodlands and heathlands that occur in mosaic patterns across the sandstone hillslopes and crests, with a high diversity of species in varying abundance.

References

Umwelt (Australia) Pty Ltd (2009). *Ulan Coal – Continued Operations Ecological Assessment.* Prepared by Umwelt (Australia) Pty Ltd on behalf of Ulan Coal Mines Limited.

Appendix B ELA Staff Experience

CURRICULUM VITAE

David Allworth

ECOLOGIST

QUALIFICATIONS

- Bachelor of Natural Resources (Honours) – University of New England
- Final year thesis of "*The role of cover and tillage on runoff on Vertosols of north-western New South Wales cropping lands*".

David has been involved in-field delivery of large scale tree plantings, the translocation and propagation of rare plant species, plant species selection for planting, vegetation surveys, and provision of management of plants for grasslands, woodlands and closed forest areas. His work has mainly been within the inland cereal cropping belt of eastern Australia.

David has written technical articles, and has also produced a wide range of extension materials for rural landholders and others. Extension work has involved one-on-one advice, the planning and presenting at field days and workshops, and provision of material for electronic and print media outlets.

EXPERIENCE

Eco Logical Australia (2012 – present)

Ulan Coal Mines Limited

- Floristic monitoring (spring & autumn, 2012 – 2015)
- Pre-clearing surveys & clearing supervision (2012 – 2015)
- Supervision of revegetation works (2015)
- Revegetation contractor supervision (2015)
- Targeted surveys for threatened species (2014, 2015)

Moolarben Coal Operations

- Floristic monitoring (2012 – 2015)
- Pre-clearing surveys & clearing supervision (2012 – 2014)
- Impact Assessments to support Modification(s) (2014)
- Rehabilitation monitoring (2012 – 2015)
- Offset Area floristic monitoring (2012 – 2015)

Other projects include works at Charbon Coal, Energy Australia and the Bylong Exploration Project.

Other Significant Projects

- Mid-Western Regional Council Saleyards Land Flora & Fauna Impact Assessment (2013)
- Edgell Land Biodiversity Sensitivity Review (2013)
- Warrego-Darling Long Term Intervention Monitoring Stage 2 (2015)
- Warrego Passing Lanes Preliminary Documentation (2015)
- BHP Caroona Native Vegetation on Cracking Clay (2015)
- Barwon-Darling & Condamine-Balonne floodplain & wetland vegetation mapping (2015)
- Locating rare plants in Central Queensland, *Dichanthium queenslandicum* and *Digitaria porrecta* for

offset areas.
- Surveys to determine the presence of *Eucalyptus cannonii* in the Lithgow-Wallerawang area.

Self-employed (2006 - 2012)
Provision of vegetation identification and management advisory services. Works completed relevant to vegetation include:
- Regional Ecosystem description of vegetation communities & production of plant species list for plant selection database (Logan City Council).
- Study of biodiversity values (including surveys for rare and threatened plant species) and investigation of issue of rehabilitation (Friends of Felton).
- Review of natural regeneration in 60 Regional Ecosystems & database establishment (Condamine Alliance).
- Assessment of sites against natural grassland criteria of the *Commonwealth Environment Protection & Biodiversity Conservation Act 1999* (National Farmers Federation (private landholders)).
- Vegetation assessments (various) for QLD Government Department of Transport and Main Roads.
- Vegetation survey and assessment of grassland and woodland sites with respect to the *Commonwealth Environment Protection & Biodiversity Conservation Act 1999* (Toowoomba City Council).
- Review of distribution of grasslands on the Darling Downs using historical images and current soils information for the development of case for Regional Ecosystem 11.8.11 in the southern Brigalow Belt (Queensland Murray Darling Committee).

Allworth Trees & Timber (2000 – 2005)
- Tree planting program (~350,000 trees) between Roma and Gatton, QLD, plus maintenance of trees one year post planting.
- Sale of trees for planting (~150,000 trees), plant rescue programs, vegetation surveys, training services.
- Survey for rare plant species and transplanting for Powerlink infrastructure.

Greening Australia (1996-1999)
Smallholders Education Project Officer, Eastern Darling Downs.

NSW Soil Conservation Service, Riverina Region (1989-1993)
Information and Public Relations Officer & Acting Regional Landcare Officer.

Queensland Conservation Council (1984-1987)
Research/administrative assistant for Australian Heritage Commission – Southeast QLD Reference Panel.

Sample Publications
Allworth, D. (1998), Distribution of some rare plant species of the Darling Downs, in *Native Vegetation of the Darling Downs,* ed. I. Menkins, Toowoomba Field Naturalists.

Allworth, D. (1998), Extension of smallholders: the use of night time field days, *Managing and Growing Trees – farm forestry and vegetation management conference*. Kooralbyn Hotel Resort, South East Queensland (editor A. Grodeki) Queensland Department of Natural Resources, Queensland Environment Protection Agency, Queensland Department of Primary Industries, and Greening Australia.

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Barker, P. and Allworth, D. (1990), *Detecting dryland salinity in the Riverina and south-western slopes of New South Wales.* Soil Conservation Service of NSW.

CURRICULUM VITAE

Sarah Dickson-Hoyle

ECOLOGIST

QUALIFICATIONS

- Bachelor of Arts/Bachelor of Science(Geography/Botany), University of Melbourne
- Master of Forest Ecosystem Science, University of Melbourne
- Final year thesis of '*Risk, remnants and roadsides: understanding fire and conservation management along a rural road, western Victoria*'.

Sarah has over four years' experience in forestry and environmental consulting, research, and natural resource management. She has experience in conducting flora surveys, forest assessment and monitoring, carbon forestry, and community based conservation management, as well as social research.

Prior to this her work with ELA, Sarah worked for two years in carbon forestry and associated services, involving plantation inventory, biomass assessment, and project and methodology development under the Carbon Farming Initiative.

She has also led a series of flora surveys as part of the Victorian Forest Monitoring Program, gaining experience in forest assessment and a sound knowledge of the flora of western and northern Victorian Mallee and heathy-woodland communities. She has worked with Landcare and other community groups on reforestation and land restoration projects throughout Victoria and NSW, and has conducted in depth research on roadside grassland conservation and fire management in western Victoria.

EXPERIENCE

Eco Logical Australia (2014 – present)
Ulan Coal Mines Limited

- Floristic Monitoring Program (Spring 2014, Autumn 2015)
- Pre-clearing surveys & clearing supervision (2012 – 2014)

Moolarben Coal Operations

- Floristic Monitoring (Spring 2014, Autumn 2015)
- Modification 9 Targeted EPBC Surveys
- Rehabilitation Monitoring (Spring 2014, Autumn 2015, Spring 2015)

Other Significant Projects

- Energy Australia - Pinedale Mine Purple Copper Butterfly survey
- Mid-Western Regional Council Caerleon Pipeline and Sewage Pump Station Review of Environmental Factors
- BHP Caroona Project Offset Properties Flora Survey and Fauna Expert Reports
- Oberon Quarry Pre-Clearing Survey
- Mid-Western Regional Council Targeted Survey – *Leucochrysum albicans* var. *tricolor*

University of Melbourne (February - May 2014)
Sessional academic tutor

International Student Volunteers (April 2012 – February 2014)
Project Leader – Australia & Thailand

CO2 Australia (March 2011 – May 2013)
Project Officer

- Lead botanist and deputy team leader, statewide forest monitoring and reporting project for the Department of Environment and Sustainability, Victorian Government
- Assistant to project managers and Director (Carbon Farming Initiative projects)
- Field team member (plantation inventory and biomass sampling)

The University of Melbourne (June 2010 – May 2013)
Laboratory class demonstrator; field and research assistant

- Demonstrating in first year level biology practical classes
- Assisting lecturers in conducting undergraduate field trips (presentations and logistics)
- Assisting post-doctoral and research fellows with field and laboratory based research projects

PUBLICATIONS

Dickson-Hoyle, S. and Reenberg, A. 2009. "The shrinking globe: globalisation and the changing geographies of livestock production'. *Danish Journal of Geography*. 109(1): 105-112

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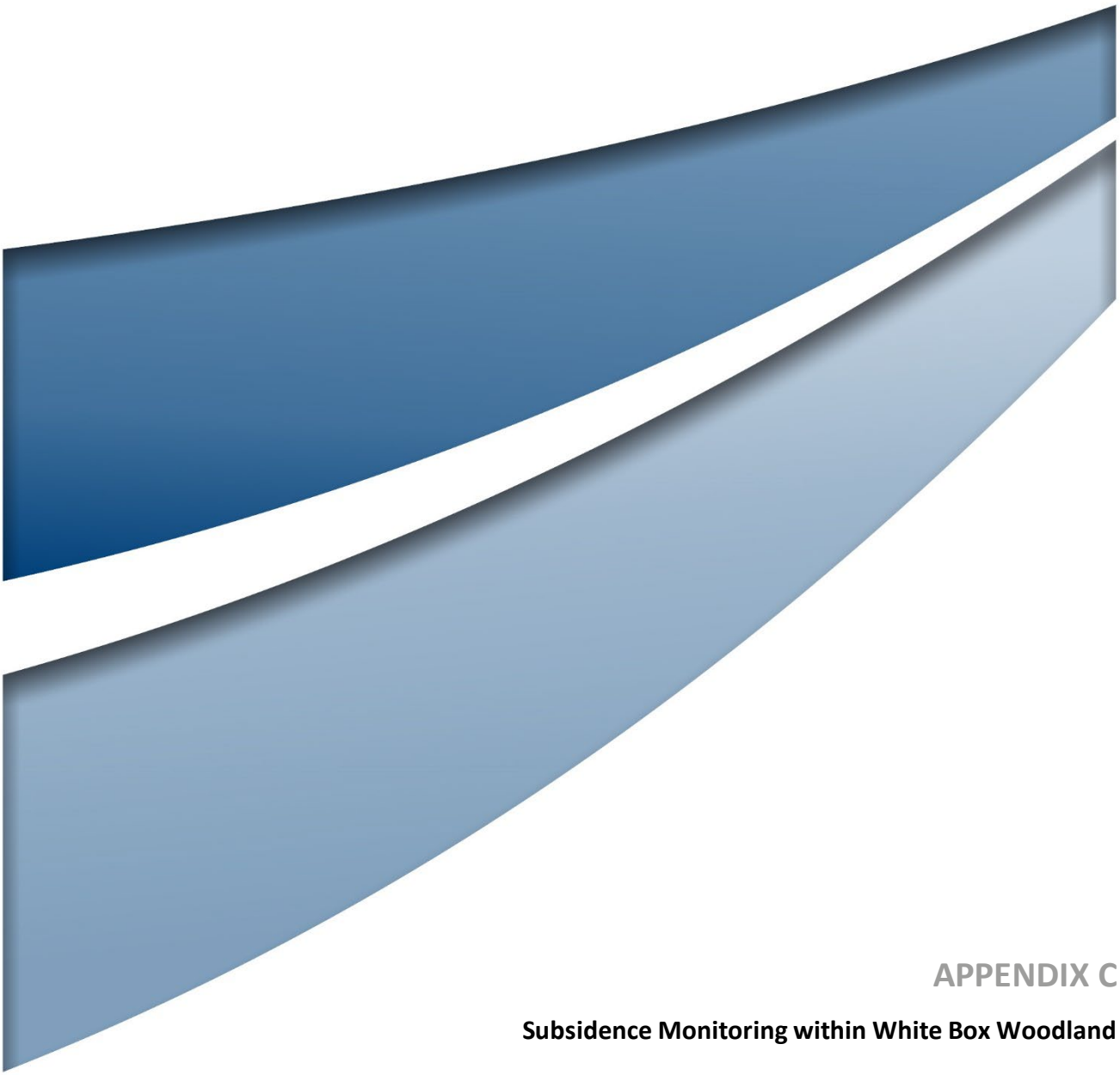

APPENDIX C

Subsidence Monitoring within White Box Woodland

ECO LOGICAL AUSTRALIA PTY LTD
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Robyn Stoney
Environment & Community Manager
Ulan Coal Mines Limited
4505 Ulan Road,
ULAN NSW 2850

Ref/Job No: 2916

22 October 2015

Dear Robyn,

RE: Subsidence monitoring within White Box Woodland

Please find below a summary of the results obtained from monitoring of floristic-based subsidence (FBS) plots located within the White Box Woodland Critically Endangered Ecological Community (CEEC) and variants under the *Commonwealth Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act).

Floristic-based subsidence surveys were undertaken above underground mining areas at locations over a range of vegetation types to monitor the impact of subsidence on vegetation floristic composition and structure. This report examines data collected for both FBS and floristic monitoring sites located within the CEEC within areas that were previously mined to examine changes that may occur to these communities within subsided areas. This data was then compared to floristic monitoring data for sites located within areas that have not been mined to determine if changes seen in subsided areas were consistent with changes seen in residual vegetation.

Data used to examine floristic composition and structure include counts of total species present and number of native and exotic species present. Native and exotic canopy, midstorey and ground covers were also measured. Results from these sites were compared against Biometric Benchmarks for HU654, the *White Box – Yellow Box grassy woodland on basalt slopes in the upper Hunter Valley, Brigalow Belt South* (DECC 2008). Biometric Benchmarks allowed comparison of the community descriptions against the community composition of the vegetation examined as part of this study. The Biometric Benchmark for native groundcover was calculated by summing the benchmarks for native grass, native shrubs and other native plant species.

The sites located within the White Box Woodland EEC that are monitored at Ulan Coal Mines Limited (UCML) are shown in the table below.

Table 1 – Summary of plots located within White Box Woodland

	Vegetation Community	Date Established	Date Monitoring Concluded	Mining Commenced	Mining Ceased
Residual					
RPA8A	White Box Woodland Grassland	Spring 2011	Spring 2014	Jan-11	Feb-12
RPA12	White Box Woodland	Spring 2011	Ongoing	Mar-14	Feb-15
BOB1	White Box Woodland	Spring 2011	Ongoing	Nov-01	Jul-02
BOB4B	White Box Woodland	Spring 2011	Ongoing	Pillar site	
BOBC6	Modified White Box Woodland	Spring 2012	Ongoing	Mar-14	Feb-15
RPA12	White Box Woodland	Spring 2011	Ongoing	Jan-11	Feb-12
RPA8A	White Box Woodland Grassland	Spring 2011	Ongoing	Not mined, used for comparison to residual vegetation characteristics.	
RPA11	White Box Woodland	Spring 2011	Ongoing		
BOBE1	White Box Woodland	Spring 2011	Ongoing		
BOBE2	Yellow Box - Red Gum Woodland	Spring 2011	Ongoing		
SI3B	Modified White Box Woodland	Spring 2011	Ongoing		
Revegetated/regenerated					
BOB9	White Box Woodland Grassland	Spring 2011	Ongoing	Jul-02	Feb-03
BOB12	White Box Woodland Grassland	Spring 2011	Ongoing	Nov-88	Aug-89
BOB17	White Box Woodland Grassland	Spring 2013	Ongoing	Dec-87	Oct-88
BOB18	White Box Woodland Grassland	Autumn 2013	Ongoing	May-14	May-15
BOB19	Modified White Box Woodland	Spring 2014	Ongoing	Nov-88	Aug-89
BOBE6	Yellow Box - Red Gum Woodland Grassland	Spring 2011	Ongoing	Not mined, used for comparison to residual vegetation characteristics.	
BOBE7A	Modified White Box Woodland	Spring 2011	Ongoing		
BOBE8	Modified White Box Woodland	Spring 2011	Ongoing		
BOBE9	Modified White Box Woodland	Spring 2013	Ongoing		
BOBE11	White Box Woodland	Autumn 2014	Ongoing		
BOBE12	Modified White Box Woodland	Spring 2014	Ongoing		
BOBE13	White Box Woodland (HU654 in new BMP)	Autumn 2015	Ongoing		
Floristic-based subsidence plots					
FBS5	White Box Woodland	Spring 2013	Ongoing	May-14	May-15
FBS6	White Box Woodland	Autumn 2014	Ongoing	May-15	Ongoing

Results from all monitoring periods are in Appendix A.

The results of the monitoring have shown that overall, the trend in the total number of species has remained consistent between sites that have and have not undergone subsidence (**Figure 1**). For example, where a decline in total species was seen in a residual floristic vegetation plot that has not undergone subsidence (i.e. BOBE1), a consistent decline was generally seen within a plot located within a subsided area (BOB1).

All plots showed a decline in total species between spring 2012 and spring 2014. Total species richness has remained stable since an increase in autumn 2014 which was seen within both residual unsubsided areas and areas where subsidence has occurred. Given that the changes in species richness occurred in both directions (i.e. both increases and decreases were observed and are of a similar quantum), the changes in species richness is considered to have remained relatively consistent across both residual and subsided areas.

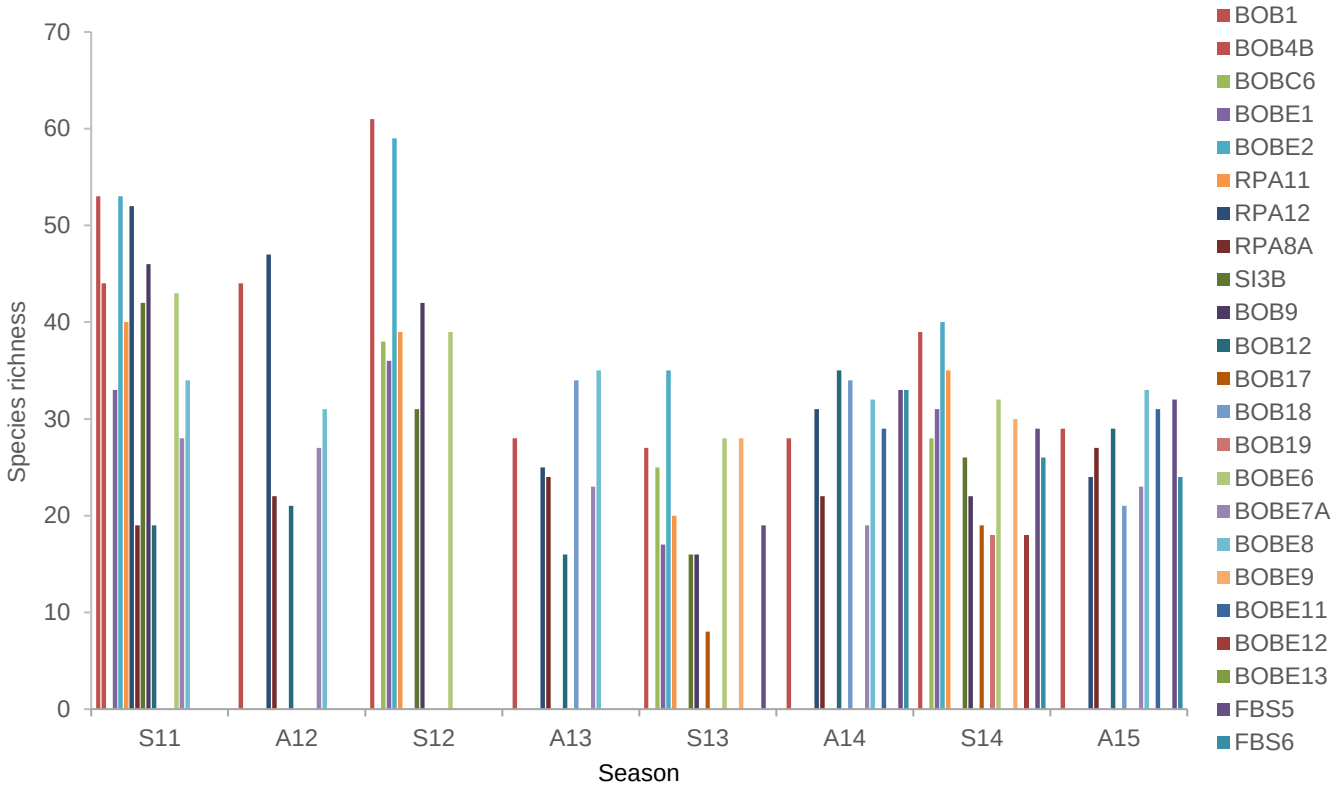


Figure 1: Total Species Richness

Native species richness has declined across residual unsubsided and subsided sites, with most sites falling below the Biometric Benchmark for White Box Woodland (DECC 2008). However, where a site was mapped as being located within a Woodland variant of the CEEC, the site was more likely to be within the upper and lower Biometric Benchmark range. This trend was shown within both subsided and unsubsided sites.

Numbers of exotic species has been variable across all monitoring periods examined. These trends are consistent between residual and subsided sites.

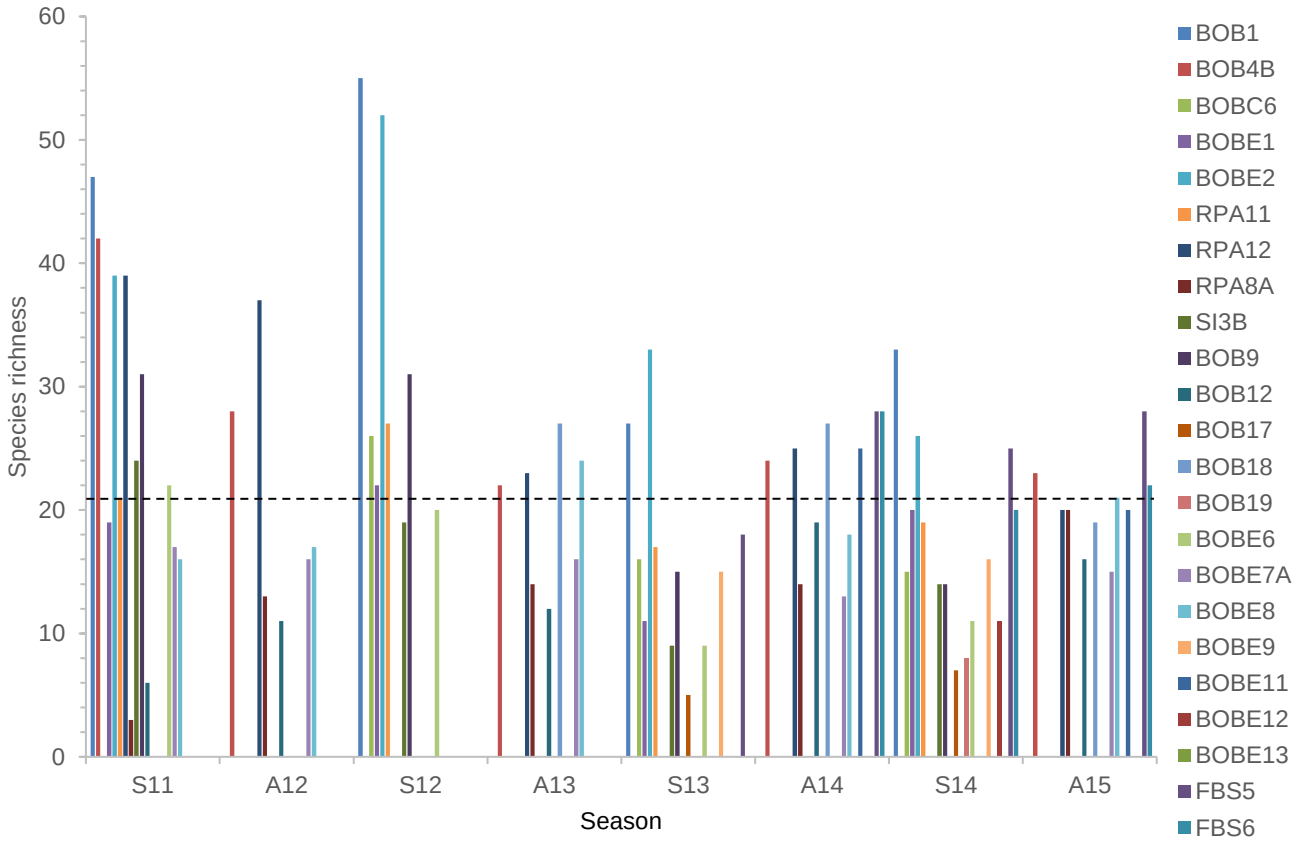


Figure 2: Native species richness. Dashed lines indicate Biometric Benchmark for native species richness in White Box Woodland.

There were no discernible differences between sites that have and have not undergone subsidence for ground cover. Overall, there has been a decline in both native and exotic species ground cover since spring 2013 where less than 5 exotic species was recorded at each site in autumn 2015. However, native species ground cover remains within the Biometric Benchmark range for White Box Woodland (DECC 2008) (**Figure 3**).

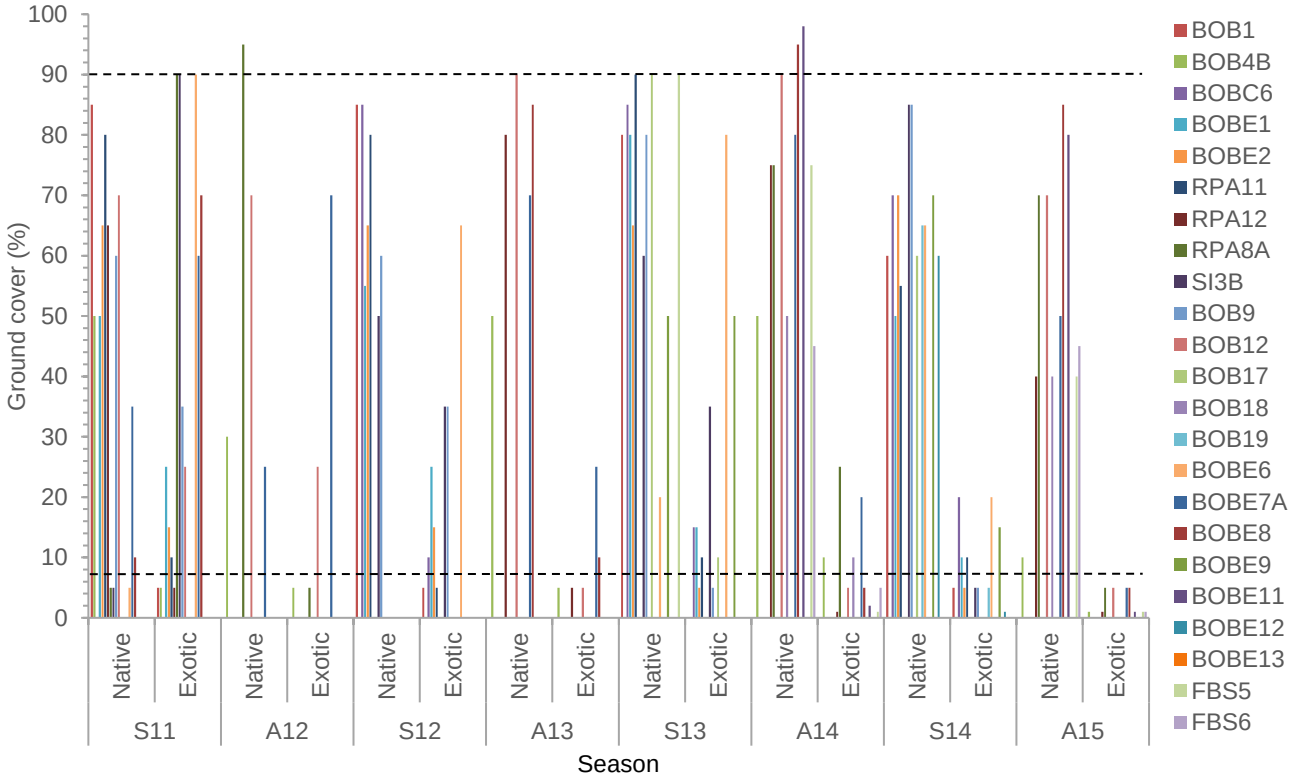


Figure 3: Native and exotic ground cover. Dashed lines indicate upper and lower Biometric Benchmarks for native groundcover in White Box Woodland.

Canopy cover and midstorey cover have been variable between sites across the monitoring period (**Figure 4** and **Figure 5**). Declining midstorey cover has occurred in both residual and subsided sites. In the spring 2014 and autumn 2015 surveys, only five sites were within the Biometric Benchmark range for canopy cover, and two sites within the midstorey Biometric Benchmark range (DECC 2008) (**Figure 4** and **Figure 5**).

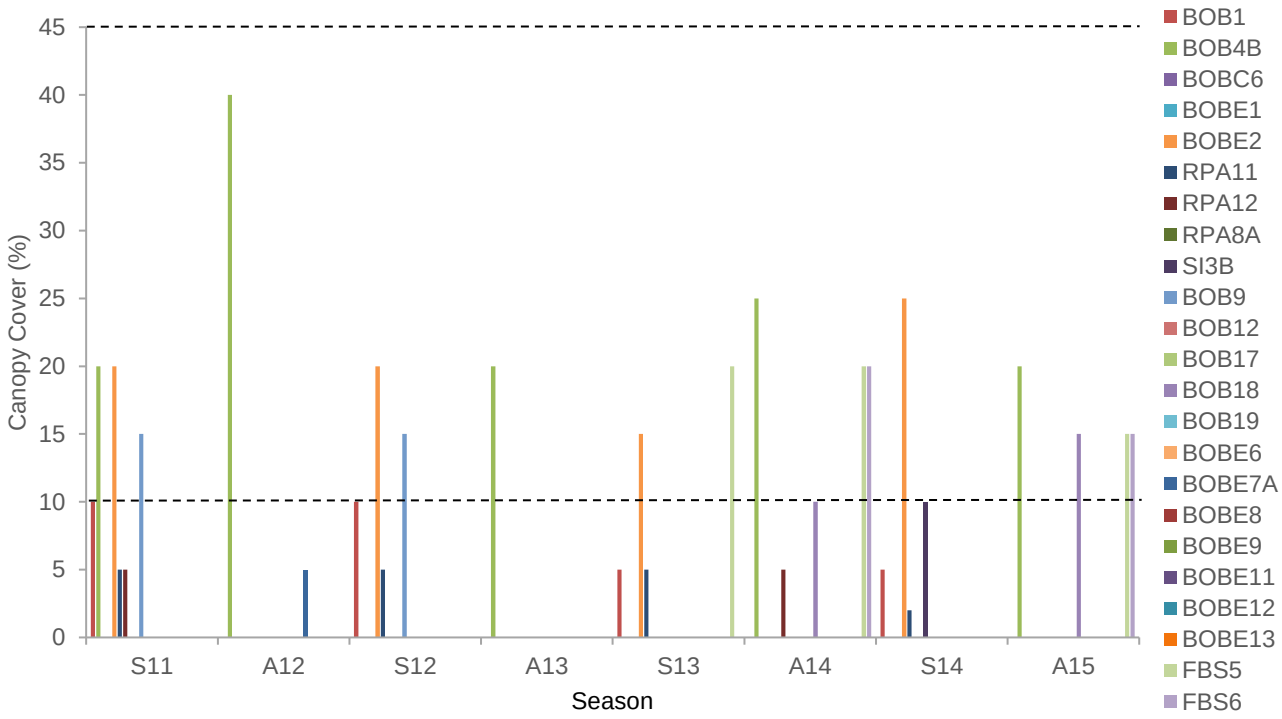


Figure 4: Canopy cover. Dashed lines indicate upper and lower Biometric Benchmarks for canopy cover in White Box Woodland.

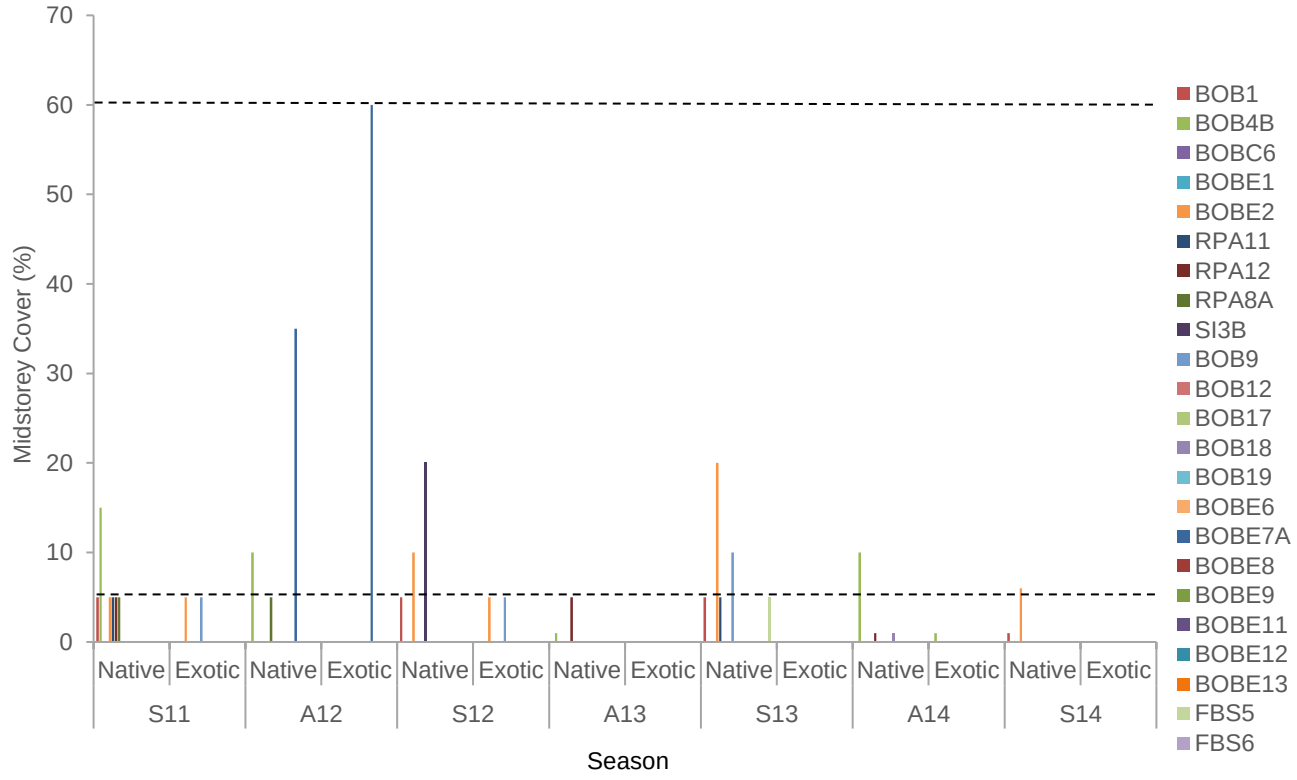


Figure 5: Midstorey cover. Dashed lines indicate the upper and lower Biometric Benchmarks for White Box Woodland.

Variability occurs between years and sites, and in comparison to the vegetation condition benchmarks, similarly in plots that are and are not subject to subsidence. Therefore, no discernible difference could be attributed to subsidence and the monitoring indicates that the *White Box Woodland* CEEC floristic plots are not significantly impacted by subsidence.

Should you have any queries regarding this information, please do not hesitate to contact me on 0408 768 941.

Kind Regards,

Rachel Murray
Senior Environmental Consultant

References

Department of Environment and Climate Change (DECC) (2008). *Vegetation Condition Benchmarks.* Available from: http://www.environment.nsw.gov.au/projects/BiometricTool.htm Date Retrieved 23/4/12.

Appendix A

Table A1: Species richness results from Spring 2011 to Autumn 2015.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2011			Autumn 2012			Spring 2012			Autumn 2013		
					Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species
RESIDUAL																
BOB 1	Nov-01	Jul-02	White Box Woodland	Spring	47	6	53				55	6	61			
BOB 4B	Pillar site		White Box Woodland	Autumn	42	0	44	28	7	44				22	4	28
BOB C6	Sep-05	Jul-06	Modified White Box Woodland	Spring							26	12	38			
BOB E1	n/a	n/a	White Box Woodland	Spring	19	14	33				22	14	36			
BOB E2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	39	11	53				52	7	59			
RPA11	n/a	n/a	White Box Woodland	Spring	21	16	40				27	12	39			
RPA12	Mar-14	Feb-15	White Box Woodland	Autumn	39	13	52	37	10	47				23	2	25
RPA8A	Jan-11	Feb-12	White Box Woodland Grassland	Autumn	3	16	19	13	9	22				14	10	24
SI3B	n/a	n/a	Modified White Box Woodland	Spring	24	18	42				19	12	31			
REVEGETATED/REGENERATED																
BOB 9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	31	15	46				31	11	42			
BOB 12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn	6	13	19	11	10	21				12	4	16
BOB 17	Dec-87	Oct-88	White Box Woodland Grassland	Spring												
BOB 18	May-14	May-15	White Box Woodland Grassland	Autumn										27	3	34

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2011			Autumn 2012			Spring 2012			Autumn 2013		
					Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species
BOB 19	Nov-88	Aug-89	Modified White Box Woodland	Spring												
BOB E6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	22	21	43				20	19	39			
BOB E7A	n/a	n/a	Modified White Box Woodland	Autumn	17	11	28	16	11	27				16	7	23
BOB E8	n/a	n/a	Modified White Box Woodland	Autumn	16	18	34	17	14	31				24	11	35
BOB E9	n/a	n/a	Modified White Box Woodland	Spring												
BOB E11	n/a	n/a	White Box Woodland	Autumn												
BOB E12	n/a	n/a	Modified White Box Woodland	Spring												
BOB E13	n/a	n/a	White Box Woodland	Spring												
FLORISTIC BASED SUBSIDENCE																
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring												
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring												

Table A1: Species richness results from Spring 2011 to Autumn 2015 cont'd.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2013			Autumn 2014			Spring 2014			Autumn 2015		
					Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species
RESIDUAL																
BOB 1	Nov-01	Jul-02	White Box Woodland	Spring	27	0	27				33	6	39			
BOB 4B	Pillar site		White Box Woodland	Autumn				24	3	28				23	4	29

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2013			Autumn 2014			Spring 2014			Autumn 2015		
					Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species
BOBC6	Sep-05	Jul-06	Modified White Box Woodland	Spring	16	6	25				15	11	28			
BOBE1	n/a	n/a	White Box Woodland	Spring	11	6	17				20	11	31			
BOBE2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	33	2	35				26	13	40			
RPA11	n/a	n/a	White Box Woodland	Spring	17	3	20				19	15	35			
RPA12	Mar-14	Feb-15	White Box Woodland	Autumn				25	4	31				20	4	24
RPA8A	Jan-11	Feb-12	White Box Woodland Grassland	Autumn				14	8	22				20	5	27
SI3B	n/a	n/a	Modified White Box Woodland	Spring	9	7	16				14	10	26			
REVEGETATED/REGENERATED																
BOB9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	15	1	16				14	8	22			
BOB12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn				19	12	35				16	13	29
BOB17	Dec-87	Oct-88	White Box Woodland Grassland	Spring	5	3	8				7	12	19			
BOB18	May-14	May-15	White Box Woodland Grassland	Autumn				27	3	34				19	1	21
BOB19	Nov-88	Aug-89	Modified White Box Woodland	Spring							8	10	18			
BOBE6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	9	19	28				11	20	32			
BOBE7A	n/a	n/a	Modified White Box Woodland	Autumn				13	4	19				15	7	23

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2013			Autumn 2014			Spring 2014			Autumn 2015		
					Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species	Native	Exotic	Total Species
BOBE8	n/a	n/a	Modified White Box Woodland	Autumn				18	12	32				21	10	33
BOBE9	n/a	n/a	Modified White Box Woodland	Spring	15	13	28				16	14	30			
BOBE11	n/a	n/a	White Box Woodland	Autumn				25	4	29				20	7	31
BOBE12	n/a	n/a	Modified White Box Woodland	Spring							11	7	18			
BOBE13	n/a	n/a	White Box Woodland	Spring												
FLORISTIC BASED SUBSIDENCE																
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring	18	1	19	28	3	33	25	4	29	28	2	32
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring				28	5	33	20	6	26	22	2	24

Dark grey shaded areas indicate site not established.

Table A2: Cover results for Spring 2011 to Autumn 2015.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2011						Autumn 2012						Spring 2012					
					Canopy		Shrub		Ground		Canopy		Shrub		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
RESIDUAL																						
BOB 1	Nov-01	Jul-02	White Box Woodland	Spring	10	0	5	0	85	5	-	-	-	-	-	-	10	0	5	0	85	5
BOB 4B	Pillar site		White Box Woodland	Autumn	20	0	15	0	50	5	40	0	10	0	30	5	0	0	0	0	0	0
BOB C6	Sep-05	Jul-06	Modified White Box Woodland	Spring													0	0	0	0	85	10
BOB E1	n/a	n/a	White Box Woodland	Spring	0	0	0	0	50	25	-	-	-	-	-	-	0	0	0	0	55	25
BOB E2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	20	0	5	5	65	15	-	-	-	-	-	-	20	0	10	5	65	15
RPA11	n/a	n/a	White Box Woodland	Spring	5	0	5	0	80	10	-	-	-	-	-	-	5	0	0	0	80	5
RPA12	Mar-14	Feb-15	White Box Woodland	Autumn	5	0	5	0	65	5	-	-	-	-	-	-	0	0	0	0	0	0
RPA8A	Jan-11	Feb-12	White Box Woodland Grassland	Autumn	0	0	5	0	5	90	0	0	5	0	95	5	0	0	0	0	0	0
SI3B	n/a	n/a	Modified White Box Woodland	Spring	0	0	0	0	5	90	-	-	-	-	-	-	0	0	20	0	50	35
REVEGETATED/REGENERATED																						
BOB 9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	15	0	0	5	60	35	-	-	-	-	-	-	15	0	0	5	60	35
BOB 12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn	0	0	0	0	70	25	0	0	0	0	70	25	0	0	0	0	0	0
BOB 17	Dec-87	Oct-88	White Box Woodland Grassland	Spring																		

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Spring 2011						Autumn 2012						Spring 2012					
					Canopy		Shrub		Ground		Canopy		Shrub		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
BOB 18	May-14	May-15	White Box Woodland Grassland	Autumn																		
BOB 19	Nov-88	Aug-89	Modified White Box Woodland	Spring																		
BOB E6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	0	0	0	0	5	90	0	0	0	0	0	0	0	0	0	0	5	65
BOB E7A	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	35	60	5	0	35	60	25	70	0	0	0	0	0	0
BOB E8	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	10	70	0	0	0	0	0	0	0	0	0	0	0	0
BOB E9	n/a	n/a	Modified White Box Woodland	Spring																		
BOB E11	n/a	n/a	White Box Woodland	Autumn																		
BOB E12	n/a	n/a	Modified White Box Woodland	Spring																		
BOB E13	n/a	n/a	White Box Woodland	Spring																		
FLORISTIC BASED SUBSIDENCE																						
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring																		
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring																		

Dark grey shaded areas indicate site not established.

Table A2: Cover results for Spring 2011 to Autumn 2015 cont'd.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2013						Spring 2013					
					Canopy		Shrub		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
RESIDUAL																
BOB1	Nov-01	Jul-02	White Box Woodland	Spring	-	-	-	-	-	-	5	0	5	0	80	0
BOB4B	Pillar site		White Box Woodland	Autumn	20	0	1	0	50	5	-	-	-	-	-	-
BOBC6	Sep-05	Jul-06	Modified White Box Woodland	Spring	-	-	-	-	-	-	0	0	0	0	85	15
BOBE1	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	0	0	0	0	80	15
BOBE2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	-	-	-	-	-	-	15	0	20	0	65	5
RPA11	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	5	0	5	0	90	10
RPA12	Mar-14	Feb-15	White Box Woodland	Autumn	5	0	5	0	80	5	-	-	-	-	-	-
RPA8A	Jan-11	Feb-12	White Box Woodland Grasslan	Autumn	0	0	0	0	0	0	-	-	-	-	-	-

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2013						Spring 2013					
					Canopy		Shrub		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
			d													
SI3B	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	0	0	0	0	60	35
REVEGETATED/REGENERATED																
BOB9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	-	-	-	-	-	-	0	0	10	0	80	5
BOB12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn	0	0	0	0	90	5	-	-	-	-	-	-
BOB17	Dec-87	Oct-88	White Box Woodland Grassland	Spring							0	0	0	0	90	10
BOB18	May-14	May-15	White Box Woodland Grassland	Autumn												
BOB19	Nov-88	Aug-89	Modified White Box Woodland	Spring												
BOBE6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	-	-	-	-	-	-	0	0	0	0	20	80
BOBE	n/a	n/a	Modified	Autumn	0	0	0	0	70	25	-	-	-	-	-	-

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2013						Spring 2013					
					Canopy		Shrub		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
7A			White Box Woodland													
BOBE 8	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	85	10	-	-	-	-	-	-
BOBE 9	n/a	n/a	Modified White Box Woodland	Spring							0	0	0	0	50	50
BOBE 11	n/a	n/a	White Box Woodland	Autumn												
BOBE 12	n/a	n/a	Modified White Box Woodland	Spring												
BOBE 13	n/a	n/a	White Box Woodland	Spring												
FLORISTIC BASED SUBSIDENCE																
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring							20	0	<5	0	90	0
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring												

Table A2: Cover results for Spring 2011 to Autumn 2015 cont'd.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2014										Spring 2014					
					Canopy		Midstorey		Midstorey 1		Midstorey 2		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
RESIDUAL																				
BOB1	Nov-01	Jul-02	White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	5	0	1	0	60	5
BOB4B	Pillar site		White Box Woodland	Autumn	25	0	10	1	0	0	0	0	50	10	0	0	0	0	0	0
BOBC6	Sep-05	Jul-06	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	70	20
BOBE1	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	50	10
BOBE2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	-	-	-	-	-	-	-	-	-	-	25	0	6	0	70	5
RPA11	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	2	0	0	0	55	10
RPA12	Mar-14	Feb-15	White Box Woodland	Autumn	5	0	1	0	0	0	0	0	75	1	0	0	0	0	0	0
RPA8A	Jan-11	Feb-12	White Box Woodland	Autumn	0	0	0	0	0	0	0	0	75	25	0	0	0	0	0	0

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2014										Spring 2014					
					Canopy		Midstorey		Midstorey 1		Midstorey 2		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
			Grassland																	
SI3B	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	10	0	0	0	85	5
REVEGETATED/REGENERATED																				
BOB9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	85	5
BOB12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn	0	0	0	0	0	0	0	0	90	5	0	0	0	0	0	0
BOB17	Dec-87	Oct-88	White Box Woodland Grassland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	60	0
BOB18	May-14	May-15	White Box Woodland Grassland	Autumn	10	0	1	0	0	0	0	0	50	10	0	0	0	0	0	0
BOB19	Nov-88	Aug-89	Modified White Box Woodland	Spring											0	0	0	0	65	5

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2014										Spring 2014					
					Canopy		Midstorey		Midstorey 1		Midstorey 2		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
BOBE6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	65	20
BOBE7A	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	0	0	0	0	80	20	0	0	0	0	0	0
BOBE8	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	0	0	0	0	95	5	0	0	0	0	0	0
BOBE9	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-	-	-	0	0	0	0	70	15
BOBE11	n/a	n/a	White Box Woodland	Autumn	0	0	0	0	0	0	0	0	98	2	0	0	0	0	0	0
BOBE12	n/a	n/a	Modified White Box Woodland	Spring											0	0	0	0	60	1
BOBE13	n/a	n/a	White Box Woodland (HU654 in	Spring											0	0	0	0	0	0

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2014										Spring 2014					
					Canopy		Midstorey		Midstorey 1		Midstorey 2		Ground		Canopy		Shrub		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
			new BMP)																	
FLORISTIC BASED SUBSIDENCE																				
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring	20	0	0	0	0	0	0	0	75	1	0	0	0	0	0	0
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring	20	0	0	0	10	0	2	0	45	5	0	0	0	0	0	0

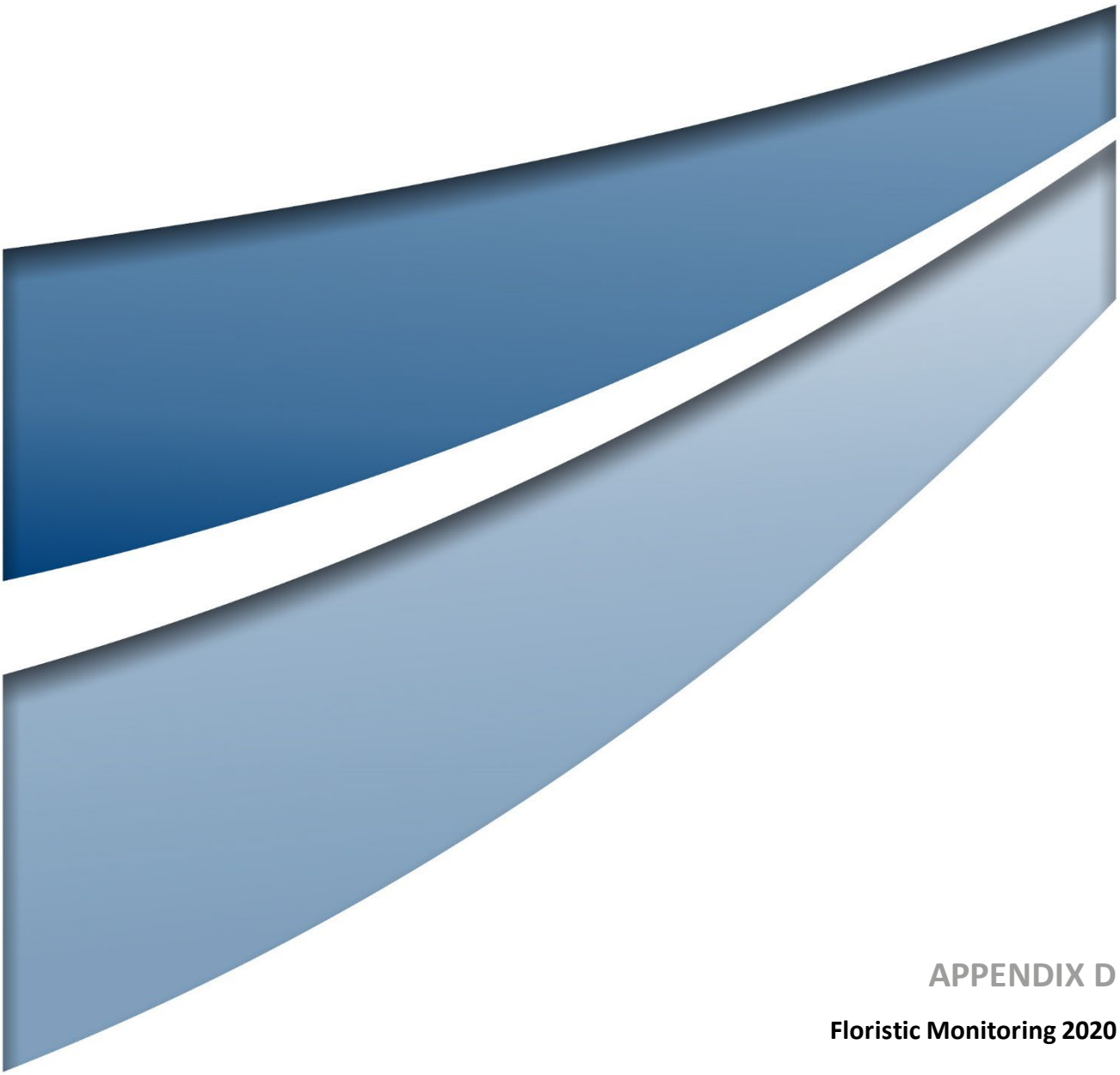
Dark grey shaded areas indicate site not established.

Table A2: Cover results for Spring 2011 to Autumn 2015 cont'd.

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2015							
					Canopy		Small tree		Shrub/Midstorey		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
RESIDUAL												
BOB 1	Nov-01	Jul-02	White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOB 4B	Pillar site		White Box Woodland	Autumn	20	0	2	0	0	0	10	1
BOB C6	Sep-05	Jul-06	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOB E1	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOB E2	n/a	n/a	Yellow Box - Red Gum Woodland	Spring	-	-	-	-	-	-	-	-
RPA 11	n/a	n/a	White Box Woodland	Spring	-	-	-	-	-	-	-	-
RPA 12	Mar-14	Feb-15	White Box Woodland	Autumn	0	0	5	0	1	0	40	1
RPA 8A	Jan-11	Feb-12	White Box Woodland Grassland	Autumn	0	0	0	0	0	0	70	5
SI3B	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-
REVEGETATED/REGENERATED												
BOB 9	Jul-02	Feb-03	White Box Woodland Grassland	Spring	-	-	-	-	-	-	-	-
BOB 12	Nov-88	Aug-89	White Box Woodland Grassland	Autumn	0	0	0	0	0	0	70	5
BOB 17	Dec-87	Oct-88	White Box Woodland Grassland	Spring	-	-	-	-	-	-	-	-

Site	Mining Commenced	Mining Ceased	Vegetation Community	Season monitored	Autumn 2015							
					Canopy		Small tree		Shrub/Midstorey		Ground	
					Native	Exotic	Native	Exotic	Native	Exotic	Native	Exotic
BOB18	May-14	May-15	White Box Woodland Grassland	Autumn	15	0	3	0	0	0	40	0
BOB19	Nov-88	Aug-89	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOBE6	n/a	n/a	Yellow Box - Red Gum Woodland Grassland	Spring	-	-	-	-	-	-	-	-
BOBE7A	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	0	0	50	5
BOBE8	n/a	n/a	Modified White Box Woodland	Autumn	0	0	0	0	0	0	85	5
BOBE9	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOBE11	n/a	n/a	White Box Woodland	Autumn	0	0	0	0	0	0	80	1
BOBE12	n/a	n/a	Modified White Box Woodland	Spring	-	-	-	-	-	-	-	-
BOBE13	n/a	n/a	White Box Woodland (HU654 in new BMP)	Spring	-	-	-	-	-	-	-	-
FLORISTIC BASED SUBSIDENCE												
FBS5	May-14	May-15	White Box Woodland	Autumn and Spring	15	0	0	0	0	0	40	1
FBS6	May-15	n/a	White Box Woodland	Autumn and Spring	15	0	2	0	3	0	45	1

Dark grey shaded areas indicate site not established.



APPENDIX D

Floristic Monitoring 2020

UCMPL Floristic Monitoring Annual Report 2020

Ulan Coal Mines Limited

ecological AUSTRALIA
A TETRA TECH COMPANY

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DOCUMENT TRACKING

Project Name	UCMPL Floristic Monitoring Annual Report 2020
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Prepared by	Rebecca Croake
Reviewed by	David Allworth, Dr Andrew Butler
Approved by	**Dr Andrew Butler**
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Template 2.8.1

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Abbreviations

Abbreviation	Definition
BC Act	NSW *Biodiversity Conservation Act 2016*
BMP	Biodiversity Management Plan
DBH	Diameter at breast height
DPIE	NSW Department of Planning, Industry and the Environment
ELA	Eco Logical Australia
EPBA Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
FBS	Floristic based subsidence
GCAA	Glencore Coal Assets Australia
HBT	Hollow bearing tree
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LWD	Large woody debris
MWRC	Mid-Western Regional Council
MZ	Management Zone
NSW	New South Wales
PA	Project Approval
PCT	Plant Community Type
PFC	Projected foliage cover
RPA	Residual Project Area
RRC	Rehabilitation report card
SOA	Salinity Offset Area
TARP	Trigger Action Response Plan
UCMPL	Ulan Coal Mines Limited
UG	Ulan Underground #3
UMC	Ulan Mine Complex
USO	Ulan Surface Operations
UW	Ulan West
VCA	Voluntary Conservation Agreement
VOA	Vegetation Offset Area

Executive Summary

Eco Logical Australia (ELA) was engaged by Ulan Coal Mines Pty Ltd (UCMPL) to undertake floristic monitoring during autumn and spring 2020 at their Ulan Mine Complex (UMC). Monitoring was undertaken in accordance with the requirements of the UCMPL Biodiversity Management Plan (UCMPL 2020).

Monitoring in 2020 consisted of floristic monitoring, floristic based subsidence monitoring and natural regeneration monitoring.

An assessment against completion criteria which are provided in the BMP was undertaken. In summary:

- Domain B is currently achieving all relevant Ecosystem and Land Use Establishment Phase and Ecosystem and Land Use Sustainability Phase completion criteria. Assessment against the TARP provided in the BMP, where relevant, concluded that no response is required and to continue the monitoring program.
- Domain D is currently achieving one (1) out of three (3) relevant Ecosystem and Land Use Establishment Phase completion criteria and none of the relevant Ecosystem and Land Use Sustainability Phase completion criteria. Completion criteria relating to canopy tree densities, fauna habitat and flora species assemblages have not yet been achieved. Assessment against the TARP provided in the BMP, where relevant, concluded that increasing vegetation cover may be required.
- Domain F is currently achieving all relevant Growth Medium Development Phase, Ecosystem and Land Use Establishment Phase and Ecosystem and Land Use Sustainability Phase completion criteria. Assessment against the TARP provided in the BMP, where relevant, concluded that no response is required and to continue the monitoring program.
- Domain G is currently achieving all relevant Ecosystem and Land Use Establishment Phase and Ecosystem and Land Use Sustainability Phase completion criteria. Assessment against the TARP provided in the BMP, where relevant, concluded that no response is required and to continue the monitoring program.
- Subsidence impacts to threatened species, populations, habitat or ecological communities were negligible and did not trigger a response from the TARP.

In addition to completion criteria, GCAA has developed a Rehabilitation Report Card (RRC). Assessment against the RRC was also undertaken as part of this report. Seven (7) rehabilitation polygons were monitored during 2020. Results indicate that within Domain B:

- Two (2) rehabilitation polygons scored ‘Acceptable’
- Four (4) rehabilitation polygons scored ‘Monitor’
- One (1) rehabilitation polygon scored ‘Maintenance’
- One (1) rehabilitation polygon was monitored within Domain D during 2020. This polygon scored ‘Monitor’

1. Introduction

ELA was engaged by UCMPL to undertake floristic monitoring during autumn and spring 2020 at their UMC. Monitoring was undertaken in accordance with the requirements of the *UCMPL Biodiversity Management Plan* (BMP; Version 5.5; UCMPL 2020).

1.1 Project background

UCMPL is wholly owned by Glencore Coal Assets Australia Pty Limited and managed Glencore Coal Assets Australia Pty Limited (GCAA). The UMC is located within the Mid-Western Regional Council (MWRC) Local Government Area (LGA), approximately 1.5 kilometres from the village of Ulan and 38 kilometres north east of Mudgee. UCMPL's landholdings straddle the Great Dividing Range and are located at the headwaters of the Goulburn and Talbragar River catchments.

UCMPL operations consist of Ulan Surface Operations (USO), Ulan Underground No. 3 (UG) and Ulan West Underground (UW).

Conservation Agreements have been established between UCMPL and the NSW Department of Planning, Industry and the Environment (DPIE) for five (5) areas to satisfy commitments to secure biodiversity offsets relating to NSW Project Approval (PA) 08_0184 and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval EPBC 2009/5252. Annual floristic monitoring and reporting is undertaken in accordance with the relevant Conservation Agreement. The 2020 reports for each Conservation Agreement area are provided in **Appendix A**. These Conservation Agreement areas include:

- Bobadeen Vegetation Offset Area (VOA)
- Spring Gully Conservation Area
- Brokenback Area 1 Conservation Area
- Brokenback Area 2 Conservation Area
- Highett Road Conservation Area.

1.2 Report objectives

A BMP (UCMPL 2020) has been developed by UCMPL to guide management of the UMC subject to the requirements of Condition 44, Schedule 3 of PA 08_0184 and the requirements of the EPBC Approval Ref: 2009/5252. Completion / success criteria have been developed for the following UMC Domains:

- Domain A – Water management area
- Domain B – Rehabilitation area – Woodland / open forest
- Domain C – Goulburn River Diversion
- Domain D – Rehabilitation area – Specific endemic vegetation community
- Domain E – Rehabilitation area – tree screen

- Domain F[1] – Bobadeen VOA
- Domain G[2] – Salinity Offset Area (SOA) and Residual Project Area (RPA)
- Domain H – Agricultural leasehold and private property.

This report provides monitoring results and assessment against specific completion / success criteria for Domain B, Domain D, Domain F and Domain G, as detailed in the BMP (UCMPL 2020). Assessment against 'all domain' completion / success criteria detailed in the BMP (UCMPL 2020) have also been undertaken in this report for Domain B, Domain D and the SOA within Domain G. The locations of Domain B, Domain D, Domain F and Domain G are shown in **Figure 1** below.

Domain F and the SOA within Domain G has been split into Management Zones (MZs) as shown in **Table 1** and **Figure 2** below (UCMPL 2020).

Table 1: Domain F and SOA management zones

Domain	MZ	Vegetation type	Description
Domain F	MZ1	Benchmark vegetation	Includes remnant woodland areas which are of benchmark condition and exhibit high native species richness and vegetation structure. Large areas of MZ1 have undergone some form of historical disturbance, mostly in the form of logging.
	MZ2	Natural regeneration	Includes previously cleared areas containing components of benchmark vegetation and often directly adjacent to remnant woodland (i.e. sources of natural recruitment). These areas are managed to avoid adverse disturbances and to maximise natural regeneration success.
	MZ3	Assisted revegetation	Includes disturbed areas within biodiversity offset areas which require intervention to revegetate the structure and dominant species composition of disturbed vegetation to a condition similar to that of the corresponding benchmark community.
SOA within Domain G	MZ4a	Regeneration / revegetation	Includes disturbed areas within the Salinity Offset Areas (SOAs) which are managed to encourage natural regeneration of cleared areas in combination with continued grazing.
	MZ4b	Benchmark vegetation	Includes remnant woodland areas of benchmark condition within SOAs which are managed to maintain or increase biodiversity values (as per MZ1).

[1] Domain F does not include the Spring Gully, Brokenback Area 1, Brokenback Area 2 and Highett Road Conservation Areas (UCML 2019)

[2]Domain G does not contain areas within the Bobadeen VOA covered by the SOA.

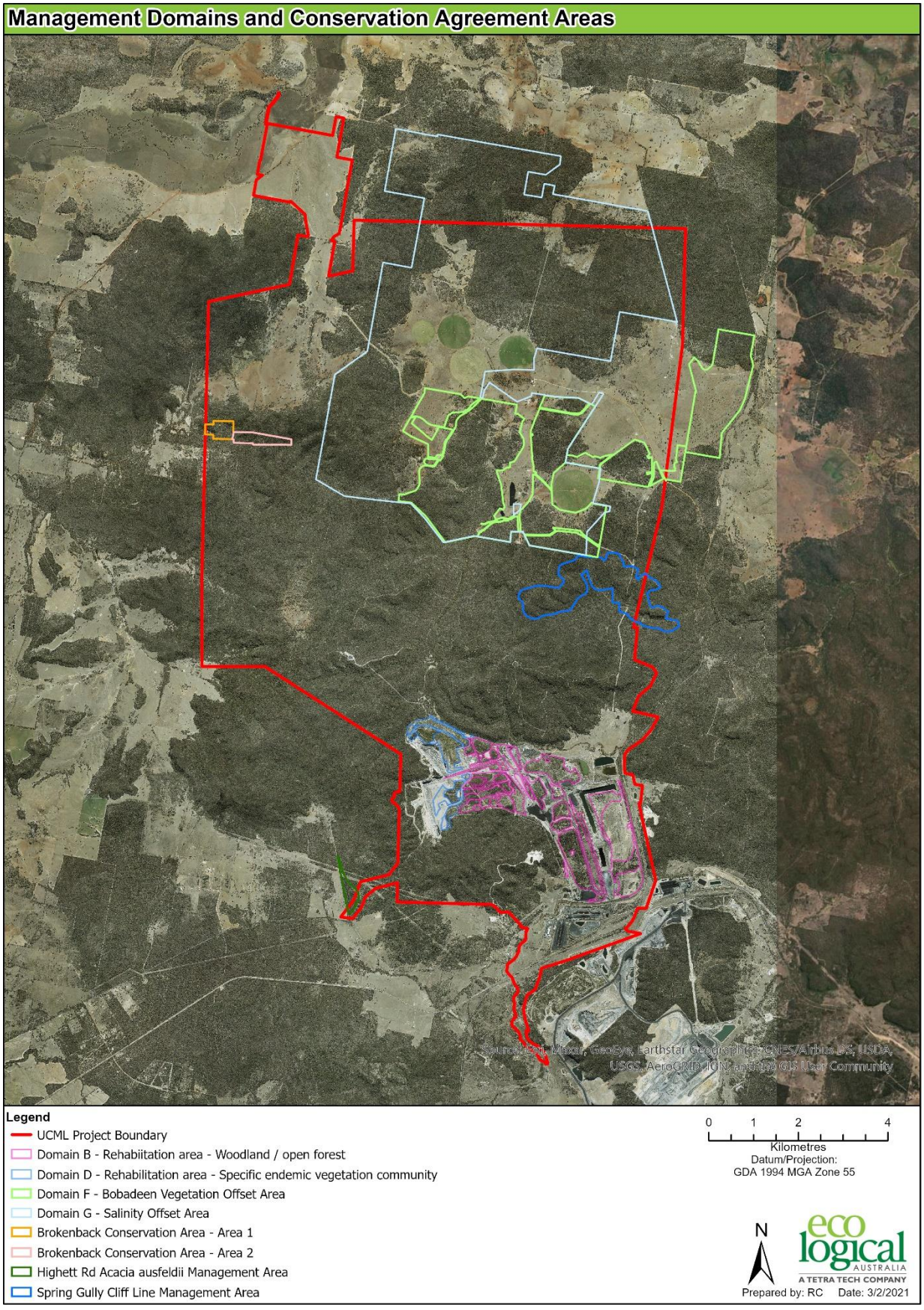

Figure 1: Management Domains and Conservation Agreement areas

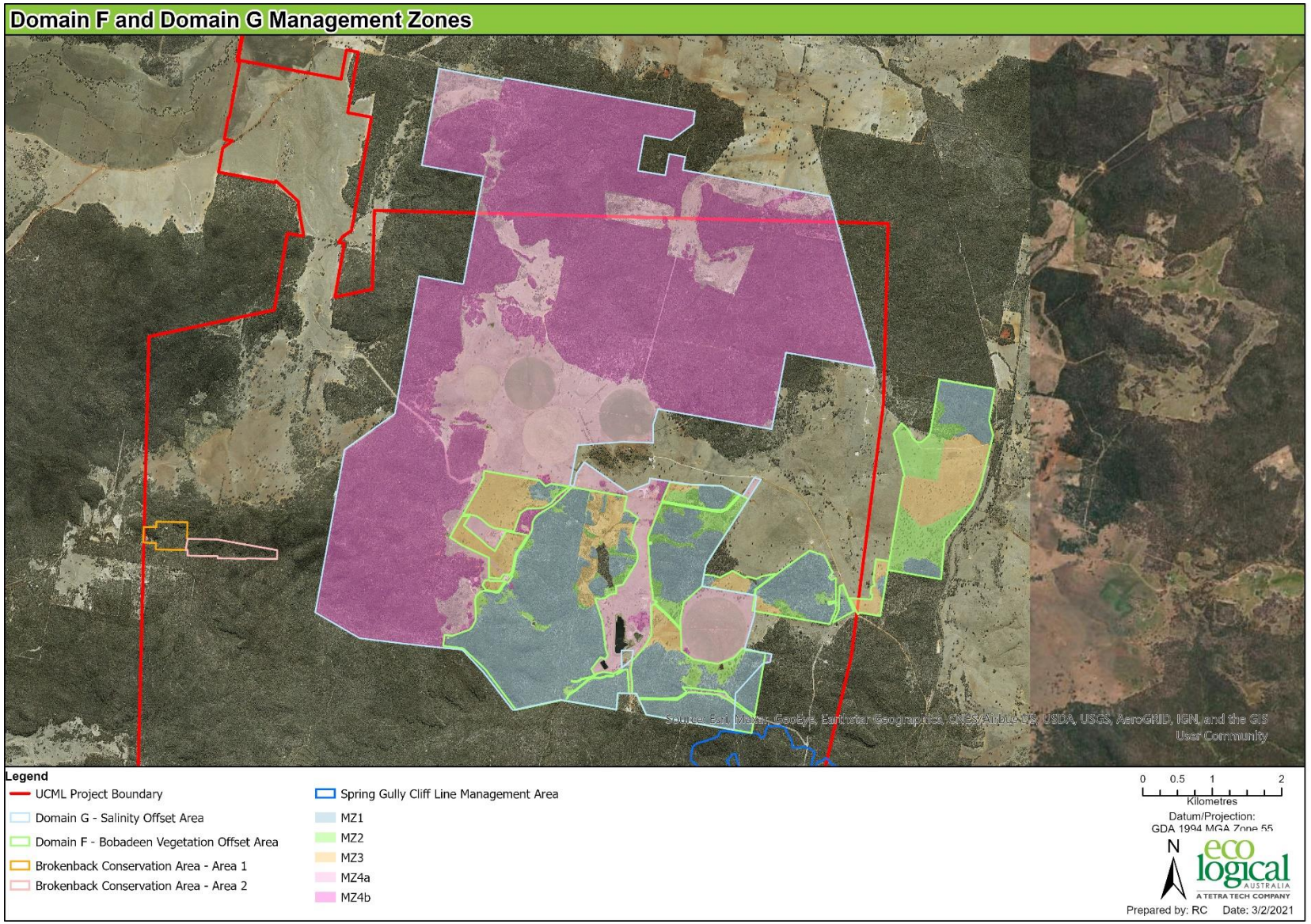

Figure 2: Domain F and SOA Management Zones

1.3 Assessment against completion criteria

The completion criteria relevant to this report, as extracted from Appendix A of the BMP is shown in **Table 2** and **Table 3** below.

Assessment against the 'all domain' completion / success criteria which apply to the Conservation Agreement areas, has been undertaken by ELA (2021b) in the UCMPL Offset Walkover Report (**Appendix B**).

Domain C – Goulburn River Diversion 2020 monitoring results and assessment against completion / success criteria was undertaken by ELA (2020) as part of the *UCMPL Goulburn River Diversion Remediation Status Assessment 2020* which is provided in **Appendix C**.

Prior to 2020, five (5) years of full floristic monitoring of MZ1 sites, as well as remnant vegetation sites located throughout VCA areas, and UCMPL owned land within the UCMPL complex, was completed to develop a scientifically sound baseline assessment of vegetation condition. MZ1 sites are regarded as being in benchmark condition, with data from these sites used as reference for sites located throughout Domain F MZ2 and MZ3, SOA MZ4a, Domain B and Domain D. Following the 2019 Annual Review, UCMPL and ELA revised the monitoring program to discontinue sites from the Domain F MZ1 monitoring program which were not required under current approvals, management plans or Conservation Agreements and did not act as reference sites for Domain F MZ2 or MZ3, SOA MZ4a, Domain B or Domain D.

A Trigger Action Response Plan (TARP) has been developed to guide management intervention throughout the UCMPL Complex. Sections of the TARP relevant to this report are shown below in **Table 4.**

The biodiversity performance criterion for subsidence from underground mining requires that mining operations to have a negligible impact upon threatened species, populations, habitat or ecological communities. Condition 24 of the UCMPL Project Approval (08_0184) states that "*The proponent shall ensure that the project does not cause any exceedances of the performance measures*". The following performance criteria from the Extraction and Subsidence BMP (UCMPL 2020) are used for assessing potential subsidence impacts:

- >10% negative movement (ie. 15% to 5% Projected Foliage Cover; PFC) in vegetation cover and abundance over two or more monitoring periods outside of normal seasonal fluctuation; or
- >10% negative change in vegetation between the White Box Woodland communities located above LW1 and LW2 and analogue vegetation sites.

Table 2: Completion criteria for Domain B, Domain D and Domain F

Domain	Phase	Domain objective	Performance indicator	Completion criteria
All domains	Ecosystem and Land Use Establishment Phase	Weed species do not present a risk to rehabilitation	Weed presence	Ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017- 2022) do not exceed 10% of plant cover. Records indicate that listed weeds are controlled in accordance with legislation.
Domain B	Ecosystem and Land Use Establishment Phase Ecosystem and Land Use Sustainability Phase	Rehabilitation area floristics and structure is representative of a native woodland / open forest Native fauna habitat present within rehabilitation area	Vegetation density	Indicative final minimum total native canopy tree densities for seeded areas to be 60 stems/ha. It is recognised that small open grassy areas add to the biodiversity of this woodland / open forest area.
			Ecosystem composition	Revegetation areas contain>75% of native flora species which are locally indigenous to the Kerrabee IBRA subregion.
			Habitat	Monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species.
			Ecosystem composition	Revegetation areas contain flora species assemblages of each Growth Form indigenous to the surrounding Kerrabee IBRA subregion.
			Ecosystem structure	Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.)
			Reproduction	Rehabilitation monitoring verifies flowering, seeding or second generation juveniles for trees and shrubs are present or likely to be.
			Native fauna	Monitoring confirms native bird and microbat species from multiple families are recorded utilising rehabilitation areas or suitable habitat is available.
Domain D	Ecosystem and Land Use Establishment Phase	Rehabilitation area floristics and structure is comparable to analogue native vegetation community Native fauna habitat present within rehabilitation area	Vegetation density	Indicative final minimum total native canopy tree densities for seeded areas to be >60 stems/ha. It is recognised that small open grassy areas add to the biodiversity of this woodland / open forest area.
			Ecosystem composition	Revegetation areas contain >75% of native flora species (trees/shrubs) consistent with the target vegetation community.
			Habitat	Monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species.

Domain	Phase	Domain objective	Performance indicator	Completion criteria
	Ecosystem and Land Use Sustainability Phase		Ecosystem composition	Revegetation areas contain flora species assemblages characteristic of the target vegetation community.
			Ecosystem structure	Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.)
			Reproduction	Rehabilitation monitoring verifies flowering, fruiting or second generation juvenile trees and shrubs are present or likely to be, based on comparable older rehabilitation sites.
			Native fauna	Monitoring confirms native bird and microbat species from multiple families are recorded utilising rehabilitation areas or suitable habitat is available.
Domain F	Growth Medium Development Phase	Facilitate the natural regeneration of Management Zone 2 areas	Natural regeneration	Monitor natural regeneration occurring within the Bobadeen VOA and update mapping with changes identified.
	Ecosystem and Land Use Establishment Phase	Re-establish native woodlands / open forest within Management Zone 3 areas	Revegetation	Monitoring to indicate native species diversity approaching or consistent with MZ1 or other appropriate analogue sites. Stem density >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community.
		Weeds and feral animal species do not present a risk to regeneration / revegetation	Weed presence	Ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) do not exceed 10% of plant cover.
	Ecosystem and Land Use Sustainability Phase	Facilitate the natural regeneration of Management Zone 2 areas	Natural regeneration	Monitoring to indicate native species diversity approaching or consistent with MZ1 or other appropriate analogue sites. Stem density established at >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community.
		Re-establish native woodlands / open forest within Management Zone 3 areas	Revegetation	Monitoring to indicate native species diversity approaching or consistent with MZ1 or other appropriate analogue sites. Stem density established at >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community.
		Control weeds	Listed weed presence	Records indicate that listed weeds are controlled in accordance with legislation.

Domain	Phase	Domain objective	Performance indicator	Completion criteria
Domain G	-	Control weeds	Occurrences of listed weeds reported and management undertaken in response	Control listed weeds – ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017 – 2022) do not exceed 10% of plant cover.
		Natural regeneration occurring resulting in the improvement of flora and fauna habitat	Monitoring determines the effectiveness of natural regeneration and identifies areas of where targeted plantings or seeding may be required	Natural regeneration is progressing throughout RPA and SOA.
		Native groundcover is stable and of high diversity	Floristic monitoring indicates stable groundcover and increasing native flora diversity	Stable to increasing groundcover (including plant cover, litter and cryptogam) with a stable to increasing native flora diversity, comparable with remnant condition sites (e.g. MZ1, MZ4b) or other appropriate analogue sites.

Table 3: Subsidence performance measure and indicator relevant to this report

Performance measure	Performance indicator	Assessment of performance indicator
Negligible impact on threatened species, populations, habitat or ecological communities.	The vegetation communities located above longwall panels in the subsidence zone are not expected to experience changes in condition different to changes in the corresponding sites located in the transition zone.	An indicator will be considered to have been triggered if: • Analysis of FBS data indicates a >10% (percentage points) decrease in canopy foliage cover of a site within the subsidence zone inconsistent with canopy foliage cover in the transition zone; and • Analysis of FBS data indicates >10% (percentage points) decrease in canopy foliage cover in the selected vegetation community located above mining areas, not seen in non-mined areas of the vegetation community. If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure to determine if the impact is a result of mining and whether any Box Gum Woodland CEEC present above the longwall has exceeded performance measure.

Table 4: TARP sections relevant to this report

Aspect / category	Key element	Trigger / response	Condition Green	Condition Amber	Condition Red
Biodiversity (Woodland / Open Forest and Specific Endemic Vegetation Community Rehabilitation Areas)	Density	Trigger	Rehabilitation area achieving the Vegetation Density Criteria for Phase 4 of rehabilitation (native tree stem density 60 per/ha).	Five years following revegetation the rehabilitation area has not achieved the Vegetation Density Criteria for Phase 4 of rehabilitation (40-60 native tree stems per/ha).	Eight years following revegetation the rehabilitation area has not achieved the Vegetation Density Criteria for Phase 4 of rehabilitation (less than 40 native tree stems per/ha).
		Response	No response required. Continue monitoring program.	Review procedures where required to increase vegetation cover.	A suitably trained person to inspect the site. Investigate use of appropriate management options to remediate. Remediate as appropriate.
	Listed weed and exotic plant species presence	Trigger	Priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) do not exceed 10% of plant cover.	Priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) do not exceed 10-20% of plant cover.	Priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) exceed 20% of plant cover
		Response	No response required. Continue monitoring program.	Engage weed management contractor to remove introduced species from the site.	Engage weed management contractor to remove introduced species from the site as soon as practicable. Investigate management measures to assist native plant establishment including use of ameliorants and implement as appropriate
	Species composition	Trigger	Rehabilitation area achieving the Ecosystem Composition Criteria for Phase 4 of rehabilitation (>75% of native flora species indigenous to the Kerrabee IBRA subregion).	50-75% of native flora species indigenous to the Kerrabee IBRA subregion.	>50% of native flora species indigenous to the Kerrabee IBRA Subregion.
		Response	No response required. Continue monitoring program.	Review native seed mix and amend accordingly. Consider remedial actions such as tubestock planting or	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options

Aspect / category	Key element	Trigger / response	Condition Green	Condition Amber	Condition Red
				re-seeding to achieve required species composition.	to achieve required species composition.
Subsidence impacts to threatened species, populations, habitat or ecological communities	Vegetation communities	Trigger	As predicted, subsidence impacts on vegetation communities are negligible, consistent with subsidence performance criteria.	Analysis of subsidence based flora data indicates a >10% (percentage points) decline in percentage foliage canopy cover of a site within the subsidence zone inconsistent with percentage foliage canopy cover in the transition zone; and >10% (percentage points) decline in percentage foliage canopy cover in the selected vegetation community located above mining areas, not seen in non-mined areas of the vegetation community.	Results from biodiversity monitoring have been confirmed that an exceedance or its likely to be exceeded regarding the Performance Measure for biodiversity
		Response	No response required. Continue monitoring program.	Implementation of management actions to assess if exceedances are due to mining related activities	Implementation of management and contingency measures responses as identified in the Contingency Plan and reporting requirements (refer to Extraction Plan BMP).

2. Methodology

Monitoring in 2020 consisted of floristic monitoring, floristic based subsidence monitoring and natural regeneration monitoring. Complete methodology including site locations and weather conditions is provided in **Appendix D**.

2.1 General floristic– Domain F

Fourteen (14) floristic sites were monitored in 2020 within Bobadeen VOA, as shown in **Table 5.** A further 30 sites located within remnant woodland / forest in the Conservation Agreement areas (specified in **Section 1.1**) were monitored as part of the VCA monitoring. The Conservation Agreement area sites have been incorporated into the data analysis for Domain F (as well as for Domain B and D). This is designed to increase the replication of "benchmark" (equivalent to MZ1) sites to provide a more robust data set against which the data from MZ2 and MZ3 sites can be compared to assess change / performance.

Grassy woodland areas throughout UCMPL are associated with the Threatened Ecological Community (TEC) White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands which is listed under the BC Act and the EPBC Act. For Grassy Woodland sites, an assessment of '*important species*' has been undertaken in accordance with the *White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands EPBC Act Policy Statement* (DEH 2006). A condition for meeting the listing criteria for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands a minimum of 12 native groundcover species (excluding grasses) including at least one 'important species' must be achieved (DEH 2006). Dry sclerophyll forest areas at UCMPL are not associated with any TEC and assessment against 'important species' has not been undertaken.

Floristic monitoring was undertaken in accordance with the BMP (UCMPL 2020). The location of sites monitored during 2020 is shown in **Figure 3**.

Vegetation mapping to a Plant Community Type (PCT) level has been undertaken throughout the UCMPL complex (ELA 2019); however, data analysis in this report has been undertaken at a vegetation formation level (Keith 2004). All PCTs within the UCMPL complex fit into two (2) main vegetation formations, Grassy Woodlands or Dry Sclerophyll Forests (shrubby sub-formation).

The PCT of each monitoring site, along with the associated vegetation formation for each site is shown in **Table 5.**

Table 5: PCTs per vegetation formation and class within the UCMPL complex

Vegetation Formation	PCT	VOA MZ1 / Conservation Area Benchmark	MZ2	MZ3
Grassy Woodlands -	281: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**BOBC1**, BOBE2, BOBC9, BOB11B, **UCMPL_CA_Site2**	BOBC10	**BOBE6**, BOBC8B

Vegetation Formation	PCT	VOA MZ1 / Conservation Area Benchmark	MZ2	MZ3
	618: White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	**BOB4B**	BOBE11, BOBE13, BOB9, BOB18, BOBE1	**BOB10B, BOB12, BOBC11, BOB17,** BOB7A, BOBE8, BOBE9, BOB19
Dry Sclerophyll Forests (Shrubby sub-formation)	478: Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	**BOBE3, UCMPL_CA_Site10, UCMPL_CA_Site11, UCMPL_CA_Site3, UCMPL_CA_Site17, UCMPL_CA_Site18, UCMPL_CA_Site24, UCMPL_CA_Site29, UCMPL_CA_Site53**	**BOB22**	BOB21, BOB23
	481: Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	**UCMPL_CA_Site5, UCMPL_CA_Site19, UCMPL_CA_Site20, UCMPL_CA_Site25, UCMPL_CA_Site28, UCMPL_CA_Site30, UCMPL_CA_Site51, UCMPL_CA_Site52**	BOB13B, BOBC4, BOBE5, BOB20	BOB15B
	623: Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion[3]	**RPA17**		BOBC7
	479: Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	**BB1, BOBC3, ACQ1, ACQ2, UCMPL_CA-Site1, UCMPL_CA_Site13, UCMPL_CA_Site15, UCMPL_CA_Site16, UCMPL_CA_Site23**		
	1675: Scribbly Gum – Narrow-leaved Ironbark – *Bossiaea rhombifolia* heathy open forest on sandstone ranges of the Sydney Basin	**SG1, UCMPL_CA_Site14, UCMPL_CA_Site7**		
	476: Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	**ALIN1, ALIN2, ALIN3**		

Note: **bold text** indicates sites monitored in 2020

[3] The vegetation community identified as PCT 623 at UMC most closely represents Dry Sclerophyll Forest (shrubby sub-formation) rather than Grassy Woodland due to high litter cover and low cover of perennial tussock grasses.

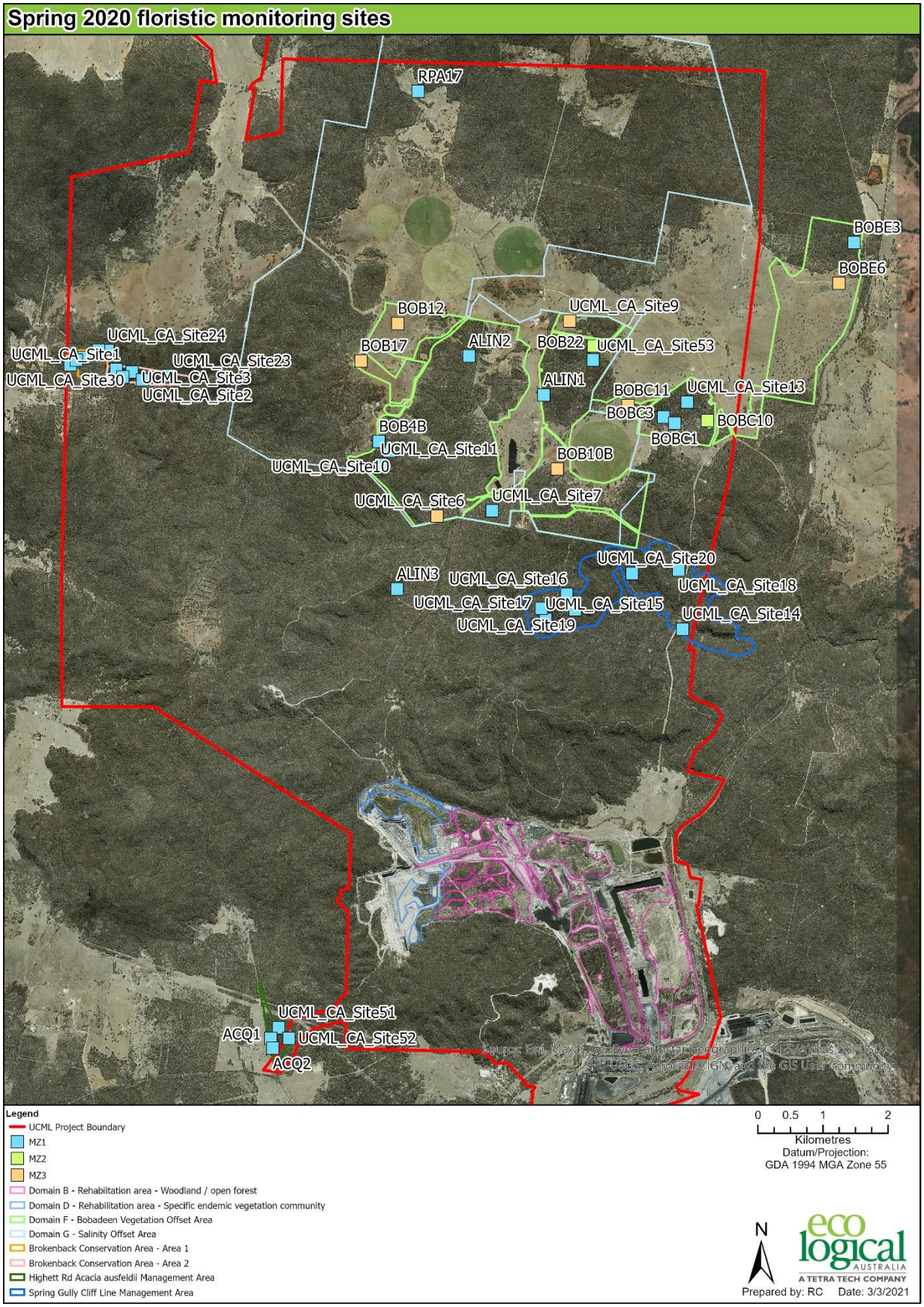

Figure 3: Spring 2020 floristic monitoring sites

2.2 Natural regeneration– Domain F and Domain G

Sixteen (16) natural regeneration transects underwent monitoring during 2020 (**Table 6** below). A drive-over of MZ2 and MZ4a areas was undertaken during July 2020 to capture the current extent of natural regeneration throughout these areas.

Table 6: 2020 natural regeneration transects

Domain	MZ	Transects
Domain F	MZ2	BOBET1, BOBET2, BOBET3, BOBET4, BOBT1, BOBT2, BOBT3, BOBCT1, BOBCT2, BOBCT2
SOA	MZ4a	SOA1, SOA2, SOA3, SOA4, SOA5, SOA6

One (1) floristic monitoring site (RPA17) was monitored within Domain G RPA during 2020. No floristic monitoring sites are present within Domain G SOA.

2.3 Open cut rehabilitation– Domain B and Domain D

Two (2) domains are present within the open cut rehabilitation:

- Domain B – Rehabilitation area – Woodland / open forest
- Domain D – Rehabilitation area - Specific endemic vegetation community.

The monitoring program is split across two (2) monitoring phases:

- Initial Establishment Monitoring (IEM) – Rapid assessment of young (0-3-year-old) rehabilitated areas completed at 2 years and 3 years to determine germination success and landform stability (UCMPL 2020).
- Long-term Monitoring (LTM) – Detailed floristic and remote sensing assessment and comparison of established rehabilitation areas (> 4 years old).

Twenty-nine (29) open cut rehabilitation sites were monitored across seven (7) polygons throughout Domain B and one (1) polygon in Domain D during spring 2020 (**Table 7** and **Figure 4** below). Twenty (20) of these sites underwent monitoring for the first-time during spring 2020. All rehabilitation areas at UCMPL are greater than 4 years old except Domain D Polygon 5, which is 3 years old.

Monitoring and assessment against the Rehabilitation Report Card (RRC) was undertaken in accordance with the BMP (UCMPL 2020), the *Development of the Annual Rehabilitation Report Card (NSW) Procedur*e (Draft version, GCAA 2021a) and the *Scientific Background Report NSW Rehabilitation Report Card* (Draft version, GCAA 2021b). The 2020 monitoring event was the first time the GCAA Rehabilitation Report Card (RRC) had been used at UCMPL.

Performance classification has been undertaken on a site and polygon basis in accordance with the ranges specified in **Table 8** below which has been extracted from the *Scientific Background Report NSW Rehabilitation Report Card* (Draft version, GCAA 2021b).

The GCAA RRC and associated weightings as extracted from the BMP (UCMPL 2020) is provided in **Appendix E**.

Table 7: Open cut rehabilitation sites

Domain	Rehabilitation polygon	Year established	Rehabilitation age	Rehabilitation phase	2020 monitoring sites
Domain B – Rehabilitation area – Woodland / open forest	Polygon 2	2008	12	LTM – Year 11+	OC4A, **2c, 2b**
	Polygon 7	2014	6	LTM – Year 4-10	**7c, 7d, 7f**, OC7A, OC7B
	Polygon 8	2005	15	LTM – Year 11+	OC5A, **8b, 8d**
	Polygon 12	2014	6	LTM – Year 4-10	OC6A, OC7E, OC6B, **12a, 12b**
	Polygon 13	2000	10	LTM – Year 11+	**13a, 13b, 13c**
	Polygon 16	1997	23	LTM – Year 11+	OC2B**, 16a, 16b, 16c**
	Polygon 15	2012	8	LTM – Year 4-10	**15a, 15b, 15c, 15d**
Domain D – Rehabilitation area - Specific endemic vegetation community	Polygon 5	2017	3	IEM – Year 3	**5c, 5d**

Note: **bold text** indicates site which underwent monitoring for the first time in 2020.

Table 8: Scores for rehabilitation performance classification

Land use / Domain	Rehabilitation age	Rehabilitation status		
		Maintenance	Monitor	Acceptable
Domain D - Targeted native vegetation	1-2	-5.0 - <3.0	3.0 – 5.0	n/a
	3	-5.0 - <3.2	3.2 – 5.0	n/a
	4-10	-5.0 - <2.9	2.9 – 5.0	n/a
	11+	-5.0 - <3.0	3.0 – <4.1	4.1 – 5.0
Domain B - Non-specific native vegetation	1-2	-5.0 - <3.0	3.0 – 5.0	n/a
	3	-5.0 - <3.2	3.2 – 5.0	n/a
	4-10	-5.0 - <2.9	2.9 – 5.0	n/a
	11+	-5.0 - <3.0	3.0 – <4.4	4.4 – 5.0

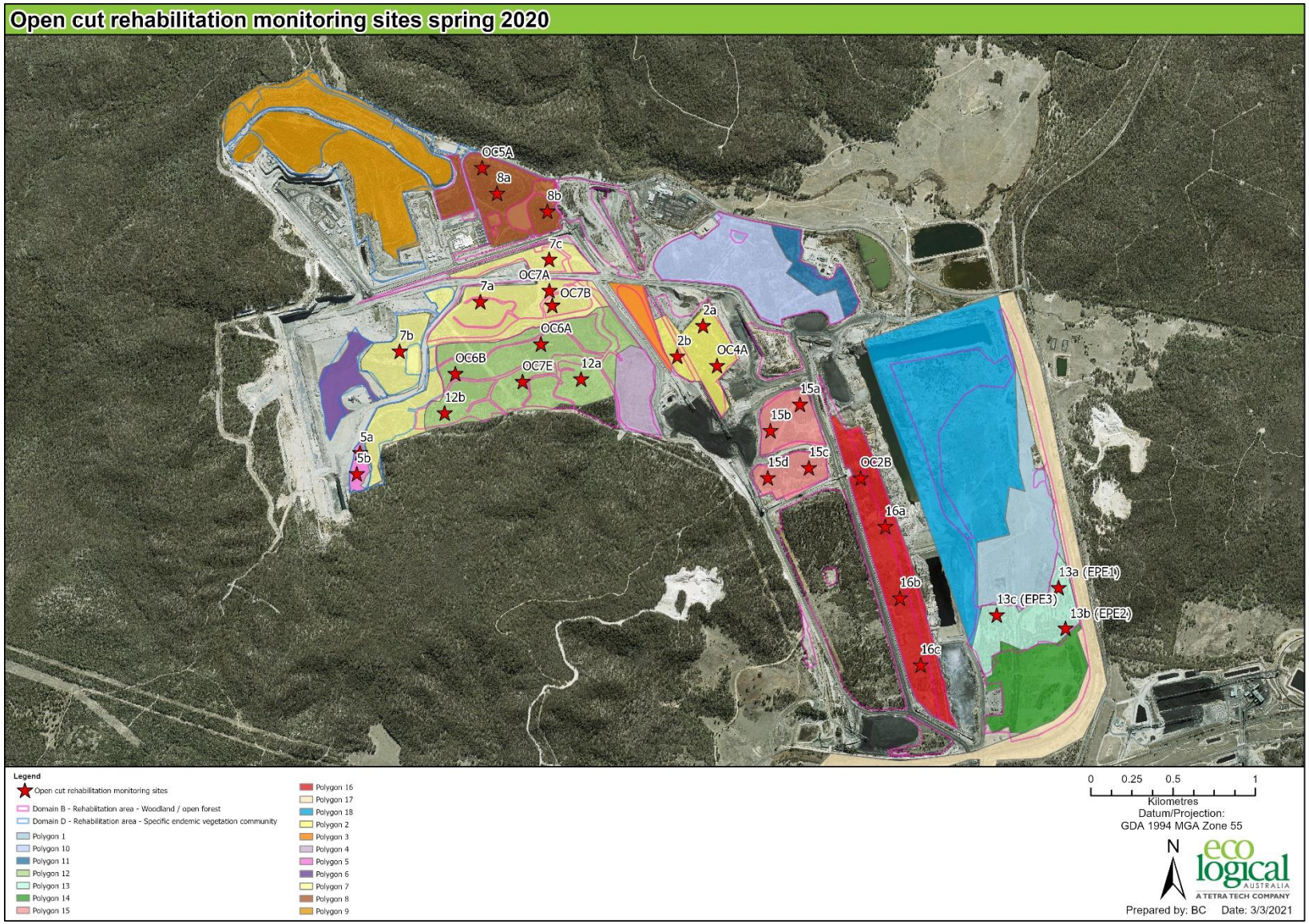

Figure 4: Open cut rehabilitation monitoring sites spring 2020

2.4 Floristic based subsidence monitoring

Floristic based subsidence (FBS) monitoring was undertaken along six (6) longwall panels during autumn and seven (7) longwall panels during spring 2020, as shown in **Table 9**. UG LWW7 L1-L10 were established and underwent baseline (pre-mining) monitoring during spring 2020. A full description of the methodology is provided in **Appendix D2**.

Table 9: Longwall panels which underwent FBS monitoring during 2020

Mine	Longwall	Autumn	Spring
Ulan West	UW LW4 L1-L10	✓	✓
	UW LW5 L1-10	✓	✓
	UW LW6 L1-L10	✓	✓
Ulan Underground No. 3	UG LWW4 L1-L10	✓	✓
	UG LWW5 L1-L10	✓	✓
	UG LWW6 L1-L10	✓	✓
	UG LWW7 L1-L10	-	✓

3. Results and discussion

3.1 General floristic– Domain F

3.1.1 Native species richness

Native species richness has been assessed throughout MZ2 and MZ3 grassy woodland and dry sclerophyll forest sites to assess against the following completion criteria relating to the Domain Objectives to facilitate the natural regeneration of MZ2 areas and to re-establish native woodlands / open forest within MZ3 areas (**Section 1.3**; UCMPL 2020) :

> *Monitoring to indicate native species diversity approaching or consistent within MZ1 or other appropriate analogue sites (UCMPL 2020).*

Changes in native species richness does not directly correlate to improvement in biodiversity values or vegetation community composition. Because of this, assessment against 'important species' has been undertaken for grassy woodland sites.

Grassy woodland sites

Native species richness of grassy woodland sites ranged from 37 to 49 (median 40) at MZ1 and from 19 to 30 (median 27) at MZ3 sites during 2020, as shown in **Table 10** below. No MZ2 grassy woodland sites were monitored during 2020. Fluctuations in native species richness over time generally coincide with fluctuations in climatic conditions, with above average rainfall year's corresponding to years which recorded high native species richness. An assessment of the relationship with climactic conditions and native species richness was undertaken as part of the *UCMPL Annual Floristic Monitoring Report 2019* (ELA 2020). This assessment found a very clear correlation between the amount of rainfall and the species richness. This means that identifying changes due to management actions or intervention above the noise caused by variations in climatic conditions can be difficult.

Table 10: Native species richness 2011 to 2020

MZ	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
MZ1	BOB11B		24	24		22					
	BOB4B		23	23	23	22					37
	BOB7	19	19	16	12*						
	BOBC1			20	20	31	34	42		31	49^
	BOBC9				22	19					
	BOBE2	39	40	30	29			37			
	UCMPL_CA_Site2										40
	Median	**29**	**23.5**	**23**	**22**	**22**	**34**	**39.5**		**31**	**40**
MZ2	BOB18				25	18	26	31	16	27	
	BOB9	27	22	14		23	17				
	BOBC10					29	31	35	36	34	
	BOBE1	17	19	10*	17						

MZ	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	BOBE11				20	21	20	23	23		
	BOBE13	42				58^	28	23	16	10	
	Median	**27**	**20.5**	**12**	**20**	**23**	**26**	**27**	**19.5**	**27**	
MZ3	BOB10B		11	13		21	17				28
	BOB12	13	9	10	19	31^	24				25
	BOB17			5*		20					
	BOB19				7	21				9	
	BOBC11								26		
	BOBC8B										19
	BOBE6	15	14	7	9						27
	BOBE8	11	15	19	17	20	24				
	BOBE9			12	12						30
	Median	**13**	**12.5**	**11**	**12**	**21**	**24**		**26**	**9**	**27**

^ denotes historical maximum, * denotes historical minimum for each MZ

MZ2 median native species richness during 2019 was between historical maximum and minimum values recorded at MZ1 sites. An increase in median native species richness for MZ2 sites was recorded between 2013 to 2017 as shown in **Figure 5** below. However, there has been no change in median species richness between 2011 and 2019 for MZ2 sites. This indicates that native species richness is not approaching MZ1 values. Therefore, based off data collected during 2019, MZ2 is not meeting the completion criteria relating to native species richness.

MZ3 median native species richness during 2020 was between historical maximum and minimum values recorded at MZ1 sites. Since 2011, there has been an increase in median native species richness for MZ3 sites; however, this trajectory closely follows the fluctuations in median native species richness recorded at MZ1 sites, likely as a result of climate, as shown in **Figure 6** below. The relative difference between MZ1 and MZ3 sites from 2011 to 2020 has reduced, indicating that native species richness is approaching MZ1 values. Therefore, based off data collected during 2020, MZ3 is meeting the completion criteria relating to native species richness.

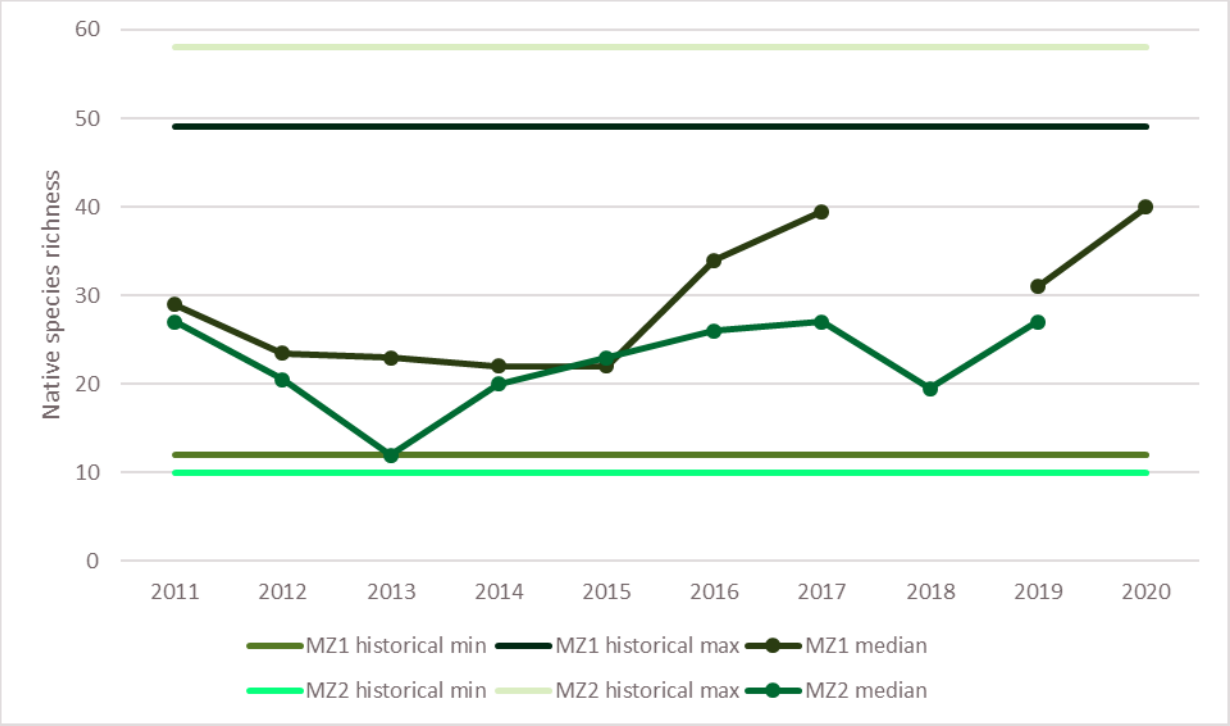

Figure 5: Grassy woodland native species richness trends 2011 to 2020; MZ1 compared to MZ2

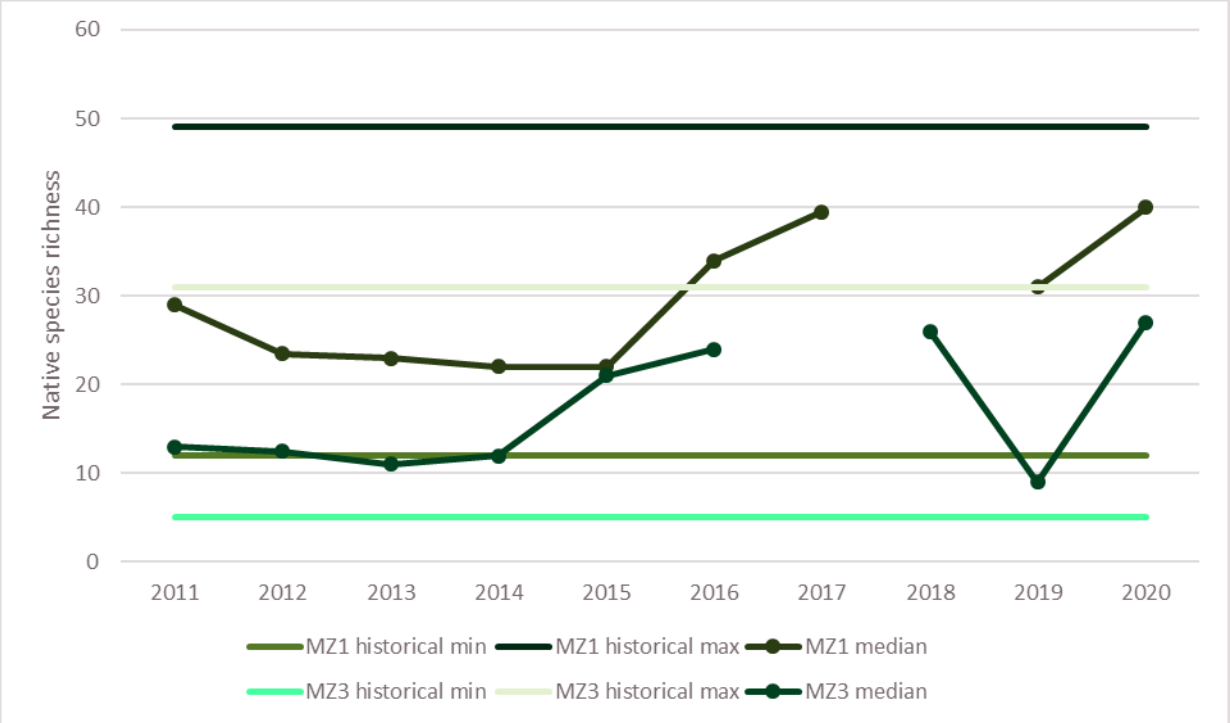

Figure 6: Grassy woodland native species richness trends 2011 to 2020; MZ1 compared to MZ3

The EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands identifies species which are important species for the purposes of this ecological community (OEH 2006). At least one important species must be present within patches of

White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands to satisfy the EPBC Act listing criteria.

Figure 7 below, shows average number of important species in MZ1, MZ2 and MZ3 from 2011 to 2020, as well as cumulative averages for each MZ. Whilst the average number of important species for MZ1 has fluctuated from 2011 to 2020, the cumulative average number of important species has remained relatively stable, which is reflective of benchmark vegetation. The MZ2 and MZ3 cumulative averages indicate an increase in the number of important species recorded over the years. Both MZ1 and MZ2 average number of important species dropped between 2011 and 2013. Average number of important species for MZ1 has almost returned to 2011 values; however, the average number of important species recorded in MZ2 during 2020 is still below what was recorded during 2011 with the difference between MZ2 average number of important species is equivalent to less than two (2) important species. This may indicate that MZ2 areas have lower resilience to disturbance, such as drought, compared to MZ1 areas.

Floristic data from 2020 indicates that, generally, important species with readily transportable seeds are found across MZ1, MZ2 and MZ3 (i.e. *Calotis lappulacea* (Yellow Burr Daisy), *Calotis cuneifolia* (Purple Burr Daisy), *Desmodium varians* (Slender Tick-trefoil)). Species with less readily transportable seeds such as herbs *Hypericum gramineum* (Small St. John's Wort), *Solenogyne dominii* and *Goodenia hederacea* (Forest Goodenia) are generally still absent from MZ2 and MZ3.

The process of some species returning to White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands which have undergone planting or other restoration is slow. The historical removal of recalcitrant species, such as *Hypericum gramineum* (Small St. John's Wort), *Solenogyne dominii* and *Goodenia hederacea* (Forest Goodenia) may be very slow to return or may never return without intervention. Literature indicates that the trajectory of restoration of Box Gum Woodlands may be too slow to detect within 10 years of establishment (Wilkins, Keith and Adam 2003).

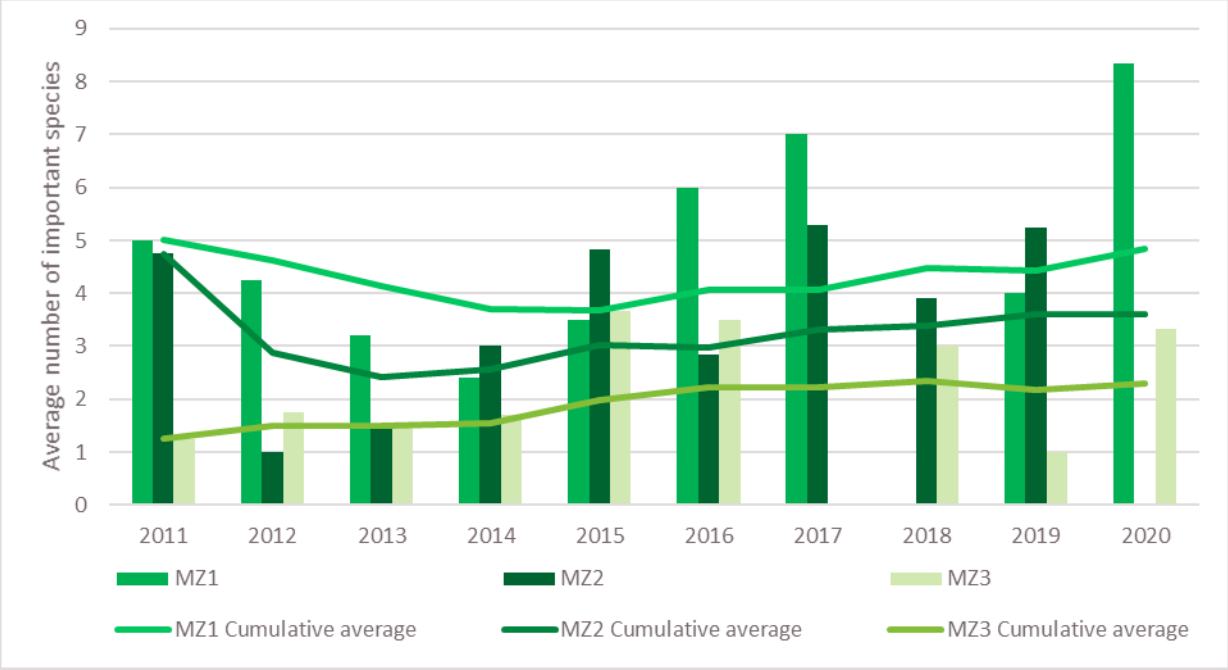

Figure 7: Average number of important species; 2011 to 2020

Dry sclerophyll forest sites

Native species richness recorded during 2020 at dry sclerophyll forest sites ranged from 6 to 43 at MZ1 sites (median 31) and from 34 to 39 at MZ2 sites (median 36.5) as shown in **Table 11**. No MZ3 sites were monitored during 2018 and no MZ3 sites were monitored during 2020.

Over the period of monitoring, the median native species richness at MZ2 sites has always fallen within the historical maximum and minimum values recorded at MZ1 sites as shown in **Figure 8**. An increase in the median native species richness has occurred for MZ2 sites since 2011 and in 2019 and 2020, the median value of MZ2 sites exceeded that at MZ1 sites. MZ2 dry sclerophyll sites are meeting the completion criteria for native species richness.

Monitoring of MZ3 dry sclerophyll forest sites has been undertaken during 2014, 2015 and 2019, with between one (1) and three (3) sites monitored during each year. The native species richness of BOB15B (2014), BOB24 (2019) and the median of the sites monitored during 2015 are within the maximum and minimum values for native species richness at MZ1 as shown in **Figure 9** below. The native species richness for the MZ3 site monitored during 2019 was equal to that recorded at MZ1 sites.

Table 11: Dry sclerophyll forest sites native species richness 2011 to 2020

MZ	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	ACQ1							34		22	42
	ACQ2							28		11*	36
	BB1		30	21	28	31				20	28
	BOBC3			20	32	34	37	37			43^
	BOBE3	24	22	16	14	17		22			20
	SG1		33	21	24						29
	UCMPL_CA_Site1										24
	UCMPL_CA_Site10										27
	UCMPL_CA_Site11										23
	UCMPL_CA_Site13										16
MZ1	UCMPL_CA_Site14										35
	UCMPL_CA_Site15										36
	UCMPL_CA_Site16										27
	UCMPL_CA_Site17										30
	UCMPL_CA_Site18										29
	UCMPL_CA_site19										37
	UCMPL_CA_Site20										32
	UCMPL_CA_Site23										37
	UCMPL_CA_Site24										20
	UCMPL_CA_Site25										24
	UCMPL_CA_Site28										37

MZ	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	UCMPL_CA_Site29										26
	UCMPL_CA_Site3										27
	UCMPL_CA_Site30										36
	UCMPL_CA_Site5										36
	UCMPL_CA_Site51										40
	UCMPL_CA_Site52										31
	UCMPL_CA_Site53										32
	UCMPL_CA_Site7										35
	Median	**24**	**30**	**20.5**	**26**	**31**	**37**	**31**		**20**	**31**
MZ2	BOB13B		36		25	65	70^	60	49	52	
	BOB20					21	21	25	25	31	
	BOB22					26	21	26	21	15*	39
	BOBC4		29	21	21		29				34
	BOBE5	19	22	17	15	25	28			28	
	RPA10	27	15	20	25	25					
	Median	**23**	**25.5**	**20**	**23**	**25**	**28**	**26**	**25**	**29.5**	**36.5**
MZ3	BOB15B				13*	19					
	BOB21					31^					
	BOB23					29				20	
	Median				**13**	**29**				**20**	

^ denotes historical maximum, * denotes historical minimum for each MZ

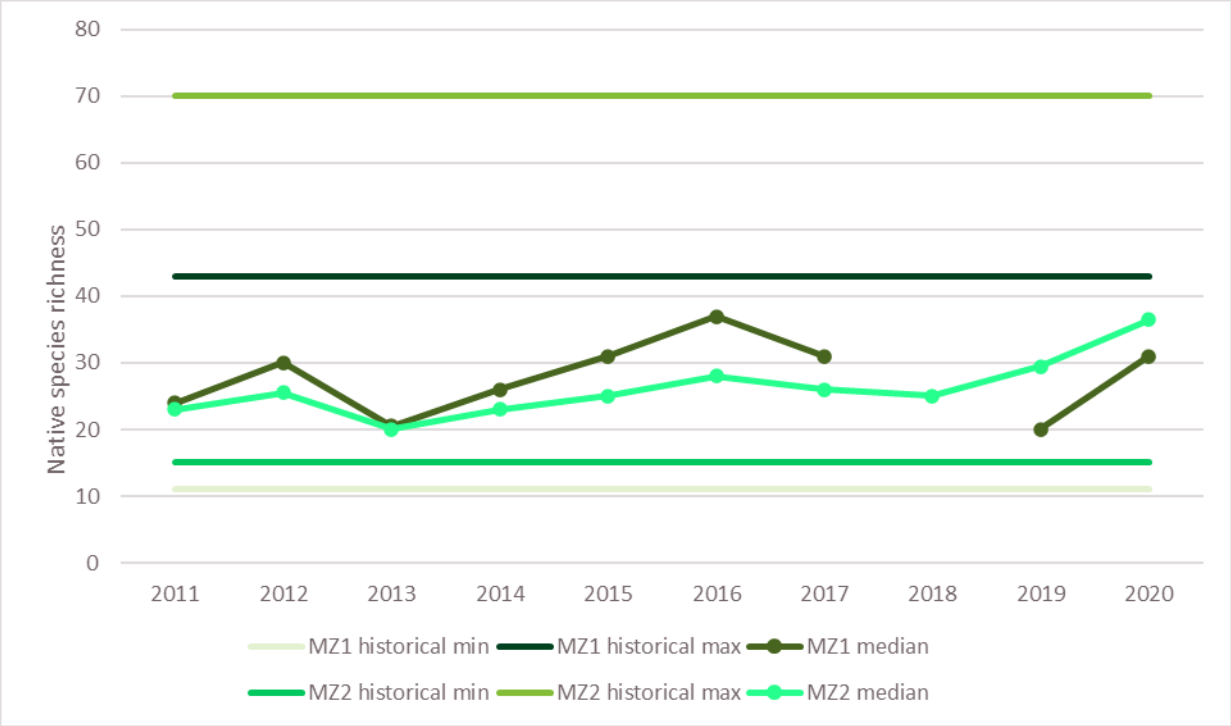

Figure 8: Dry sclerophyll forest native species richness trends 2011 to 2020; MZ1 compared to MZ2

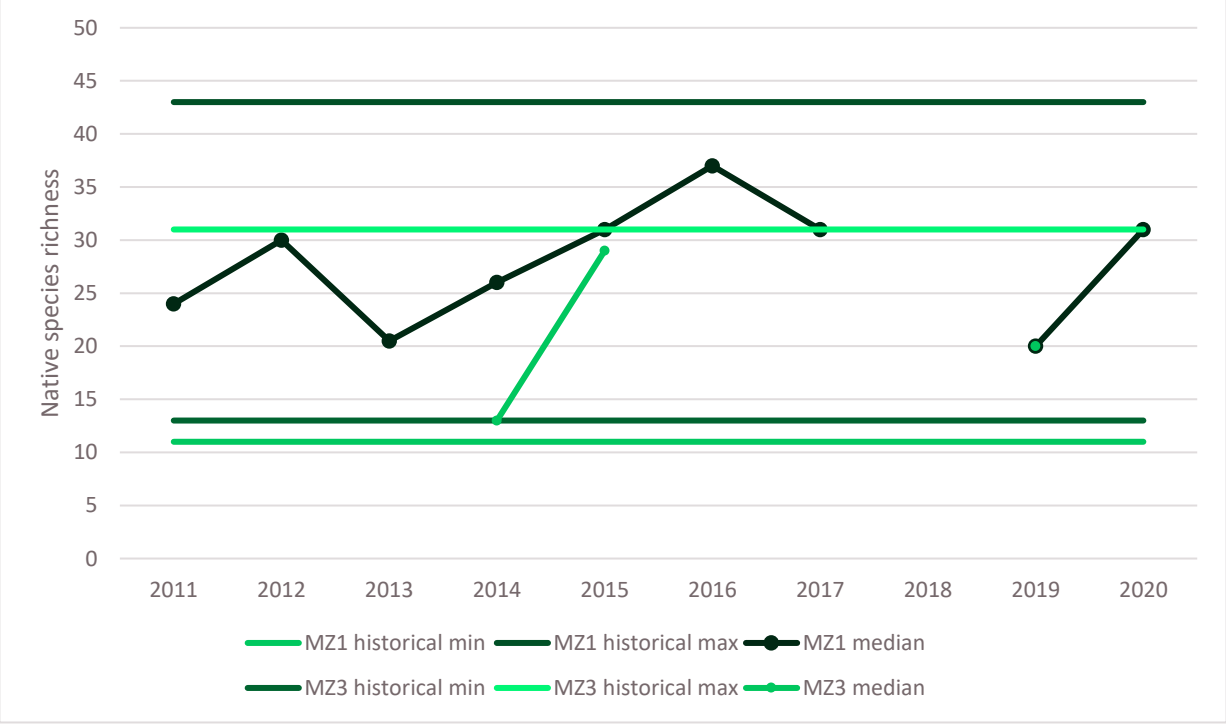

Figure 9: Dry sclerophyll forest native species richness trends 2011 to 2020; MZ1 compared to MZ3

3.1.2 Weed presence

Weed presence has been assessed throughout Domain F MZ2 and MZ3 grassy woodland and dry sclerophyll forest sites to assess against the following completion criteria relating to the Domain Objectives weeds and feral animal species do not present a risk to regeneration / revegetation (**Section 1.3,** UCMPL 2020):

> *Ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) do not exceed 10% of plant cover*

During 2020, the MZ3 median for exotic species cover was 11.3% compared to a median of 0.1% recorded at MZ1 sites. *Trifolium* spp. (clover species), *Carthamus lanatus* (Saffron Thistle) and *Echium vulgare* (Patterson's Curse) were commonly recorded across most MZ3 grassy woodland sites.

A total of seven (7) priority weeds were recorded both opportunistically and during surveys across the UCMPL Complex during 2020:

- *Hypericum perforatum* (St John's Wort)
- *Rubus fruiticosa* spp. aggregate *(Blackberry*)
- *Opuntia stricta* (Common Prickly Pear)
- *Xanthium spinosum* (Bathurst Burr)
- *Xanthium occidentale* (Noogoora Burr)
- *Heliotropium amplexicaule* (Blue Heliotrope)
- *Rosa rubiginosa* (Sweet Briar).

Priority species cover and abundance for grassy woodland sites and dry sclerophyll forest sites monitored during 2020 is discussed below. A map showing the locations of priority weeds recorded during 2020 throughout the UCMPL Complex is provided in **Appendix H**.

Grassy woodland sites

Two priority weed species, *H. perforatum* and *X. spinosum* were recorded throughout grassy woodland sites during 2020 as shown in **Table 12**. Where present, PFC of priority weeds across grassy woodland sites during 2020 ranged from 0.1% to 0.9%.

The completion criteria related to weeds is currently being met as data collected during 2020 indicates that priority weed cover does not exceed 10% of plant cover throughout MZ1 or MZ3 grassy woodland sites.

Table 12: Priority weeds recorded at grassy woodland sites during 2020

MZ	Site	Priority weed species	PFC (%)
MZ1	BOB4B	*H. perforatum*	0.1
	BOBC1	*X. spinosum*	0.2
	MZ1 average of all sites		**0.04**
MZ3	BOB12, BOBC8, BOBE6, BOBE9	*H. perforatum, X. spinosum*	0.4 to 0.9
	BOBC8	*H. perforatum*	0.6

MZ	Site	Priority weed species	PFC (%)
	MZ3 average of all sites		**0.3**

Dry sclerophyll forest sites

Three priority weed species, *H. perforatum, X. spinosum* and *O. stricta* were recorded throughout dry sclerophyll forest sites during 2020 as shown in **Table 13**. PFC of priority weeds across dry sclerophyll sites during 2020 ranged from 0.1% to 0.3%.

Exotic species cover was slightly higher at MZ2 sites, with an average of 1.35% (median 1.35%) recorded compared to MZ1 sites with an average of 0.3% recorded (median 0.2%).

The completion criteria related to weeds is currently being met as data collected during 2020 indicates that priority weed cover does not exceed 10% of plant cover throughout MZ1 or MZ2 dry sclerophyll forest sites.

Table 13: Priority weeds recorded at dry sclerophyll forest sites during 2020

MZ	Sites	Priority weed species	PFC (%)
MZ1	ACQ1, UCMPL_CA_Site28	*O. stricta*	0.2 to 0.3
	BOBC3, UCMPL_CA_Site13, UCMPL_CA_Site53	*X. spinosum*	0.1 to 0.2
	UCMPL_CA_Site52	*H. perforatum, O. stricta*	0.3
	MZ1 site average		**0.04**
MZ2	BOB22	*X. spinosum*	0.2
	MZ2 site average		**0.1**

3.1.3 Canopy species stem density

Canopy species stem density has been assessed throughout Domain F MZ2 and MZ3 grassy woodland and dry sclerophyll forest sites to assess against the following completion criteria relating to the Domain Objectives to facilitate the natural regeneration of MZ2 areas and to re-establish native woodlands / open forest within MZ3 areas (**Section 1.3,** UCMPL 2020):

Stem density >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community

Grassy woodland sites

Canopy species stem density/ha for grassy woodland sites is shown in **Table 14**. Data indicates that average stem density across MZ2 sites monitored during 2019 was 142 stems/ha. Average stem density recorded during 2019 may be biased towards sites located in areas of good tree cover (i.e. BOB18, BOBC10 and BOBE13) and not representative of MZ2 in its entirety.

Stem density across MZ3 grassy woodland sites monitored during 2020 was 305 stems/ha due to planting.

Stem density across MZ2 and MZ3 is generally consistent with grassy woodland stem density (i.e >40 stems/ha).

Table 14: Canopy species stem density per hectare for grassy woodland sites

MZ	Site	2016	2017	2018	2019	2020
MZ1	BOB4B					500
	BOBC1	350	550		275	475
	BOBE2		375			
	Average	**350**	**463**		**275**	**488**
MZ2	BOB18	250	300	325	225	
	BOB9	25				
	BOBC10	100	125	75	125	
	BOBE13	50	50	50	75	
	Average	**94**	**125**	**127**	**142**	
MZ3	BOB10B					200
	BOB12	25				25
	BOB19				150	
	BOBC11			600		
	BOBC8B					50
	BOBE6					750
	BOBE8	50				
	BOBE9					500
	Average	**38**		**600**	**150**	**305**

Dry sclerophyll forest sites

Canopy species stem density for dry sclerophyll forest sites is shown in **Table 15**. The data is highly variable between sites and the average stem density recorded each year is strongly influenced by which sites are monitored. However, the data indicates that stem density at MZ2 dry sclerophyll forest sites has exceeded 60 stems/ha at all sites except for BOB20 which consistently records zero (0) stems/ha and RPA10 (which has not been monitored since 2016).

Only one MZ3 dry sclerophyll forest site has been monitored between 2015 and 2020. Stem density at this site was 22 stems/ha in 2019, less than the desired 60 stems/ha.

Table 15: Stem density per hectare for dry sclerophyll forest sites

MZ	Site	2016	2017	2018	2019	2020
MZ1	ACQ1		1875		950	1325
	ACQ2		775		1325	1000
	BB1				500	300
	BOBC3	1400	2950			2675

MZ	Site	2016	2017	2018	2019	2020
	BOBE3		575			275
	SG1					125
	Average	**1400**	**1544**		**925**	**950**
MZ2	BOB13B	1100	1850	1100	450	
	BOB20	0	0	0	0	0
	BOB22	75	75	100	75	75
	BOBC4	2500				5000
	BOBE5	125			12525	
	RPA10	0				
	Average	**633**	**642**	**400**	**3263**	**1692**
MZ3	BOB23				22	
	Average				**22**	

3.2 Natural regeneration

Natural regeneration of Domain F has been assessed against the following completion criteria relating to the Domain Objectives to facilitate the natural regeneration of MZ2 areas and to re-establish native woodlands / open forest within MZ3 areas (**Section 1.3,** UCMPL 2020):

> *Monitor natural regeneration occurring within BOAs and update mapping with changes identified*, and, *Stem density >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community*

Natural regeneration of Domain G has been assessed against the following completion criteria relating to the Domain Objective native regeneration is occurring and resulting in the improvement of flora and fauna habitat (**Section 1.3,** UCMPL 2020):

> *Natural regeneration is progressing throughout the RPA and SOA.*

3.2.1 Domain F

Baseline mapping of areas of natural regeneration was undertaken during July 2020. This identified numerous areas of natural regeneration throughout Domain F MZ2, as shown in **Figure 10** and **Figure 11**.

Results indicate that natural regeneration has occurred throughout Domain F. Consistent with observations made in previous years, natural regeneration is most frequently observed adjacent to areas of remnant woodland / forest. Baseline spatial data collected during 2020 will be compared with data to be collected during 2025 to determine the rate of natural regeneration and allow assessment of progression of natural regeneration.

Natural regeneration transect monitoring results for Domain F MZ2 are shown in **Table 16**. Transects located within Domain F MZ2 recorded between one (1) and 124 seedling or sapling individuals.

Domain F MZ2 transects BOBET1, BOBET2, BOBET3 and BOBET4 which are located within *PCT618 - White Box x Grey Box – red gum – Rough-barked Apple grassy woodland on rich soils on hills in the Upper Hunter Valley* generally recorded low numbers of seedlings or saplings (2 to 11 individuals). The groundcover of areas of PCT 618 are typically dominated by perennial and annual native grass species including *Austrostipa scabra* (Rough Speargrass), *Rytidosperma* spp. (Wallaby grasses), *Themeda triandra* (Kangaroo Grass) and *Bothriochloa macra* (Red Grass) which may inhibit germination and suckering and success of regenerating canopy species.

Numbers of naturally regenerating canopy species throughout Domain F MZ2 have fluctuated over the years. The germination of canopy species seedlings appears to be episodic and likely related to climatic conditions suitable for germination. The natural attrition of a proportion of seedlings and saplings (i.e. <5 cm diameter at breast height (DBH)) across transects occurs over time. The number of stems reaching the 5 – 15 cm DBH range is far less than those in the <5 cm DBH range across all transects, which is typical of established woodland / forest communities.

Maps of the extent of natural regeneration for each transect compared to the previous monitoring are provided in **Appendix A**.

Table 16: Domain F natural regeneration transect results 2018 and 2020

Transect	2018		2020	
	<5 cm	5-15 cm	<5 cm	5-15 cm
BOBET1	5	0	2	0
BOBET2	46	0	11	1
BOBET3	11	0	10	0
BOBET4	4	0	2	0
BOBT1	1	2	28	5
BOBT2	55	8	8	11
BOBT3	43	1	134	26
BOBCT1	124	62	74	24
BOBCT2	11	5	66	2
BOBCT3	82	1	31	1

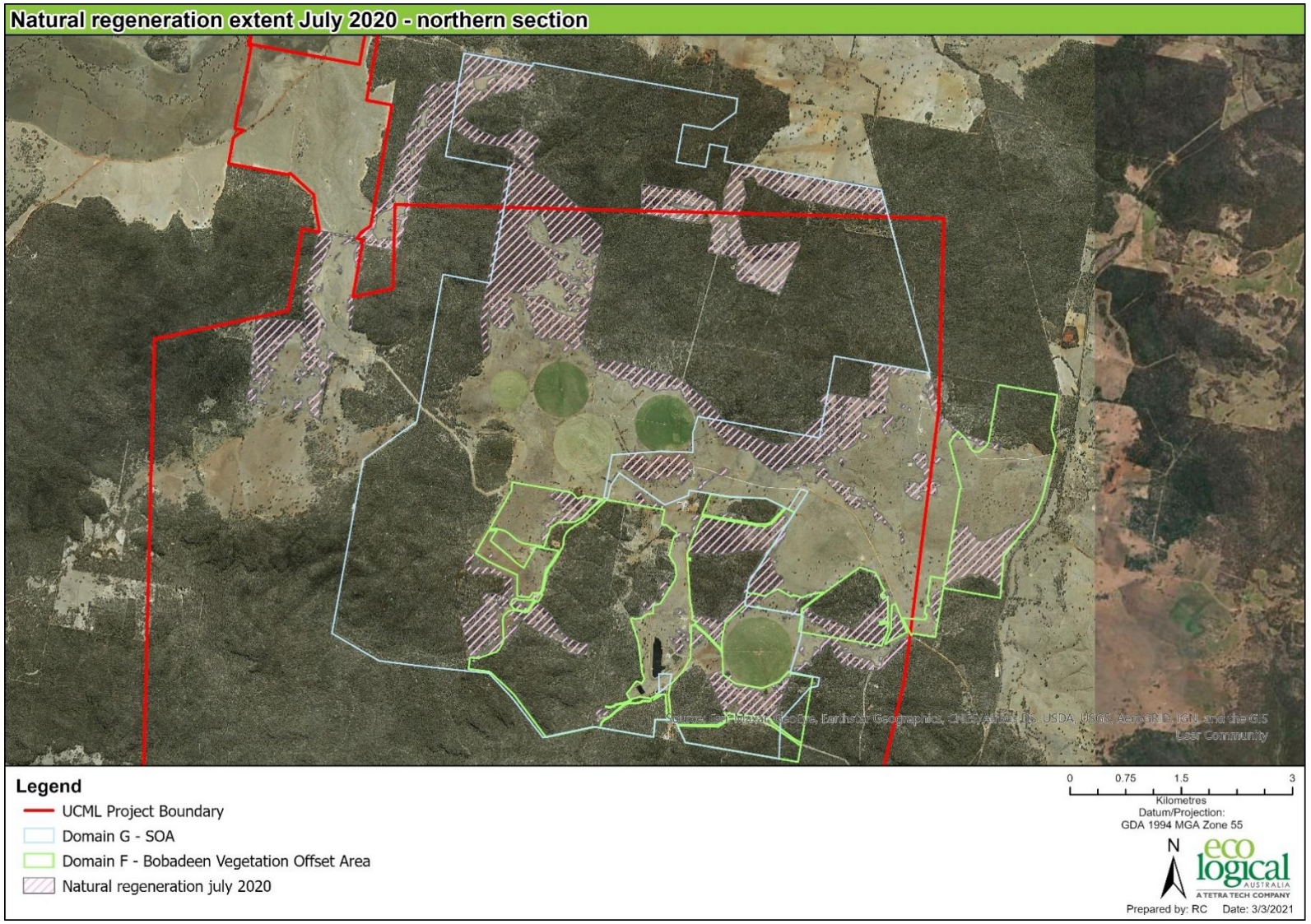

Figure 10: Natural regeneration extent July 2020 – northern section

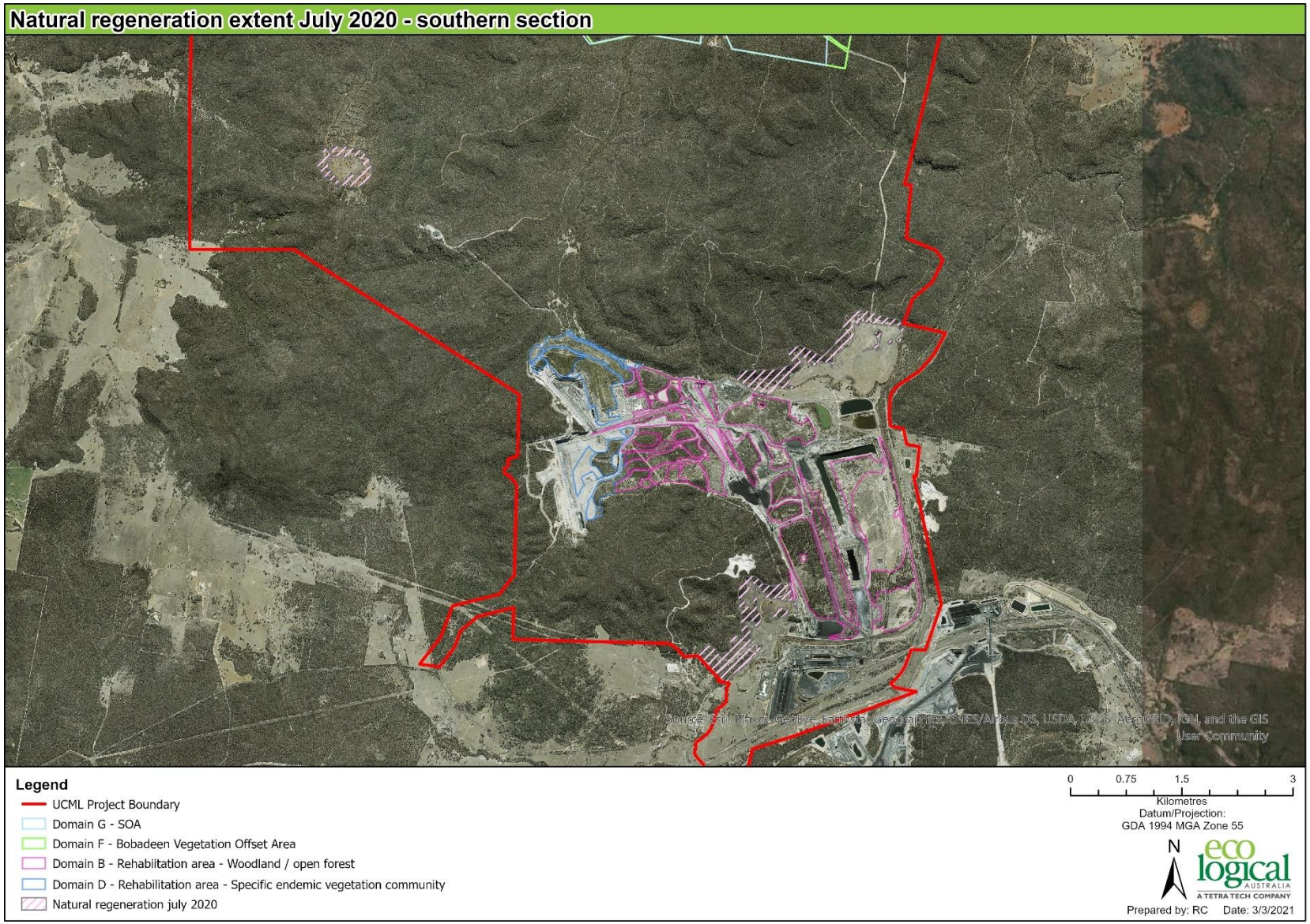

Figure 11: Natural regeneration extent July 2020 – southern section

3.2.2 Domain G

Baseline mapping of areas of natural regeneration was undertaken during July 2020. This identified numerous areas of natural regeneration throughout Domain F MZ2, as shown in **Figure 10** and **Figure 11** above.

There are no natural regeneration transects present with Domain G RPA. All transects located within SOA MZ4a recorded between ten (10) and 99 seedling or sapling individuals (i.e. <5 cm DBH). Consistent with Domain F, numbers of naturally regenerating canopy species throughout SOA MZ4a have fluctuated over the years.

Maps of the extent of natural regeneration for each transect compared to the previous monitoring are provided in **Appendix A**.

Table 17: Domain G - SOA natural regeneration transect results 2016 to 2020

Transect	2016		2017		2018		2019		2020	
	<5 cm	5-15 cm	<5 cm	5-15 cm	<5 cm	5-15 cm	<5 cm	5-15 cm	<5 cm	5-15 cm
SOA1	92	4			162	2			99	8
SOA2	60	0			40	16			15	5
SOA3	60	0			64	2			28	1
SOA4			104	4			108	15	22	4
SOA5			102	0			70	0	47	0
SOA6			16	4			63	0	10	1

3.3 Open cut rehabilitation– Domain B and Domain D

3.3.1 Domain B – Rehabilitation area – Woodland / open forest

3.3.1.1 Ecosystem composition

At all Polygons monitored in spring 2020 the proportion of native species endemic to the Kerrabee IBRA subregion was greater than the 75% Completion Criteria target for the secondary Domain (**Table 18**). Species recorded throughout the rehabilitation that were not endemic to the Kerrabee IBRA subregion included *Eucalyptus cladocalyx* (Sugar Gum) in Polygon 13, *Acacia brachystachya* (Umbrella Mulga) recorded in Polygon 2 and Polygon 12, and *Acacia baileyana* (Cootamundra Wattle) recorded in Polygon 13 and Polygon 16.

At a site level, all sites contain flora species assemblages of each Growth Form endemic to the surrounding Kerrabee IBRA subregion.

Table 18: Average native species richness

Rehabilitation polygon	Average native species richness 2020	Proportion of native species endemic Kerrabee IBRA subregion
Polygon 2	27	94%
Polygon 7	23	100%
Polygon 8	35	100%
Polygon 12	27	99%
Polygon 13	21	93%
Polygon 15	22	100%
Polygon 16	19	100%
MZ1 Dry sclerophyll forest sites average	**31**	**100%**
Completion criteria target	**-**	**75%**

3.3.1.2 Tree stem density

With a minimum stem density/ha of 70 stems/ha at Polygon 16, all polygons recorded greater than the 60 stems /ha Completion Criteria target for the secondary Domain (**Table 19**).

Table 19: Vegetation density

Rehabilitation polygon	Average tree stem density / ha
Polygon 2	230
Polygon 7	1314
Polygon 8	747
Polygon 12	582
Polygon 13	850
Polygon 15	332
Polygon 16	70
MZ1 Dry sclerophyll forest sites average	**950**
Completion criteria target	**60**

3.3.1.3 Habitat features

This indicates that large woody debris (LWD) is developing within Domain B and is likely to continue to do so into the future as branch falls increase as trees mature and tall *Acacia* spp. senescence (particularly *A. doratoxylon* and *A. linearifolia*). Average LWD at each polygon ranged from 1.5m to 33.8m; however, the median value was 5m indicating that most polygons have only small amounts of LWD (**Table 20**). LWD remains lower than average LWD recorded throughout MZ1.

Table 20: Average LWD for each rehabilitation polygon

Polygon	Average length of LWD (m)
Polygon 2	3.5
Polygon 7	1.5
Polygon 8	5.5
Polygon 12	4.3
Polygon 13	5.0
Polygon 15	10.0
Polygon 16	33.8
Average	**9.0**
Median	**5.0**
MZ1 average	**44.5**

No hollow bearing trees (HBTs) were recorded across the rehabilitation during 2020. Hollows can often take more than 100 years to form (Koch *et al* 2008). Nest boxes have been installed within Domain B to provide additional habitat for hollow utilising species.

Litter and rock cover provide habitat for numerous groups of invertebrates, reptiles, amphibians, and mammals. Average percentage litter cover per polygon was generally good and ranged from 18% at Polygon 16 to 63% at Polygon 13. Average percentage rock cover (>2 cm in diameter) per polygon ranged from 1.5% at Polygon 8 to 4% at Polygon 2.

Structural elements including groundcover, shrub cover and canopy cover are also important for habitat. At the polygon scale, structural diversity was recorded throughout all Domain B polygons, with varying amounts of canopy, midstorey and groundcover recorded throughout each polygon. This diversity in structural representation provides habitat for a range of fauna guilds.

As the rehabilitation matures, it is expected that habitat features will increase. Fauna monitoring results are provided in the *UCMPL Fauna Monitoring Report 2020* (ELA 2021a).

3.3.1.4 Reproduction

Seedlings and / or saplings of canopy species were recorded throughout all Domain B rehabilitation polygons monitored during 2020. The average proportion of regenerating canopy species for each polygon ranged from 10% at Polygon 7 to 86% at Polygon 15, as shown in **Table 21** below.

Shrub species including *Acacia* species were observed to be flowering, fruiting or in bud throughout each polygon monitored during 2020.

Table 21: Average proportion of natural regeneration of canopy species

Rehabilitation polygon	Average proportion of natural regeneration of canopy species
Polygon 2	23%
Polygon 7	10%

Rehabilitation polygon	Average proportion of natural regeneration of canopy species
Polygon 8	52%
Polygon 12	48%
Polygon 13	61%
Polygon 15	86%
Polygon 16	67%

3.3.2 Domain D - Rehabilitation area - Specific endemic vegetation community

One polygon (Polygon 5) was monitored within Domain D during 2020.

3.3.2.1 Native species richness

Native species richness for Polygon 5 ranged from 12 species at 5d to 21 species at 5c. Native species richness at Polygon 5 is lower compared to average native species richness for MZ1 dry sclerophyll forest sites (benchmark sites) monitored during 2020. All the native species recorded within Polygon 5 during 2020 were endemic to the Kerrabee IBRA Subregion.

3.3.2.2 Tree stem density

Tree stem density for Polygon 5 ranged from 100 stems / ha at 5c to 250 stems / ha at 5d. *Acacia linearifolia* was the dominant canopy species recorded throughout Polygon 5. No *Eucalyptus* species were recorded within 5c or 5d during 2020.

Stem density recorded throughout Polygon 5 is considerably lower compared to that recorded throughout MZ1 dry sclerophyll forest sites (benchmark sites) in 2020 which recorded an average of 950 stems/ha. MZ1 dry sclerophyll forest sites throughout the UCMPL Complex are typically dominated by *Eucalyptus* species.

3.3.2.3 Habitat features

No LWD was recorded within 5c or 5d during 2020. HBTs are also absent due to the lack of mature trees.

Surface rock was present at 5c and 5d, with between 28% and 32% rock cover (>2 cm diameter) recorded during 2020.

Structural layers are undeveloped within Polygon 5 with no canopy cover was recorded during 2020. Midstorey was also sparse to absent in some areas.

As the rehabilitation matures, it is expected that habitat features will increase. Fauna monitoring results are provided in the *UCMPL Fauna Monitoring Report 2020* (ELA 2021a).

3.3.2.4 Reproduction

No canopy species were recorded within 5c or 5d during 2020 and therefore canopy regeneration was also absent. No flowering or fruiting of shrub species was recorded at either site during 2020. As such, Polygon 5 is not currently meeting the completion criteria relating to reproduction (**Section 1.3**).

3.4 Floristic based subsidence

Sites UG LWW7 L1 to L10 were established and underwent baseline monitoring during spring 2020.

For sites with three or more years of data, trends between longwall and transition sites have been compared. Average projected foliage cover (PFC) results for the duration of monitoring for UW LW4, UW LW5, UG LWW4, UG LWW5, UW LW6 and UG LWW6 is shown in **Table 22** below.

Floristic based subsidence monitoring data indicates that percentage change in average canopy PFC since monitoring began is relatively consistent between longwall and transition sites for all longwalls. All longwalls recorded a decrease in PFC across longwall sites and / or transition sites since monitoring began (**Table 22**).

Greater decreases in average canopy PFC at longwall sites compared to transition sites were recorded across all longwalls except UW LW6 and UW LW4.

Table 22: Absolute change in average PFC for longwall and transition sites between baseline monitoring and spring 2020 monitoring

Longwall	Longwall sites – absolute change in average PFC (%)	Transition sites – absolute change in average PFC (%)
UG LWW4	-1	0
UG LWW5	-9	-7
UG LWW6	-8	-5
UW LW4	-6	-6
UW LW5	-8	-3
UW LW6	0	-5

Canopy dieback resulting from drought conditions experienced throughout 2017 to early 2020 has been observed in intact native plant communities through the region. This is reflected throughout floristic monitoring results as well as FBS results obtained during monitoring across the UCMPL Project Area in 2020.

Several subsidence cracks were recorded over UW LW5 and UG LWW5 and LWW6, as shown in **Appendix H**. Trees adjacent to or near recorded cracking or slumping appeared to be in good health at time of monitoring. The effects of root tearing caused by subsidence related cracking and / or slumping cannot be determined with current methodology. Field observations of trees appear to be healthy or not adversely affected near subsidence related cracking or slumping.

No longwalls recorded a greater than 10% decrease in average canopy PFC (**Table 22**). Fluctuations in PFC were recorded at each longwall for the duration of monitoring, with longwall and transition sites following similar trajectories as shown in **Figure 12** and **Figure 13**.

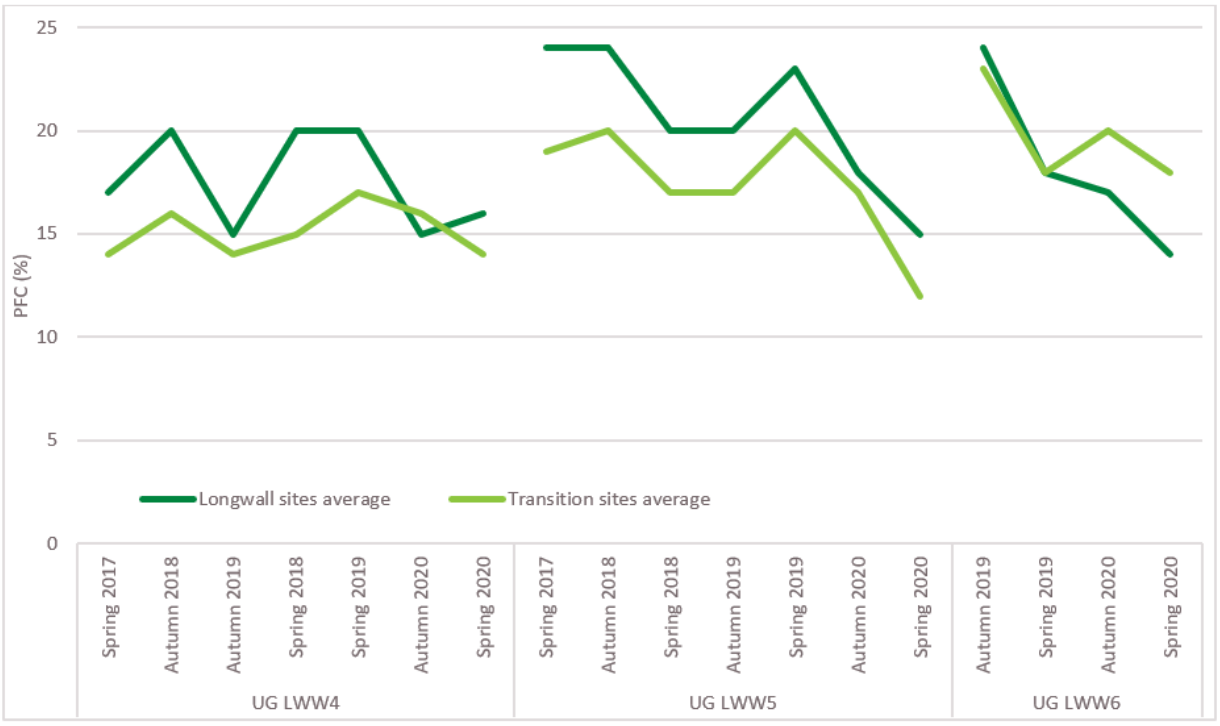

Figure 12: UG Longwalls – average PFC at longwall sites compared to transition sites

Figure 13: UW Longwalls – average PFC at longwall sites compared to transition sites

4. Summary of assessment against completion / success criteria

A summary of assessment against the completion / success criteria and application of the TARP triggers (**Table 4, Section 1.3)** is provided in **Table 23**. Application of the TARP to FBS monitoring results is provided in **Table 24**.

Table 23: Summary of assessment against completion criteria and TARP triggers

Domain	Phase	Domain objective	Completion criteria	Completion criteria status	TARP outcome
All domains	Ecosystem and Land Use Establishment Phase	Weed species do not present a risk to rehabilitation	Ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017- 2022) do not exceed 10% of plant cover	**Achieved** Priority weeds do not exceed 10% of plant cover throughout the UCMPL Complex. During monitoring in 2020, several infestations of *Hypericum perforatum* were recorded throughout the UCMPL Complex, specifically within the Bobadeen VOA (**Appendix H**).	No response required. Continue monitoring program.
Domain B	Ecosystem and Land Use Establishment Phase	Rehabilitation area floristics and structure is representative of a native woodland / open forest Native fauna habitat present within rehabilitation area	Indicative final minimum total native canopy tree densities for seeded areas to be 60 stems/ha. It is recognised that small open grassy areas add to the biodiversity of this woodland / open forest area.	**Achieved** All areas monitored during 2020 recorded a stem density greater than 60 stems / ha. Rehabilitation areas are achieving the vegetation density criteria for Phase 4 of rehabilitation.	No response required. Continue monitoring program.
			Revegetation areas contain>75% of native flora species which are locally indigenous to the Kerrabee IBRA subregion	**Achieved** Rehabilitation area achieving the Ecosystem Composition Criteria for Phase 4 of rehabilitation (>75% of native flora species indigenous to the Kerrabee IBRA subregion).	No response required. Continue monitoring program.
			Monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species	**Achieved** A range of structural habitats, including groundcover, shrub and canopy cover, rock, litter and LWD are present throughout Domain B.	No TARP trigger
	Ecosystem and Land Use Sustainability Phase		Revegetation areas contain flora species assemblages of each Growth Form indigenous to the surrounding Kerrabee IBRA subregion	**Achieved** Rehabilitation areas contain flora species assemblages of each growth form indigenous to the surrounding Kerrabee IBRA subregion.	No response required. Continue monitoring program.

Domain	Phase	Domain objective	Completion criteria	Completion criteria status	TARP outcome
			Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.)	**Achieved** A range of structural habitats, including groundcover, shrub and canopy cover, rock, litter and LWD are present throughout Domain B.	No TARP trigger
			Rehabilitation monitoring verifies flowering, seeding or second generation juveniles for trees and shrubs are present or likely to be.	**Achieved** Regeneration in the form of canopy species seedlings or saplings were recorded within all rehabilitation polygons during 2020. Flowering and / fruiting of shrubs was recorded at all rehabilitation polygons during 2020.	No TARP trigger
Domain D	Ecosystem and Land Use Establishment Phase	Rehabilitation area floristics and structure is comparable to analogue native vegetation community Native fauna habitat present within rehabilitation area	Indicative final minimum total native canopy tree densities for seeded areas to be >60 stems/ha. It is recognised that small open grassy areas add to the biodiversity of this woodland / open forest area.	**Not yet achieved** No canopy species were recorded within Polygon 5 of Domain D during 2020.	Review procedure where required to increase vegetation cover.
			Revegetation areas contain >75% of native flora species (trees/shrubs) consistent with the target vegetation community	**Achieved** 100% of the native flora species recorded within Polygon 5 of Domain D are consistent with the target vegetation community.	No response required. Continue monitoring program.
			Monitoring confirms rehabilitated areas provide a range of vegetation structural habitats (e.g. eucalypts, shrubs, ground cover, developing litter layer, etc.) to encourage use by native fauna species	**Not yet achieved** Vegetation structure remains undeveloped within no canopy cover or midstorey recorded during 2020.	No TARP trigger
	Ecosystem and Land Use		Revegetation areas contain flora species assemblages characteristic of the target vegetation community	**Not yet achieved** No canopy species were recorded within Polygon 5 of Domain D during 2020.	No TARP trigger

Domain	Phase	Domain objective	Completion criteria	Completion criteria status	TARP outcome
	Sustainability Phase		Native rehabilitation areas provide a range of structural features (e.g. trees, shrubs, ground cover, developing litter layer etc.)	**Not yet achieved** Vegetation structure remains undeveloped within no canopy cover or midstorey recorded during 2020.	No TARP trigger
Domain F	Growth Medium Development Phase	Facilitate the natural regeneration of Management Zone 2 areas	Monitor natural regeneration occurring within the Bobadeen VOA and update mapping with changes identified	**Achieved** Natural regeneration monitoring was undertaken across ten (10) transects located throughout the Bobadeen VOA. A drive over to map natural regeneration was also undertaken during 2020.	No TARP trigger.
	Ecosystem and Land Use Establishment Phase	Re-establish native woodlands / open forest within Management Zone 3 areas	Monitoring to indicate native species diversity approaching or consistent with MZ1 or other appropriate analogue sites. Stem density >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community	**Achieved** Average stem density across MZ3 grassy woodland sites monitored during 2020 was 305 stems/ha. Only one site monitored during 2020 recorded less than 40 stems/ha (BOB12 25 stems/ha). Only one (1) MZ3 dry sclerophyll forest site has been monitored between 2015 and 2020. This site recorded 22 stems/ha.	No TARP trigger.
		Weeds and feral animal species do not present a risk to regeneration / revegetation	Ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017-2022) do not exceed 10% of plant cover	**Achieved** Priority weeds do not exceed 10% of plant cover throughout the UCMPL Complex. Assessment against feral animals is provided in the *UCMPL Fauna Monitoring Report 2020* (ELA 2021).	No response required. Continue monitoring program.
	Ecosystem and Land Use Sustainability Phase	Facilitate the natural regeneration of MZ2 areas	Monitoring to indicate native species diversity approaching or consistent with MZ1 or other appropriate analogue sites. Stem density established at >40 stems/ha for woodland, >60 stems/ha for Open Forest vegetation community	**Achieved** Native species diversity at grassy woodland and dry sclerophyll forest MZ2 sites is approaching grassy woodland and dry sclerophyll forest MZ1 sites. MZ2 grassy woodland sites recorded an average stem density of greater than 40 stems/ha during	No TARP trigger.

Domain	Phase	Domain objective	Completion criteria	Completion criteria status	TARP outcome
				2020. Only one site monitored during 2020 recorded less than 40 stems/ha (BOB9 25 stems/ha). MZ2 dry sclerophyll forest sites recorded an average stem density of greater than 60 stems/ha during 2020.	
Domain G	-	Control weeds	Control listed weeds – ensure priority weeds (as per LLS Central Tablelands Strategic Weed Management Plan 2017 – 2022) do not exceed 10% of plant cover.	**Achieved** Priority weeds do not exceed 10% of plant cover throughout the UCMPL Complex. Two (2) priority weeds, *Opuntia stricta* and *Heliotropium amplexicaule* were recorded throughout Domain G (**Appendix H**); however, cover did not exceed 10% of plant cover.	No response required. Continue monitoring program.
		Natural regeneration occurring resulting in the improvement of flora and fauna habitat	Natural regeneration is progressing throughout RPA and SOA.	**Achieved** Six (6) natural regeneration transects were monitored within the SOA during 2020. Monitoring data indicates that natural regeneration is increasing (progressing) throughout the SOA. A baseline drive-over was also undertaken to map the extent of natural regeneration throughout the SOA and RPA.	No TARP trigger.
		Native groundcover is stable and of high diversity	Stable to increasing groundcover (including plant cover, litter and cryptogam) with a stable to increasing native flora diversity, comparable with remnant condition sites (e.g. MZ1, MZ4b) or other appropriate analogue sites	**Achieved** One site (RPA17) within the RPA was monitored during 2020. RAP17 recorded plant cover, litter and cryptogam cover consistent with MZ1 sites. Field observations throughout Domain G recorded plant cover, litter and cryptogram in areas in remnant condition (i.e. SOA MZ4b)	No TARP trigger.

Domain	Phase	Domain objective	Completion criteria	Completion criteria status	TARP outcome
				similar to that recorded in remnant condition MZ1 areas. No areas of active erosion or significant priority weed infestations were recorded throughout Domain G. A more detailed assessment against this completion criteria would require the establishment of floristic monitoring sites within the SOA within Domain G.	

Table 24: Assessment against subsidence performance indicators and TARP

Aspect / category	Performance indicator	Performance indicator status	TARP outcome
Subsidence impacts to threatened species, populations, habitat, or ecological communities	An indicator will be considered to have been triggered if: • Analysis of FBS data indicates a >10% (percentage points) decrease in canopy foliage cover of a site within the subsidence zone inconsistent with canopy foliage cover in the transition zone; and • Analysis of FBS data indicates >10% (percentage points) decrease in canopy foliage cover in the selected vegetation community located above mining areas, not seen in non-mined areas of the vegetation community.	Monitoring data for the duration of monitoring for each longwall indicates that there has not been a >10% decrease in canopy foliage cover. Canopy dieback because of drought conditions experienced throughout 2017 to early 2020 has been observed in intact native plant communities through the region. Subsidence impacts on vegetation communities, threatened flora species and threatened flora habitat are negligible.	No response required. Continue monitoring program

5. Assessment against RRC

5.1 Domain B

Assessment against the RRC has been undertaken for each Domain B rehabilitation polygon. Overall scores[4] for each polygon are summarised in **Table 25**Error! Reference source not found. below. Polygon 8 and Polygon 13 achieved results 'acceptable' relative to their respective age group. Polygon 2, Polygon 7 and Polygon 15 scored a RRC results of 'monitor' and Polygon 16 scored a RRC result of 'maintenance'. Individual site scores for each polygon are provided in **Appendix A**.

Table 25: RRC results summary

Polygon	Overall score	RRC result
Polygon 2	3.7	Monitor
Polygon 7	3.0	Monitor
Polygon 8	5.0	Acceptable
Polygon 12	4.7	Monitor
Polygon 13	5.0	Acceptable
Polygon 15	4.35	Monitor
Polygon 16	1.70	Maintenance

5.2 Domain D

Overall, Polygon 5 scored a RRC result of 'monitor'. Despite the lack of *Eucalyptus* species, Polygon 5 still recorded the highest possible score. Individual site scores for Polygon 5 are provided in **Appendix A**.

[4] Overall scores have been calculated based off the median score of all sites in accordance with the *Development of the Annual Rehabilitation Report Card (NSW) Procedu*re (Draft version, GCAA 2021a) and the *Scientific Background Report NSW Rehabilitation Report Card* (Draft version, GCAA 2021b).

6. Recommendations

6.1 General Floristic – Domain F MZ2 Grassy Woodland Sites

Native species richness in MZ3 areas throughout Domain F are generally lower than MZ1 and MZ2. Floristic data indicates that the number of EPBC Act Policy Statement Important Species is also lower in MZ3 sites compared to MZ1 sites. ELA recommends that a trial is developed to determine best practices for returning missing important species into Grassy Woodland Sites within MZ3. Potential trials include:

- Transferring soil from MZ1 grassy woodland areas into MZ3 grassy woodland areas with the aim of bringing a seed bank of important species with limited dispersal mechanisms into MZ3 grassy woodland areas.
- Scarification in areas dominated by dense native perennial grass swards to artificially create habitat for other native species for which a dense grass swards may impede or inhibit germination and persistence.
- Installation of large woody debris across MZ2 and MZ3 which may provide habitat for native species. Large woody debris acts as protection from grazing and soil moisture loss and may result in higher native species richness counts, including many important species listed in the EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands.

6.2 Natural regeneration – Domain F and Domain G

Soil seed bank germination trials are recommended to be undertaken throughout MZ2 areas across the UCMPL Project Area in order to confirm the presence and viability of a canopy species seed bank to determine which areas have a potential to regenerate naturally and which areas may require further intervention in the form of seeding or tubestock plantings, and the subsequent rezoning to MZ3. Seed bank trials could involve subjecting soil samples to a range of germination conditions and identifying germinates. Germination data collected as a part of this trial will augment baseline natural regeneration mapping undertaken during 2020.

ELA also recommends that UCMPL review the value of natural regeneration transects. Transects are established in areas where natural regeneration is occurring; however, do not cover areas where natural regeneration is initialising across the entire UCMPL Project Area. A landform scale assessment of natural regeneration by using remote sensing techniques, including the use of drones may provide a more detailed picture of the occurrence and initialisation of natural regeneration across UCMPL.

6.3 All Domains –management recommendations

Hypericum perforatum (St John's Wort) remains the highest threat weed across the UCMPL Project Area. ELA recommends that survey for the St John's Wort biocontrol Chrysolina beetle be undertaken within areas of St John's Wort infestation. Survey for the Chrysolina beetle should be undertaken during spring when adult beetles are present.

ELA also recommends that mapping of the St John's Wort distribution be undertaken. Baseline mapping of St John's Wort will enable an assessment of the effectiveness management practices into the future.

Locations of infestations of St John's Wort, which were recorded opportunistically, are presented in **Appendix H**.

6.4 Open cut rehabilitation - Domain D and Domain B

6.4.1 Domain D – Polygon 5

6.4.1.1 Habitat features

It is recommended that installation of habitat features be undertaken throughout Polygon 5. Given the young age of this rehabilitation, installation of habitat features can be undertaken with minimal impact to the rehabilitation area from associated machinery and works. Habitat features suitable for installation within this rehabilitation area include:

- Rock piles with overhangs, cracks, and crevices to support roosting microbats and provide habitat for several reptile and mammal species.
- Scattered and piled LWD.
- Stags erected upright to provide perching habitat.

6.4.1.2 Native species richness

No Eucalypts were recorded within Polygon 5 during 2020. ELA recommends that this rehabilitation area be reseeded or replanted.

6.4.2 RRC recommendations

Native species richness (Total) is currently assessed by determining if the species present are or are not characteristic of each growth form for the target native vegetation as described in approval documents (**Appendix E**).

- ELA recommends this attribute be modified to better assess the presence and density of key canopy species, such as *Eucalyptus* species. This is particularly applicable to areas of IEM rehabilitation. The current RRC does not consider germination or planting success for areas of IEM rehabilitation. Assessment against this criterion for Polygon 5 during 2020 showed that areas can score a perfect score (i.e. 5; Monitor) even when they lack canopy species necessary to form a specific vegetation community.

7. References

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Appendix A Conservation Agreement reports

Provided electronically.

Appendix B Offset walkover annual report

Provided electronically.

Appendix C UCMPL Goulburn River Diversion Remediation Status Assessment 2020 (ELA 2020)

Provided electronically.

Appendix D Methodology

D1 Floristic monitoring

The 2020 floristic monitoring program was undertaken by ELA ecologists David Allworth, Tom Kelly and Rebecca Croake between 12 and 20 March 2020. The full list of sites which underwent monitoring during 2020 are presented in **Table 26** below. Floristic monitoring was undertaken in accordance with methodologies outlined in the BMP (UCMPL 2020).

Floristic monitoring involved monitoring of floristic quadrats (20 m x 20 m) and collection of cover (from 1-5% and then to nearest 5%) and abundance (1-10, 20, 50, 100, 500, 1000 or specified greater number of individuals) for each species. Biometric plot data was also collected using the BioBanking assessment methodology (OEH, 2014) within a 20 m x 50 m plot.

In addition, within the permanent 20 m x 20 m quadrats, the following data were also collected:

- floristic composition and structure
- progress of revegetation/regeneration towards target native vegetation community
- general health of vegetation
- evidence of natural regeneration
- requirements for species-specific planting or thinning
- success of management actions implemented following previous monitoring inspections
- non-vascular ground cover (litter, cryptogam, logs >10 cm diameter, rocks >5 cm diameter, bare soil) (% cover)
- the occurrence and abundance of weeds, evidence of animal disturbance and observable impacts.

Table 26: 2020 floristic monitoring sites

Vegetation class	MZ	Site
Grassy woodland	MZ1	BOB4B
		BOBC1
	MZ3	BOB10B
		BOB12
		BOBC8B
		BOBE6
		BOBE9
Dry sclerophyll forest	MZ1	ACQ1
		ACQ2
		BB1
		BOBC3
		BOBE3
		SG1
	MZ2	BOB22

Vegetation class	MZ	Site
		BOBC4

D2 Floristic based subsidence

FBS monitoring was undertaken along six (6) longwall panels during autumn and seven (7) longwall panels during spring 2020 (**Table 27**, **Figure 14** and **Figure 15**). UG LWW7 L1-L10 were established and underwent baseline (pre-mining) monitoring during spring 2020.

Table 27: FBS monitoring sites

Mine	Longwall	Autumn	Spring
Ulan West	UW LW4 L1-L10	✓	✓
	UW LW5 L1-10	✓	✓
	UW LW6 L1-L10	✓	✓
Ulan Underground No. 3	UG LWW4 L1-L10	✓	✓
	UG LWW5 L1-L10	✓	✓
	UG LWW6 L1-L10	✓	✓
	UG LWW7 L1-L10	-	✓

The following data was collected from each site:

- Projected foliage cover (5% increments) of upper canopy;
- Canopy health and defoliation (all in 5% increments):
  - Percentage of epicormic foliage in relation to total tree foliage
  - Proportion of primary branches within canopy that have died back
  - Percentage of current canopy foliage as a proportion of the estimated canopy foliage volume/potential canopy
  - Percentage of canopy foliage discoloured
- Photograph of the canopy (camera placed on top of the star picket, facing up); photograph facing due north, south, east and west from the north-west star picket.

Any evidence of subsidence opportunistically observed was also recorded with a handheld GPS.

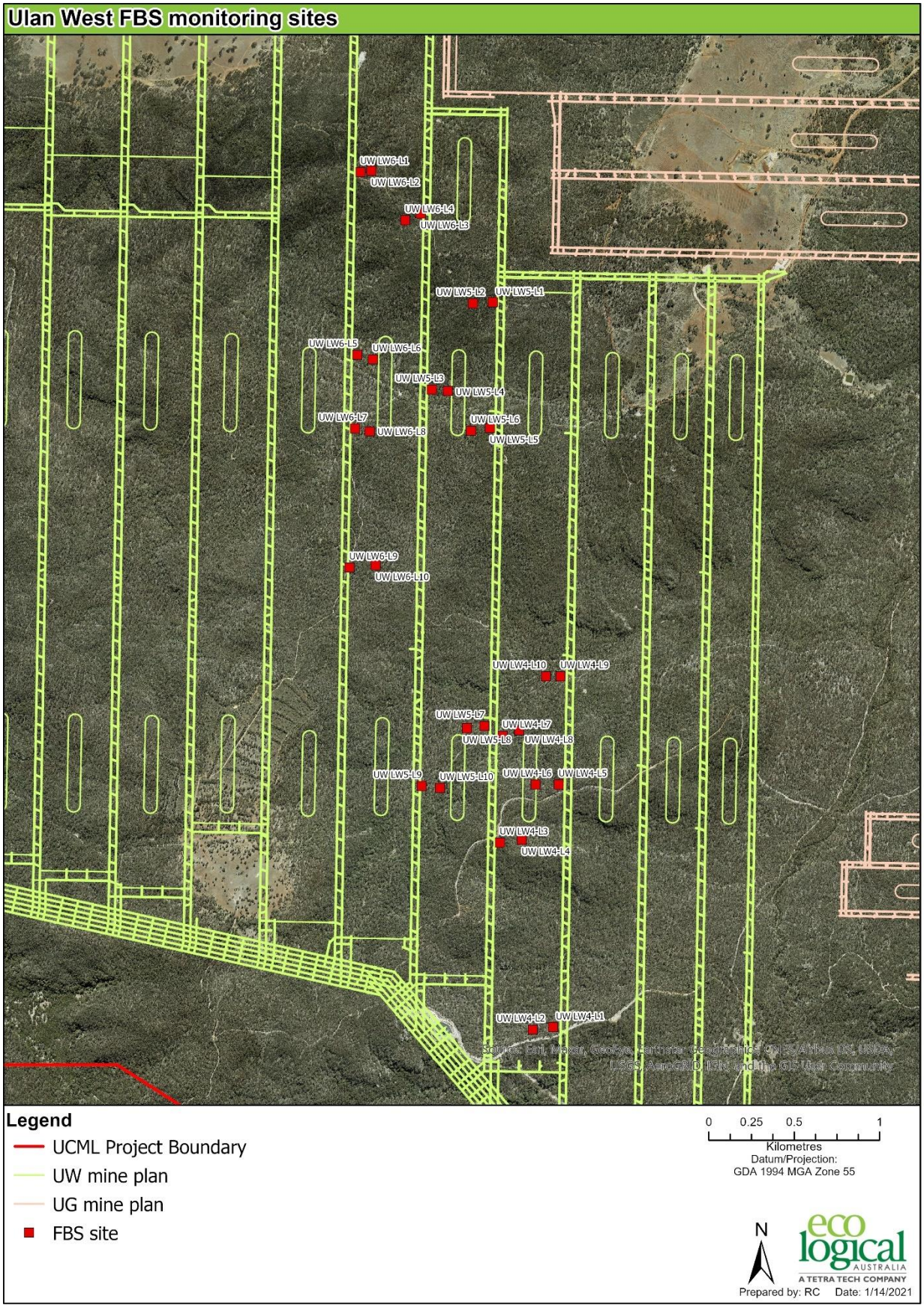

Figure 14: Ulan West FBS monitoring sites