

## Appendix D: EPBC Act significance tests

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### Malleefowl (*Leipoa ocellata*)

The Malleefowl (*Leipoa ocellata*) is listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). This assessment of impact significance has been conducted according to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (Commonwealth Department of Environment, Water, Heritage and the Arts [DEWHA] 2009) for vulnerable species.

The Malleefowl is a large ground-dwelling, pheasant-like bird that occurs across southern Australia in temperate, semi-arid districts where the annual rainfall is 200 to 450 millimetres (mm) (Marchant & Higgins 1993). In New South Wales (NSW) it occurs west of the Great Dividing Range, from the Pilliga scrub south-west towards to the districts of Griffith, Wellington, Balranald, and continuously into north-western Victoria and south-eastern South Australia (Morris *et al.* 1981; Marchant & Higgins 1993; NSW Office of Environment and Heritage [OEH] 2012). The species is mostly sedentary and established pairs tend to stay in the same area year-round. Local movements do occur between seasons in some areas, and larger movements can occur in response to drought and fire (Marchant & Higgins 1993). Chicks and juveniles disperse only a short distance (rarely more than 20 kilometres [km] or so) from their incubation mound (Marchant & Higgins 1993).

The Malleefowl occurs mostly in mallee woodlands, but sometimes ranges into surrounding woodlands or shrublands of other sorts (Marchant & Higgins 1993; OEH 2012). The Malleefowl prefers taller mallee with a dense but discontinuous canopy (to provide abundant leaf-litter for mounds) and floristically rich shrub and herb layers to provide food plants (e.g. *Acacia*, *Cassia*, *Bossiaea* and *Beyeria* spp.). It tends to be less common in short or open mallee woodlands with a spinifex (*Triodia* spp.) understorey, but still occurs in such habitats. Lighter sandy or loamy soils are preferred because they provide drainage, rather than ease of digging (Marchant & Higgins 1993).

The home range size is not well known. Home ranges may be up to 100 hectares (ha), but there is often considerable overlap between home ranges of different pairs. During the breeding season males stay close to the mound and use a much reduced area (Benshemesh 2007). Home range and density of breeding pairs may vary according to a range of factors including climate (i.e. rainfall), vegetation type, season, recent conditions (e.g. drought) and condition of habitat (e.g. whether grazed or not). For the purposes of this assessment, we have assumed a theoretical conservative estimate of density, based on the area of potential primary habitat (1,575 ha) and the home range of the species (100 ha), of about one pair per 100 ha.

The Malleefowl builds a large mound of sand (with loam and pebbles) incorporating a litter of leaves, bark, twigs and small branches, in which they incubate their eggs with the heat of fermenting vegetation. The organic content varies considerably. Organic material is usually collected from June to August and then mixed following spring rains to begin the fermentation process. Eggs are laid any time from mid-September to early February, but usually in the spring through the early summer. The average size recorded for 34 clutches was 15 eggs (ranging from 3 to 33) (Marchant & Higgins 1993).

The species is mainly granivorous but berries, invertebrates, herbage (especially buds) and bulbs contribute to the diet. *Acacia* seeds are particularly important. Small congregations have been reported feeding on crop stubble, such as barley. A source of surface water is not needed, but individuals will drink readily when water is available (Marchant & Higgins 1993).

Habitat loss and degradation have caused extensive declines in Malleefowl abundance and distribution throughout its range (Benshemesh 2007; Garnett *et al.* 2011). Higher rainfall (300-450 mm) mallee with the most diverse understory has been extensively cleared for agriculture or grazed by stock. Competition with grazing stock (sheep [*Ovis aries*] and cattle [*Bos taurus*]) and feral animals (rabbits [*Onychotagus cuniculus*] and goats [*Capra hircus*]) reduces habitat viability because grazed mallee offers much less herbage and seed for Malleefowl to feed on. Large fires also probably kill most Malleefowl in their wake, as the birds are poor fliers.

Fire in mallee has the effect of preventing or reducing breeding for up to 20 or 30 years, although in some instances breeding will resume after 6 years. Predation by foxes (*Vulpes vulpes*) is often high, particularly for eggs, chicks, juveniles and even adults (Marchant & Higgins 1993; NSW National Parks and Wildlife Service [NPWS] 1999; Benshemesh 2007; Garnett *et al.* 2011).

In the north-western edge of the Campaspe footprint, several observations of tracks were made and a nesting mound found. At another location outside the Campaspe footprint but within the Mining Lease Application (MLA) 1 area, tracks were recorded. At one location in the footprint of the Atlas Mine a nesting mound was found. The proposed mine general arrangement would avoid these two nesting mounds<sup>1</sup>. Records of the Malleefowl, including footprints, mounds and sightings were made throughout the proposed offset area. Two records made during the field survey and three contained in the Atlas of NSW Wildlife Databases came from further afield in the general vicinity of the Atlas-Campaspe study area. The Malleefowl has been recorded twice in recent surveys by Ecotone Ecological Consultants for the Balranald Mineral Sands Project. One Malleefowl was observed in the study area for the West Balranald Deposit and two active Malleefowl mounds were recorded in the study area for the Nepean Deposit (Ecotone Ecological Consultants 2012a; 2012b). No mounds, tracks or individuals were observed within the Ivanhoe Rail Facility study area and there are no database records within 20 km of the study area.

Known breeding and foraging habitats of the Malleefowl that occur in the Atlas-Campaspe Mine footprint and proposed offset area are Linear Dune Mallee and Sandplain Mallee. Potential habitats (supplementary habitats that might be used on occasions for foraging or dispersal), include Belah-Rosewood Woodland, Acacia Woodland/Shrubland, Disturbed Shrubland and Cleared Land during seeding and harvesting of crops. Potential secondary or supplementary foraging habitat exists within the Ivanhoe Rail Facility footprint, including Belah-Rosewood Woodland and Native Grassland.

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

***Criterion 1: lead to a long-term decrease in the size of an important population of a species?***

The population in and around the Atlas-Campaspe Mine study area is part of a broader population occurring on leasehold land in the vicinity, containing some 300 pairs (Ewin 2007). Based on the area of potential primary habitat (1,575 ha) and the home range of the species (100 ha), and assuming a density of breeding pairs of one per 100 ha, a conservative theoretical estimate is that up to 15 breeding pairs could potentially be impacted by the Project. Despite this theoretical estimate, detailed surveys over the Project area revealed only the two mounds proposed surface area and are avoided through revision of the mine general arrangement<sup>1</sup>; however, the Project is likely to impact any individuals using those mounds.

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<sup>1</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.



No signs of the species were recorded at the Ivanhoe Rail Facility, and it is unlikely a local population of the species occurs there. No records of the species exist within 20 km of the area Ivanhoe Rail Facility study area.

The Project area is not at the edge of the species' range.

***Criterion 2: reduce the area of occupancy of an important population?***

The Project would reduce the area of occupancy occupied by the Malleefowl. The Project would lead to the loss of approximately 1575 ha of primary Malleefowl habitat due to the Atlas-Campaspe Mine. Approximately 40 ha of potential secondary or supplementary foraging habitat would be impacted at the Ivanhoe Rail Facility. Further, the rehabilitated post-mine landforms would include the establishment of species representative of Linear Dune Mallee and Sandplain Mallee such as *Eucalyptus socialis*, *E. dumosa* and *Callitris* sp. The species is considered to have an area of occupancy that greatly exceeds 20,000 square kilometres (km<sup>2</sup>) (Garnet *et al.* 2011). The Project impacts are not considered to significantly reduce the area of an important population.

***Criterion 3: fragment an existing important population into two or more populations?***

The Project would lead to habitat loss and consequentially some fragmentation of the habitat for the Malleefowl. However, the landscape is a natural mosaic of different woodlands including but not entirely consisting of mallee. In that respect the mallee is naturally fragmented. The Malleefowl is adapted to a mosaic landscape. The loss of mallee habitat as a result of the Project would not cause any part of the population to become isolated from the rest of the population, and so would not fragment the population.

No known populations exist in the vicinity of the Ivanhoe Rail Facility study area. Further, potential secondary or supplementary foraging habitat occurs in the nearby surrounds.

***Criterion 4: adversely affect habitat critical to the survival of a species?***

No critical habitat has been declared for the Malleefowl (SEWPaC 2012). The locality is not identified in the National Recovery Plan (Benshemesh 2007) or on the Species Profile and Threats (SPRAT) database (SEWPaC 2012).

***Criterion 5: disrupt the breeding cycle of an important population?***

Based on the area of potential primary habitat (1,575 ha) and estimating a density of breeding pairs of one per 100 ha, the conservative theoretical estimate is that up to 15 breeding pairs could potentially be impacted by the Project. Despite this theoretical estimate, detailed surveys over the Project area revealed only two mounds within the proposed surface area and are avoided through revision of the mine general arrangement<sup>2</sup>; however, there are potential impacts on any individuals using those mounds, such as loss of home range around the mounds.

However, the breeding cycle of the majority of the population would not be affected; the action is likely to disrupt the breeding cycle of only a proportion of this population. The presence of other birds in the surrounding areas (particularly the proposed offset area) would mean that potential interruption to the life cycle of a few pairs would not lead to the extinction of the local population. Habitat enhancement in the offset area could provide considerable compensation to the impacted pairs and other pairs outside the impact footprint.

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<sup>2</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

No known populations exist in the vicinity of the Ivanhoe Rail Facility study area and it is unlikely that one exists.

***Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

At least 1,575 ha of mallee habitat, which is considered to be primary habitat for Malleefowl in the study area, would be cleared for the Project at the Atlas-Campaspe Mine. A further 2,705 ha of potential foraging (or supplementary habitats) which might be used on occasions by Malleefowl, where they adjoin suitable mallee habitat would also be cleared for the Project in the same area.

It is conservatively estimated that up to 15 home ranges of Malleefowl breeding pairs could potentially be impacted by the Project based on the area of potential habitat (1,575 ha) and estimating a density of breeding pairs of one per 100 ha. Despite this estimate, detailed surveys revealed only two mounds were found in the proposed surface disturbance area and have subsequently been avoided by Cristal revising their proposed mine general arrangement<sup>3</sup>.

The habitat loss would not affect the majority of the population, but it would have impacts on a small proportion of this population. Over eight times this area of mallee habitats occurs in the proposed offset area, which would be managed to enhance its ecological viability and reduce existing threats to Malleefowl occurring there. It is unlikely that the Project would lead to a significant decline in the regional population.

No known populations exist in the vicinity of the Ivanhoe Rail Facility study area and it is unlikely that one exists. Further, only 40 ha of potential secondary or supplementary foraging habitat would be impacted in this area, which is unlikely to cause the species to decline.

***Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?***

The Project would not result in the introduction of any harmful or invasive species being introduced to the Project or proposed offset area. Several invasive species that have been identified as a threat to the Malleefowl already exist in the area. Foxes are known to prey on Malleefowl and exotic grazers (feral goats, European rabbits and livestock) reduce food availability. A feral animal control programme would be implemented in the Project and offset areas, aiming to reduce predation and competition pressures from invasive species.

***Criterion 8: introduce disease that may cause the species to decline?***

The Project would not lead to the introduction of any diseases that are potentially harmful to the Malleefowl. No avian diseases have been identified as a threat to the Malleefowl (cf. Marchant & Higgins 1993; Benshemesh 2007; Garnett *et al.* 2011). The Project does not involve the movement of any animals, however it may involve the movement of biological products such as soil and seeds on the types of transport vehicles and when back-fill substrate is brought in.

These products could harbour or transmit diseases that impact on wildlife. In general, no soil born disease is known to exist in the semi-arid region and as such should not be issue for the Malleefowl.

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<sup>3</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

***Criterion 9: interfere substantially with the recovery of the species?***

The approved National Recovery Plan for the Malleefowl (Benshemesh 2007) contains 18 objectives:

1. Reduce permanent habitat loss.
2. Reduce the threat of grazing pressure on Malleefowl populations.
3. Reduce fire threats.
4. Reduce predation.
5. Reduce isolation of fragmented populations.
6. Promote Malleefowl-friendly agricultural practices.
7. Reduce Malleefowl mortality on roads.
8. Provide information for regional planning.
9. Monitor Malleefowl and develop an adaptive management framework.
10. Determine the current distribution of Malleefowl.
11. Examine population dynamics including longevity, recruitment and parentage.
12. Describe habitat requirements that determine Malleefowl abundance.
13. Define appropriate genetic units for management of Malleefowl.
14. Assess captive breeding and re-introduction of Malleefowl.
15. Investigate infertility and agrochemicals.
16. Facilitate communication between groups.
17. Raise public awareness through education and publicity.
18. Manage the recovery process.

The Project would be inconsistent with objectives 1 and 5. The loss and fragmentation of habitats are considered in response to Criterion 3. The Project could potentially be inconsistent with objective 3. Mining activities carry the risk of causing accidental wildfires and changing (increasing) the fire regime. However, a fire management strategy would be developed that aims to minimise fire outbreaks within the Project area and manages appropriate fire regimes within the proposed offset area that would benefit the Malleefowl and other wildlife species.

Based on the area of potential primary habitat (1,575 ha) and estimating a density of breeding pairs of one per 100 ha, the theoretical conservative estimate is up to 15 mounds could potentially be impacted by the Project. Despite this theoretical estimate, detailed surveys over the Project area revealed only two mounds were found in the proposed surface area and are avoided through revision of the mine general arrangement<sup>4</sup>.

The proposed offset would aim to compensate for fragmentation by enhancing the habitat quality and integrity of the proposed offset area, which includes 12,765 ha of primary mallee habitats and 3,675 ha of potential foraging habitat. Improved fire management, integrated pest management and reduced grazing pressure would give considerable compensation to offset localised fragmentation. In these ways, the Project would assist with the implementation and success of the National Recovery Plan.

***Conclusion***

The Project would result in the removal of approximately 1,575 ha of good quality habitat for the Malleefowl as well as 2,705 ha of potential foraging or supplementary habitats at the Atlas-Campaspe Mine.

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<sup>4</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

The Project is therefore considered likely to lead to a significant impact on the species according to EPBC Act criteria, on the basis that it would reduce the area of occupancy of the species and potentially lead to a small decrease in the size of the population.

The proposed offset area would contain approximately 12,765 ha of mallee habitats (more than three times that in the development footprint) that would be managed to enhance their viability. This would include implementation of a fire management strategy consistent with the National Recovery Plan, removal of stock and goats and reduction of predation from feral animals through integrated pest management. Based on the area of potential primary habitat (1,575 ha) and estimating a density of breeding pairs of one per 100 ha, the theoretical conservative estimate is up to 15 mounds could potentially be impacted by the Project. Despite this theoretical estimate, detailed surveys over the Project area revealed only two mounds were found in the proposed surface area and are avoided through revision of the mine general arrangement<sup>6</sup>. In this context, the proposed mine would have only limited detrimental impacts on the regional population of Malleefowl (probably the loss of between two and 15 territories) that would not lead to the extinction of the population.

Proposed avoidance mitigation and management measures would include:

- Management of 12,765 ha of primary mallee habitats and 3,675 ha of potential foraging or supplementary habitats in the proposed offset area to improve their ecological viability.
- Implementation of integrated pest management in the Project area and offset area to reduce competition for Malleefowl from herbivores.
- Implementation of integrated pest management in the Project area and offset area to reduce predation of Malleefowl from European red foxes and feral cats.
- Reduced stock grazing in the Project area and offset area reduces competition for Malleefowl from herbivores.
- Implementation of fire management to maintain a low frequency fire regime that favours the Malleefowl.
- Avoidance of direct impacts to two nesting mounds proposed to occur within the proposed surface disturbance area<sup>7</sup>.
- Adopting vegetation clearance protocol.
- Speed limits to minimise the risk of vehicle strike on native fauna.
- Inclusion of the risk of vehicle strike to fauna in inductions to increase awareness.
- Installing road signs that increase awareness of fauna vehicle strike.

The Project would remove 40 ha of supplementary foraging habitat (Belah-Rosewood Woodland and Native Grassland) within the Ivanhoe Rail Facility footprint. No breeding pairs are expected to occur within the Ivanhoe Rail facility study area given no mounds, tracks, or individuals were recorded during survey, there are no records of the species within 20 km of the area, and there is no primary habitat (mallee woodland) in close vicinity to the area.

<sup>6</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

<sup>7</sup> The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

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### *Australasian Bittern (Botaurus poiciloptilus)*

The Australasian Bittern (*Botaurus poiciloptilus*) is listed as Endangered under the EPBC Act. While this species has a wide distribution over south-eastern Australia it is considered to be uncommon. In NSW, Australasian Bittern is a part of one of three Australian sub-populations, the south-eastern sub-population, which is found in the riparian and wetland areas in the east and south of the state (NSW Scientific Committee 2011). Australasian Bitterns favour permanent freshwater wetlands where there is tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). However, temporary, open wetlands may be used when population density is high or during relocation (SEWPaC 2012). They are secretive during the day, hiding amongst dense reeds or rushes. They feed mainly at night on a variety of prey including frogs, fish, yabbies, spiders, insects and snails. Australasian Bitterns may construct feeding platforms over deeper water. Platforms are constructed from reeds that the bird tramples and are often littered with remains of prey. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds. There are usually six olive-brown eggs to a clutch. Breeding pairs of Australasian Bitterns are solitary and territorial. They occupy relatively large home ranges of 40 to 50 ha and occur at low densities. Generation length is estimated as five years (Garnett & Crowley 2000).

Based on evidence from broadscale surveys, the Australasian Bittern is believed to have undergone a reduction in population size in NSW. This reduction is believed to have resulted from the loss of suitable wetland habitat over a number of years. Birdlife International (2012) estimates the Australian population to be between 247 and 796 individuals, and the NSW population to be between 82 and 162 individuals. In 2000, the area of occupancy for Australasian Bitterns in NSW was estimated to be between 600 and 800 km<sup>2</sup>. However, as a result of loss of wetland habitat since that time, it is likely that this figure is now lower (NSW Scientific Committee 2011).

Breeding sites, foraging habitat and food for Australasian Bitterns are threatened by drainage of wetlands and alteration of natural flow regimes. The inland habitat of the Australasian Bittern is subject to diversion of water, salinisation and the drainage of permanent swamps (Garnett & Crowley 2000). Grazing and burning of wetland habitats may also threaten the Australasian Bittern. Other threats to Australasian Bitterns include reduced water quality as a result of siltation and pollution, and predation by foxes and feral cats (*Felis catus*). The use of pesticides and other chemicals near wetland areas also pose a threat to Australasian Bitterns.

***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:***

***Criterion 1: lead to a long-term decrease in the size of a population of a species?***

The Australasian Bittern has been recorded in the Lower Murray-Darling Catchment Management Authority (CMA) including in the Willandra Lakes Region World Heritage Area (NPWS 2003) and Kinchega National Park (OEH 2012), closest to the Project area is a record from the Atlas of NSW Wildlife Database located approximately 63 km to the south-east. While the species was not recorded in the Project area or surrounds and there are no records within a 20 km radius of the study area, potential foraging habitat may be impacted by the Project. In addition, this species often occurs together with the Australian Painted Snipe (*Rostratula australis*) (SEWPaC 2012), which has been recorded in the locality. Potential foraging habitat for this species in the Project area is located within and around two patches of Ephemeral Wetland; one patch occurs in the south-eastern section of the proposed offset area and the other adjacent to the Campaspe footprint. Additional foraging habitat occurs in form of Grass and Herbland Depressions in the Atlas-Campaspe Mine footprint and Chenopod Depressions along the proposed mineral concentrate transport route.



The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The Ephemeral Wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation. The edges of Grass and Herbland Depressions as well as Chenopod Depressions are surrounded by quite dense ground vegetation.

Although the species has not been recorded in the Project area or close surrounds, the species may still use the Ephemeral Wetland habitat when population density is high or during relocation (SEWPaC 2012). Whilst the Project has attempted to avoid direct impacts to the wetland nearby to the Campaspe footprint, changes in local hydrology as a result of the Project is likely to cause a number of flow on effects to potential foraging/ supplementary habitat for the species.

The Project area is not at the edge of the species' range and is not recognised as an important locality to support the species' continued viability.

The Project is not likely to lead to a long-term decrease in the size of the population in this area, given that the species was not recorded and potential habitat in the Project area is limited.

***Criterion 2: reduce the area of occupancy of the species?***

The Project would result in the loss of 5 ha of potential foraging habitat that this species could use during wetter periods. While there would be no direct impact on an Ephemeral Wetland, there is potential for the wetlands to be indirectly impacted by changes in hydrological regimes in the area and from disturbance due to mining operations, particularly the Ephemeral Wetland adjacent to the Campaspe footprint. The Campaspe footprint would temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the operation of the Campaspe section of the mine. Cristal Mining Australia Limited (Cristal Mining) would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area.

Changes to the hydrology in the area can, potentially, reduce the amount of water entering these wetlands. Changes to water levels and time periods between inundation have flow-on effects on some biota including aquatic, semi-aquatic and fringing vegetation, aquatic invertebrates, amphibians and more (OEH 2012). With the likely reduction in water-dependent flora and fauna in the local area, foraging and breeding resource for the Australasian Bittern also are likely to be reduced and therefore reducing available habitat in the area

Despite the potential impacts to this Ephemeral Wetland, a total of 21 ha of similar potential habitat, including an Ephemeral Wetland and Grassland and Herbland Depressions would be conserved in the proposed offset area. Further better quality habitat exists in the surrounding area, including in the Willandra Lakes Region World Heritage Area where this species is known to exist (NPWS 2003).

Therefore, the action would not reduce the species area of occupancy by a significant amount.

***Criterion 3: fragment an existing population into two or more populations?***

The Australasian Bittern has not been recorded in the Project area or close surrounds. The closest record is about 70 km to the south-east of the Project area. Consequently, The Project would not cause any part of the population to become isolated from the rest of the population, and so would not fragment the regional population.

***Criterion 4: adversely affect habitat critical to the survival of a species?***

No critical habitat has been declared for the Australasian Bittern (SEWPaC 2012) and no National Recovery Plan has been compiled for the species. Alteration of wetland habitat is listed as a threatening factor in the SPRAT database (SEWPaC 2012). The area impacted by the Project does contain a small Ephemeral Wetland area but this is not critical to the survival of the species.

***Criterion 5: disrupt the breeding cycle of a population?***

The Ephemeral Wetland areas that may be impacted by the Project are small, ephemeral in nature and have only retained a small portion of fringing vegetation. Given the species makes nests over densely-vegetated wetlands on a platform of reeds, no breeding habitat is considered to be present in the Project area or close surrounds. Therefore, the Project would not disrupt the breeding cycle of an important population. Conservation of potential habitat for the Australasian Bittern in the proposed offset area would provide considerable compensation to the Australasian Bittern.

***Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

Approximately 5 ha of potential foraging habitat for the Australasian Bittern would be affected by the Project. The habitat loss is unlikely to have impacts on the regional population. A similar area of habitat occurs in the proposed offset area (21 ha), which would be managed to enhance its ecological viability.

***Criterion 7: 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 Project would not result in the introduction of any harmful or invasive species being introduced to the Atlas-Campaspe study area. A number of invasive species that have been identified as a threat to the Australasian Bittern exist in the area. The feral cat and fox are likely to prey on the Australasian Bittern. Exotic grazers (i.e. feral goats, rabbits and livestock) reduce food availability and alter vegetation structure and in particular livestock severely alter the vegetation around the edges of wetlands. Integrated pest management within the proposed offset area together with current management in Mungo National Park and State Conservation Area, that also form a component of the regional population area, would aim to reduce predation and competition pressures from invasive species.

***Criterion 8: introduce disease that may cause the species to decline?***

The Project would not lead to the introduction of any diseases that are potentially harmful to the Australasian Bittern. No avian diseases have been identified as a threat to the Australasian Bittern (SEWPaC 2012). The Project does not involve the movement of any animals, however it may involve the movement of biological products such as soil and seeds on the types of transport vehicles and when back-fill substrate is brought in. These products could harbour or transmit diseases that impact on wildlife. In general, no soil born disease is known to exist in the semi-arid region and as such should not be issue for the Australasian Bittern.

***Criterion 9: interfere substantially with the recovery of the species?***

There is currently no National Recovery Plan or threat abatement plan for the Australasian Bittern. Actions that are recommended to facilitate the conservation and recovery of the species include (OEH 2012; SEWPaC 2012):

1. Retaining and managing suitable wetland habitats.
2. Controlling feral animals in and close to wetlands.
3. Fencing of wetlands to exclude trampling by stock.

The Atlas-Campaspe Mine footprint has been designed to avoid an area of Ephemeral Wetland. However, the mining of the Campaspe deposit would affect the local catchment area reporting to the Ephemeral Wetland next to the Campaspe footprint (Evans & Peck 2012). The potential indirect impacts (i.e. disruption of catchment area) on this area would be compensated through the protection and habitat enhancement of similar and potential habitat within the proposed offset area.

The proposed programmes to control feral animals and remove livestock and thus reduce the effects of trampling are consistent with actions 2 and 3. In these ways, the Project would assist with the implementation and success of the recovery actions.



The Project would not interfere substantially with the recovery of the Australasian Bittern.

### Conclusion

The Australasian Bittern was not recorded in the study area and no records for the species occurring within a 20 km radius were found. However, the species has been recorded in the nearby overflow areas of the Murrumbidgee River and the Willandra Lakes Region World Heritage Area and potential habitat for this species occurs in the study area in Ephemeral Wetlands, Grass and Herbland Depressions in the Project and offset areas, and Chenopod Depressions along the proposed mineral concentrate transport route.

The Atlas-Campaspe Mine footprint would result in the removal of 5 ha of potential foraging habitat for this species and the introduction of potential indirect impacts to a further 9 ha in the Ephemeral Wetland adjacent to Campaspe footprint due to changes in local hydrological patterns. The Ephemeral Wetland in proposed offset area may also be impacted by these changes in surface water flows. Disturbance caused mining operations as a result of the Campaspe footprint could also impact waterbirds that may use the wetlands. However, the proposed surface development is not expected to have a significant impact on the Australasian Bittern given that:

- This species was not recorded in the Project area and no records within a 20 km radius were found.
- The area of potential habitat that would be removed is only small (5 ha).
- A total of 21 ha of similar potential habitat would be conserved in the proposed offset area.
- While potential hydrological changes and disturbance could impact Ephemeral Wetland habitat adjacent to the Campaspe footprint during mine operations, this area is ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore, these impacts are not considered likely to affect the long-term survival of the species in the region.

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### *Australian Painted Snipe (Rostratula australis)*

The Australian Painted Snipe (*Rostratula australis*) is listed as Vulnerable under the EPBC Act. This assessment of impact significance has been conducted according to the SEWPaC *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA 2009) for vulnerable species.

The Australian Painted Snipe occurs in wetlands in all states of Australia but it is most common in eastern Australia. The Murray-Darling Basin appears to be an important area for this species (Birdlife International 2012). The Australian Painted Snipe generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans (SEWPaC 2012). They also use inundated grassland, dams, rice crops, sewage farms and bore drains. Sites where this species typically occurs include those with emergent grass tussocks, sedges, rushes or reeds. The Australian Painted Snipe also occurs in areas that are lined with trees, or that have some fallen timber (Marchant & Higgins 1993). This species breeds in shallow wetlands with areas of bare wet mud and canopy cover nearby. Most breeding records are on or near small islands in freshwater wetlands (SEWPaC 2012) but they have also been recorded nesting in and near swamps, flooded areas, grazing land, sedges, grasses, Saltwater Couch (*Paspalum vaginatum*), *Tecticornia* sp. and grass (Marchant & Higgins 1993).

It is estimated that the population of Australian Painted Snipes has declined by more than 30 percent over the last 26 years (Birdlife International 2012). Population estimates suggest that the population is currently unlikely to exceed 2,500 individuals and may be as few as 1,000 individuals (Birdlife International 2012).

Loss and alteration of wetland habitat is probably the primary factor in the decline of the Australian Painted Snipe (SEWPaC 2012). This loss and alteration is primarily due to the drainage of wetlands and the diversion of water to agriculture and reservoirs, which reduces flooding and precludes the formation of temporary shallow wetlands (Garnett & Crowley 2000; SEWPaC 2012). A decline in water quality because of increased nutrient and saline content has probably also contributed to the decline of Australian Painted Snipes. Clearing of wetland vegetation and grazing, both of which degrade Australian Painted Snipe habitat, and predation by foxes and feral cats pose additional threats (NSW Scientific Committee 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:***

***Criterion 1: lead to a long-term decrease in the size of an important population of a species?***

This Australian Painted Snipe was recorded in the Ephemeral Wetland nearby the Campaspe footprint. There are also records for this species in the Lower Murray-Darling CMA (OEH 2012). There is potential breeding and foraging habitat for this species in Ephemeral Wetlands, Chenopod Shrubland Depression and Grass and Herbland Depressions. The potential habitat for this species is located within two patches of Black Box Woodland; one patch occurs in the south-eastern section of the proposed offset area and the other near the Campaspe footprint. The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation.

The Project would result in the direct loss of 5 ha of potential breeding and foraging habitat in the Chenopod Shrubland Depression that the Australian Painted Snipe could use during wetter periods.

The proposed mining at Atlas and Campaspe is expected to have a limited, localised and temporary effects on areas where temporary surface ponding occurs at the Atlas Campaspe Mine site (i.e. through excavation) (GEO-ENG 2013). This applies to depressions located beside and 2.5 km to the south of the Campaspe footprint.

There are two Ephemeral Wetlands associated with Black Box Woodland with potential to be indirectly impacted by changes to hydrology. The initial mine design was refined to avoid as much of the Black Box Woodland and the associated Ephemeral Wetland in these locations as practicable. However, mining of the Campaspe deposit (between Years 11 to 13) would remove an area of woodland and part of the clay associated with the water holding capacity in this depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining. To minimise this, Cristal Mining would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate run-on to adjacent depressions. The Campaspe footprint would also temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the mining of the Campaspe deposit. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area. This would provide for the potential for species representative of Black Box Woodlands (e.g. *Eucalyptus largiflorens*) to establish. Following the re-establishment of the depression and run-on to it, and the establishment of these species, these depressions and specifically the vegetation surrounding these depressions, would provide potential habitat for the Australian Painted Snipe.

While potential habitat for this species would be removed and disturbed by the Project, and changes to hydrology could affect potential habitat, it is considered that the Project is not likely to lead to a long-term decrease in the size of an important population of this species given that:

- The species would only use these wetlands during optimal conditions.
- Only a relatively small area (5 ha) of potential habitat in Chenopod Shrubland Depression would be directly impacted by the Project,
- Only a small area (9 ha) of breeding and foraging habitat in the Ephemeral Wetland would be indirectly impacted by the Project,
- 21 ha of similar potential habitat would be conserved in the proposed offset area, and
- Better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Lakes Region World Heritage Area.

The study area is not at the edge of the species' range and is not recognised as an important locality to support the species' continued viability

***Criterion 2: reduce the area of occupancy of an important population?***

The Australian Painted Snipe occurs in wetlands in all states of Australia. The Project would directly impact on one small area (5 ha) of potential breeding and foraging habitat that is likely to be used by the species during periods of good conditions. A further 9 ha in the Ephemeral Wetland close to the Campaspe footprint may be indirectly impact by changes in local hydrological patterns associated with the mine. Despite this, the Project would not reduce the species area of occupancy by a significant amount in given the species is known from all states and better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Lakes Region World Heritage Area.

***Criterion 3: fragment an existing important population into two or more populations?***

The Australian Painted snipe is capable of travelling great distances. The movements of the Australian Painted Snipe are poorly understood and the species is possibly dispersive in response to the flooding and drying out of wetlands. Consequently, the Project would not cause any part of the population to become isolated from the rest of the population, and so would not fragment the regional population.

***Criterion 4: adversely affect habitat critical to the survival of a species?***

No critical habitat has been declared for the Australian Painted Snipe (SEWPaC 2012) and no National Recovery Plan has been compiled for the species. Alteration of wetland habitat is listed as a threatening factor in the SPRAT database (SEWPaC 2012). The area impacted by the Project does contain a small Ephemeral Wetland area but this is not critical to the survival of the species.

***Criterion 5: disrupt the breeding cycle of an important population?***

The Project would directly impact on one small area (5 ha) of potential breeding and foraging habitat that is likely to be used by the species during periods of good conditions. A further 9 ha in the Ephemeral Wetland close to the Campaspe footprint may be indirectly impact by changes in local hydrological patterns associated with the mine. The species is likely to utilise these habitat areas to breed after inundation during periods of heavy rain, at which times numerous similar depressions and water bodies would be present throughout the region. The Project would therefore not disrupt the breeding cycle of an important population.

***Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

Approximately 5 ha Chenopod Depression habitat which is potential breeding and foraging habitat for the Australian Painted Snipe would be cleared for the Project and a further 9 ha in the Ephemeral Wetland close to the Campaspe footprint may be indirectly impact by changes in hydrological patterns feeding the wetland. This habitat loss would have impacts on a very small proportion of the population (few breeding pairs at most) and would not affect the majority of the regional population. A similar area of habitat (approximately 21 ha) occurs in the proposed offset area, which would be managed to enhance its ecological viability and reduce existing threats to the Australian Painted Snipe.

***Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?***

The Project would not result in the introduction of any harmful or invasive species being introduced to the Atlas-Campaspe study area. A number of invasive species that have been identified as a threat to the Australian Painted Snipe exist in the area. The feral cat and fox are likely to prey on the Australian Painted Snipe, who is a ground breeder. Exotic grazers (i.e. feral goats, rabbits and livestock) reduce food availability and alter vegetation structure and in particular livestock severely alter the vegetation around the edges of wetlands. Integrated pest management within the proposed offset area together with current management in Mungo National Park and State Conservation Area, that also form a component of the regional population area, would aim to reduce predation and competition pressures from invasive species.

***Criterion 8: introduce disease that may cause the species to decline?***

The Project would not lead to the introduction of any diseases that are potentially harmful to the Australian Painted Snipe. No avian diseases have been identified as a threat to the Australian Painted Snipe (SEWPaC 2012). The Project does not involve the movement of any animals, however, it may involve the movement of biological products such as soil and seeds on the types of transport vehicles and when back-fill substrate is brought in. These products could harbour or transmit diseases that impact on wildlife. In general, no soil born disease is known to exist in the semi-arid region and as such should not be an issue for the Australian Painted Snipe.

***Criterion 9: interfere substantially with the recovery of the species?***

No National Recovery Plan has been compiled for the Australian Painted Snipe and thus no recovery actions formally recognized. However, the following recovery actions have been recommended (Garnett & Crowley 2000; OEH 2012) and are relevant to this assessment:

1. Protect and manage habitat at principal breeding and wintering sites and, as a precautionary measure, identify and protect any additional habitat used by the Australian Painted Snipe in the last 10 years.

2. Initiate control programmes for feral animals, and erect fencing to prevent grazing and trampling of wetlands by cattle, at suitable wetlands.
3. Rehabilitate selected wetlands that were formerly used for breeding.

The Project would be inconsistent with objective 1. The Australian Painted Snipe has been recorded in the Ephemeral Wetland area adjacent to the Campaspe footprint. While some potential habitat (5 ha) would be removed in the Project area and there is potential for the two Ephemeral Wetland areas to be indirectly impacted by altered hydrological regimes and disturbance, neither of the Ephemeral Wetlands would be directly impacted by the Project. The exposure to impacts of habitat loss from extraction in the Project would be compensated through the protection and habitat enhancement of similar and potential habitat within the proposed offset area. The proposed programme to control feral animals and remove livestock and thus reduce the effects of trampling is consistent with objectives 2 and 3. In these ways, the Project would assist with the implementation and success of the recovery actions. Further, the current surveys have assisted the recovery actions by identifying localities of the species occurrence and contributing to the understanding of distribution patterns and habitat requirements for the species within south-western NSW. The Project would not interfere substantially with the recovery of the Australian Painted Snipe.

### Conclusion

The Australian Painted Snipe was recorded in the study area in the Ephemeral Wetland close to the Campaspe footprint. Potential habitat for this species occurs in the study area in Ephemeral Wetlands, Chenopod Shrubland Depression and Grass and Herbland Depressions.

The Project would result in the removal of 5 ha of potential breeding and foraging habitat for this species. In addition, potential changes to hydrological regimes as a result of the Campaspe footprint and disturbance due to mining operations could have indirect impacts on the species in the study area, particularly in the Ephemeral Wetland of 9 ha close to the Campaspe footprint. However, the Project is not expected to have a significant impact on the Australian Painted Snipe given that:

- The area of potential habitat that would be removed is only small (5 ha).
- A total of 21 ha of similar potential habitat would be conserved in the proposed offset area.
- While potential hydrological changes and disturbance could impact the Ephemeral Wetlands, these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore these impacts are not considered likely to affect the long-term survival of the species in the region.
- There is better quality wetland habitat nearby, including in the Willandra Lakes Region World Heritage Area.

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### Regent Parrot (eastern subspecies) (*Polytelis anthopeplus monarchoides*)

The eastern subspecies of the Regent Parrot (*Polytelis anthopeplus monarchoides*) is listed as Endangered under the NSW *Threatened Species Conservation Act, 1994* (TSC Act). It is also listed nationally as Vulnerable under the EPBC Act. The taxon is hereafter referred to as the ‘eastern Regent Parrot’.

The eastern Regent Parrot is restricted to a single population in inland south-eastern Australia, in the lower Murray-Darling basin region in South Australia, Victoria and NSW. In NSW it occurs along the Murray River downstream of Tooleybuc (about 135 km south of the Project site), the Wakool River downstream of Kyalite (about 130 km south of the Project site), and the Murrumbidgee River immediately upstream from the junction with the Murray River, along with mallee woodlands adjoining all these areas. There are scattered records along the Darling River as far north as Menindee, but it not known to breed along the Darling. During the breeding season this parrot is typically within 20 km of the nesting sites along the rivers. There are no large scale movements, but some flocking and dispersal occurs in the winter. At this time it may occur up to 60 km from the rivers. However, there are very few records in NSW away from the Murray River during the non-breeding season, so possibly the NSW birds join non-breeding flocks in Victoria (Morris *et al.* 1981; Blakers *et al.* 1984; Higgins 1999; Barret *et al.* 2003; Garnett *et al.* 2011; Baker-Gabb and Hurley 2011; OEH 2012; SEWPac 2012).

The eastern Regent Parrot nests in River Red Gum (*Eucalyptus camaldulensis*) forests along the Murray, Wakool and lower Murrumbidgee Rivers, and possibly the Darling River downstream of Pooncarie (about 85 km north-west of the Project area). Typical nest trees are large, mature and healthy trees, or senescing trees, or dead trees, but generally with many spouts and usually located close to a major watercourse. The parrots generally forage in mallee woodlands, but foraging also occurs in riverine forests and woodlands. Mallee woodlands within 20 km of nesting sites form a critical foraging habitat for breeding birds. Birds move between the riverine nesting habitat and foraging sites along corridors of natural vegetation. When foraging, it usually occurs in pairs or small parties, though it may form larger flocks during the non-breeding season. Food consists of seeds, berries, buds, blossom and rarely insects. A wide range of seeds from grasses, chenopods, daisies and eucalypts are consumed. It sometimes feeds on cereal crops or spilt grain. Breeding is colonial with 20 or more nests in a colony. Nests are usually within 150 metres (m) of each other up to five nests in a single tree (Blakers *et al.* 1984; Higgins 1999; Garnett *et al.* 20011; Baker-Gabb and Hurley 2011; OEH 2012; SEWPac 2012).

Essentially, the eastern Regent Parrot requires the following habitat features (Baker-Gabb and Hurley 2011):

- Large River Red Gums, generally within 120 m of water, for nesting.
- Mallee woodlands within 20 km and ideally within 5 km of nest sites for foraging.
- Treed flight corridors between these two habitats.

The total adult breeding population of eastern Regent Parrots is estimated at 1,500 pairs, with 600 in NSW (Baker-Gabb and Hurley 2011).

OEH (2011) lists the following 11 threats to the species in NSW:

1. The major threat is the loss of mallee woodland within 20 km of the Murray River.
2. The decline or clearing of vegetation along flight paths, which disrupts movement, may increase the risk of predation, limit access to suitable foraging habitat or reduce foraging efficiency to the point where nesting habitat becomes unsuitable or breeding success is affected.
3. Illegal egg collecting or removal of chicks from nests may result in the destruction of nest hollows and can impact upon populations through the loss or death of individual birds. However, the current level of this threat in NSW is currently unknown.

4. Birds may feed on roadsides and thus be at risk of being struck by vehicles.
5. Competition for nest hollows with feral honeybees can result in the abandonment of nest sites.
6. Both breeding and foraging habitat is threatened by rising groundwater, with areas upstream of Euston Weir particularly affected.
7. Harvesting of River Red Gum has the potential to result in the loss of nest trees and limit the recruitment of new nest trees.
8. Harvesting of mallee for charcoal may reduce the suitability of these sites as foraging habitat.
9. Grazing has the potential to reduce the quality of foraging habitat.
10. The impact of fire management on this species is unknown, but as fire is an important component in mallee ecosystems, it is likely that inappropriate fire regimes may impact on foraging habitat.
11. Eastern Regent Parrots have been persecuted in almond orchards in Victoria and South Australia because of damage done to ripening crops. Although almond production is relatively small in NSW, the birds may be from NSW breeding colonies.

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

***Criterion 1: lead to a long-term decrease in the size of an important population of a species?***

The eastern Regent Parrot was recorded once during the field study; outside the Project area just to the south of the proposed Atlas footprint. There are no historical records in the wildlife databases for the vicinity of the study area. The record is outside the species' normal range (Baker-Gabb and Hurley 2011; OEH 2012) and does not indicate a resident population or a regular habitat.

There eastern Regent Parrot is considered to be a rare vagrant in the Project area, with no known population occurring in the area (Baker-Gabb and Hurley 2011). The potential foraging habitat to be cleared is not considered important for an important population of the species and consequently, the proposed habitat removal would not cause the species to decline.

***Criterion 2: reduce the area of occupancy of an important population?***

Given that the species is only likely to occur as a rare vagrant at most, with no known population occurring in the Project area (Baker-Gabb and Hurley 2011), it is unlikely that the area of occupancy of an important population would be reduced. The rehabilitated post-mine landforms may in time provide potential foraging habitat for the Regent Parrot, with the establishment of species representative of Linear Dune Mallee and Sandplain Mallee such as *Eucalyptus socialis*, *E. dumosa* and *Callitris* sp.

***Criterion 3: fragment an existing important population into two or more populations?***

Given that the species is only likely to occur as a rare vagrant at most, with no known population occurring in the Project area (Baker-Gabb and Hurley 2011); it is unlikely that the Project would fragment any populations. Further, extensive areas of potential habitat would remain connected outside the Project area.

***Criterion 4: adversely affect habitat critical to the survival of a species?***

No critical habitat has been declared for the eastern Regent Parrot (SEWPaC 2012). The locality is not identified in the National Recovery Plan (Baker-Gabb and Hurley 2011) or on the SPRAT database (SEWPaC 2012).

***Criterion 5: disrupt the breeding cycle of an important population?***

The species known breeding range is closely associated with the Murray-Darling River system, and only rare vagrants are likely to occur in the Project area (Baker-Gabb and Hurley 2011). The Project therefore would not disrupt the breeding cycle of any population.



***Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

In the study area potential foraging habitat for the eastern Regent Parrot includes Linear Dune Mallee and Sandplain Mallee. The Project would progressively remove up to 1,575 ha of potential foraging habitat for the eastern Regent Parrot. This includes 1,040 ha of Linear Dune Mallee and 535 ha of Sandplain Mallee. No breeding habitat would be cleared.

Given that the species is only likely to occur as a rare vagrant at most, with no known population occurring in the Project area (Baker-Gabb and Hurley 2011), the Project would not affect habitat for the species in any way which is likely to cause the species to decline.

***Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?***

The Project would not result in the introduction of any harmful or invasive species being introduced to the study area, or known habitat for populations of the eastern Regent Parrot, given the species is not considered to use the area for regular habitat.

***Criterion 8: introduce disease that may cause the species to decline?***

The Project would not lead to the introduction of any diseases that are potentially harmful to the eastern Regent Parrot in the study area, or known habitat for populations of the eastern Regent Parrot.

***Criterion 9: interfere substantially with the recovery of the species?***

The approved National Recovery Plan for the eastern Regent Parrot (Baker-Gabb and Hurley 2011) contains six objectives:

1. Determine population trends in the eastern Regent Parrot.
2. Reduce environmental impacts and restore habitat.
3. Identify strategic flyways and their features and protect and enhance these.
4. Reduce human-induced mortality of eastern Regent Parrots.
5. Investigate key aspects of the biology and ecology of the eastern Regent Parrot.
6. Increase community involvement in the eastern Regent Parrot recovery programme.

The Project would not be inconsistent with any of these objectives. The Project area is outside the normal distribution and habitat areas of the species.

***Conclusion***

The Project would have little or no impact on the eastern Regent Parrot. There is no population in the locality. The eastern Regent Parrot's close reliance on the Murray-Darling River system means that there is no important habitat for the species in the Project area.

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Accessed: August 2012.

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

The Corben's Long-eared Bat (also known as South-eastern Long-eared Bat [*Nyctophilus corbeni*]) is listed as Vulnerable under the EPBC Act. This assessment of impact significance has been conducted according to the SEWPaC *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (DEWHA 2009) for vulnerable species.

It has only recently been described as *Nyctophilus corbeni* (Parnaby 2009) and therefore in older publications is referred to as the south-eastern form of the Greater Long-eared Bat (*N. timoriensis*) (e.g. Churchill 2008; Turbill *et al.* 2008). Its distribution is restricted to the Murray-Darling Basin from far eastern South Australia and north-western Victoria through inland areas of NSW extending northwards to southern central Queensland (Ellis *et al.* 1999; Turbill & Ellis 2006). In NSW it occurs through western NSW excluding the north-western corner of the state and extends eastwards to the western slopes and the upper Hunter Valley (Turbill & Ellis 2006; Schulz & Lumsden 2012; OEH 2012).

The species is relatively easy to identify in the hand (e.g. Churchill 2008) but currently it is not possible to distinguish this species ultrasonically from other members of the genus that frequently occur in sympatry, particularly the Lesser Long-eared Bat (*N. geoffroyi*) and the Gould's Long-eared Bat (*N. gouldi*) (Reinhold *et al.* 2001; Pennay *et al.* 2004). Therefore in the current survey, this species was probably significantly under-reported due to the fact that although this genus was commonly recorded by bat detector at many sites, none could be identified to species level.

This species occurs in a wide range of forested habitats across its range from vine forest patches through to open woodland and Acacia Shrubland (Churchill 2008; Schulz & Lumsden 2012). Similarly in south-western NSW it has been recorded from a wide range of habitats including Black Box Woodland, Belah-Rosewood Woodland communities, chenopod sandplain mallee, deep sand mallee on irregular or linear dunefields, mallee box open woodland, cypress-pine woodland, Gum Coolibah (*Eucalyptus intertexta*), Mulga (*Acacia aneura*) Woodland, River Red Gum, lining watercourses, Moonah (*Melaleuca lanceolata*), mallee and other shrublands (OEH 2012).

Although having a widespread distribution and being locally common in some locations the biology of this species is poorly known. It is a nocturnal species that predominantly feeds on a variety of small flying insects caught by gleaning or while in flight primarily below, within or just above a timbered canopy or on the edges of more open situations (Dominelli 2000; Schulz & Lumsden 2012). During the day roosts are typically occupied by a single individual within tree hollows, including standing dead trees often close to the ground (Dominelli 2000; Lumsden *et al.* 2008). For example, in mallee in north-western Victoria, 11 individuals were radiotracked to 29 roosts that were typically only occupied for a single night. These roosts were primarily located in the dead spouts on mallee eucalypts in areas of long-unburnt mallee, with some under bark or in the fissures of dead Buloke (*Allocasuarina luehmannii*) or Belah (*Casuarina cristata*) (Lumsden *et al.* 2008). In this study, roosts were on average  $1.89 \pm 1.61$  km (range 0.34–7.06 km) from the capture point and unlike other members of the genus large distances were generally travelled between consecutive roosts:  $1.91 \pm 1.86$  km (range 25 m–5.88 km). The commuting distance travelled by this species between foraging and roosting areas is not known. The Corben's Long-eared Bat gives birth in late spring/early summer and the young are flying and independent in January (Schulz & Lumsden 2012). The maternity roost characteristics in this species have not been documented.

The species displays a significant preference for larger patches of habitat, with surveys in central western NSW finding a tenfold difference in relative abundance between trapping sites within large continuous forest remnants compared to small forest areas (Turbill & Ellis 2006). However, the area of habitat required for this species to persist in a given area is not known (Schulz & Lumsden 2012).

Important habitat attributes identified for the species include the presence of a large amount of woody vegetation (within 10 km) on highly drained, lower fertility soils (Pennay 2002). Old-growth vegetation is considered a critical habitat component, with 28 of the 29 roost sites located in the Hattah-Kulkyne National Park/Nowingi area found in long unburnt mallee or woodland vegetation with some trees estimated to be several hundred years old (Lumsden *et al.* 2008). The fragmented distribution of the South-eastern Long-eared Bat may increase the likelihood of local populations becoming extinct as a result of stochastic events, such as prolonged drought or widespread fire. The overall population size is unknown and population trends in this species are not known but would have declined overall within the state given that large sections of its preferred wooded habitat has been cleared and remaining remnants are fragmentary in nature (Schulz & Lumsden 2012).

This species is threatened by a number of processes, particularly habitat loss and fragmentation, timber harvesting activities including the loss of hollow-bearing trees and removal of standing dead trees; too frequent fire regimes that result in the loss of roosting habitat; habitat degradation by domestic stock, feral pigs (*Sus scrofa*) and feral goats impacting on prey availability; predation by foxes and feral cats at roosts; hollow competition with feral species; and the exposure to agrichemicals (Schulz & Lumsden 2012).

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

***Criterion 1: lead to a long-term decrease in the size of an important population of a species?***

The capture rates of this species during the current surveys throughout the Atlas-Campaspe Mine study area, was amongst the highest recorded throughout this species' range (Schulz & Lumsden 2008) and is attributed to the large expanse of continuous habitat, much of which has remained unburnt for a long period of time (after Lumsden *et al.* 2008). Therefore, the population occurring within the Atlas-Campaspe study area, including the proposed development area is considered an important population. However, it is not known how large an area of habitat this important population inhabits. It is likely to incorporate the entire area of continuous habitat comprising a patchwork Black Box Woodland, Belah-Rosewood Woodland, Linear Dune Mallee, Sandplain Mallee and Acacia Woodland/Shrubland extending outward from the study area limits to the borders of the Hay Plain to the east, west to beyond Mungo National Park, south to beyond the Southern Mallee Land Use Agreement Reserve and north to beyond the boundary of Boree Plains Station. The species is considered most likely to breed in the aforementioned habitats within the study area and foraging only in the local occurrence of Sandhill Pine Woodland. Within this vast tract of continuous habitat, the Atlas-Campaspe Mine footprint would result in the removal of approximately 3,863 ha of potential habitat.

The Corben's Long-eared Bat was recorded during the current surveys at eight localities in the Atlas-Campaspe Mine MLA, with seven localities within the Atlas footprint and one locality within the Campaspe development area but outside the Campaspe footprint. This species were recorded from 10 localities outside the Project area in the current survey, including nine localities within the proposed offset area. There were no previous records from within the Atlas-Campaspe Mine footprint, but previous records from 10 localities in adjoining areas, including two within the proposed offset area, one in the eastern part of Mungo National Park and four in the Southern Mallee Land Use Agreement Reserve.

The Project would lead to a small decrease in the size of this population in this area. The proposed offset area could provide considerable protection and habitat enhancement within 15,830 ha of suitable habitat incorporating 11 known localities of the species.

The Ivanhoe Rail Facility would remove approximately 10 ha of potential breeding and foraging habitat, in Belah-Rosewood Woodland. The species may also forage along the treed edges of the Native Grassland. There is one database record of the species from the areas surround the Ivanhoe Rail Facility study area, approximately 1km to the north-east in the township of Ivanhoe. Only a relatively small area of potential foraging habitat would be removed in comparison to the large areas that would remain largely unaffected. Any local population of the species that could occur would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds. Known and predicted habitat occurs throughout much of the Darling Depressions (Part B) CMA sub-region (OEH 2012), so the species is unlikely to be geographically restricted at the Ivanhoe study area. The Project is unlikely to lead to a decrease in the size of a population in the Ivanhoe Rail Facility area, if one were to occur.

***Criterion 2: reduce the area of occupancy of an important population?***

The Corben's Long-eared Bat occupies a large distribution from far eastern South Australia and north-western Victoria through inland areas of NSW including the western slopes of the Great Dividing Range and the Upper Hunter Valley and extending northwards to southern central Queensland (Turbill & Ellis 2006). The Atlas-Campaspe Mine footprint would lead to the loss of 3,863 ha of potential habitat comprising of breeding and foraging Belah-Rosewood Woodland, Linear Dune Mallee, Sandplain Mallee, Black Box Woodland, Acacia Woodland/Shrubland and foraging only habitat Sandhill Pine Woodland. The Ivanhoe Rail Facility would remove approximately 10 ha of potential habitat, in Belah-Rosewood Woodland. Protection and habitat enhancement of potential habitat within the proposed offset area (15,830 ha) could provide considerable compensation for components of the local population outside the Atlas-Campaspe Mine footprint. A key rehabilitation objective for the Project would be to selectively place clay materials in low-lying portions of the re-profiled landform within the mine path to reinstate the water holding capacity of, and run-on to adjacent depressions. This would provide for the potential for species representative of Black Box Woodlands (e.g. *Eucalyptus largiflorens*) to establish. Following the re-establishment of the depression and run-on to it, and the establishment of these species, these depressions may provide potential habitat (following the development of hollows) for the Corben's Long-eared Bat. The action would lead to a small reduction in the species area of occupancy.

***Criterion 3: fragment an existing important population into two or more populations?***

The Atlas-Campaspe Mine footprint is located within an extensive area of continuous vegetation supporting a landscape patchwork of Belah-Rosewood Woodland, Linear Dune Mallee, Sandplain Mallee, Acacia Woodland/Shrubland that supports known locality records of the species to the north, south and west of the Atlas-Campaspe Mine footprint area. Further, individuals roosting in the surrounding areas are likely to fly and feed across the proposed mine site given this species has been documented to move over wide areas of up to 7 km (Lumsden *et al.* 2008). Consequently, it would not cause any part of the population to become isolated from the rest of the population, and so would not fragment the regional population. Similarly, potential habitat for the species would remain connected in the surrounds of the Ivanhoe Rail Facility, and therefore would not fragment any population in this area.

***Criterion 4: adversely affect habitat critical to the survival of a species?***

No critical habitat has been declared for the Corben's Long-eared Bat (SEWPaC 2012a). The locality is not identified in the National Recovery Plan (Schulz & Lumsden 2012) or on the SPRAT database (SEWPaC 2012b).

***Criterion 5: disrupt the breeding cycle of an important population?***

The Atlas-Campaspe Mine footprint would remove approximately 3,863 ha of potential habitat including seven known occurrence localities. Given lactating females were captured during surveys, the species is considered likely to breed in the area. Potential breeding cycle disruption would occur to only a small proportion of the regional population and the majority of the population would not be impacted. Habitat enhancement in the offset area could provide compensation to other components of the population outside the affected area. The progressive provision of artificial roosts (on post-mine rehabilitation) would be made and could further act to retain a component of the affected component of the population within the impact area.

Reduction in disruption of the breeding cycle of individuals within the footprint area would be to undertake all habit clearing outside the period when young are born and raised until independent. The Corben's Long-eared Bat gives birth in late spring/early summer and the young are flying and independent in January (Schulz & Lumsden 2012).

In relation to the Ivanhoe Rail Facility, only a relatively small area of potential foraging habitat would be removed in comparison to the large areas that would remain largely unaffected. Any local population of the species that could occur would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds. This small loss of habitat is unlikely to disrupt the breeding cycle of an important population.

***Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?***

Approximately 3,863 ha of breeding and foraging habitat comprising of Belah-Rosewood Woodland, Linear Dune Mallee, Sandplain Mallee, Black Box Woodland, Acacia Woodland/Shrubland, for the Corben's Long-eared Bat, would be cleared for the Atlas-Campaspe Mine footprint. A further 3 ha of foraging habitat in Sandhill Pine Woodland would also be cleared. The number of individuals of this species impacted by this action is unknown. However, the habitat loss would not affect the majority of the regional population but it would have impacts on a small proportion of this population. Over four times this area of known and potential habitat as listed above occurs in the proposed offset area, which would be managed to enhance its ecological viability and reduce existing threats to the Corben's Long-eared Bat occurring there. It is unlikely that The Project would lead to significant decline in the regional population.

Similarly, only a relatively small area of potential foraging habitat would be removed at the Ivanhoe Rail Facility, in comparison to the large areas that would remain largely unaffected. Any local population of the species that could occur would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds. This small loss of habitat is unlikely to cause the species to decline.

***Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?***

The Project would not result in the introduction of any harmful or invasive species being introduced to the Atlas-Campaspe study area or the Ivanhoe Rail Facility. A number of invasive species that have been identified as a threat to the Corben's Long-eared Bat exist in the area. The feral cat and fox are known to prey on the Corben's Long-eared Bat and exotic grazers (i.e. feral goats, rabbits and livestock) reduce food availability and alter vegetation structure. Integrated pest management within the proposed offset area together with current management in Mungo National Park and State Conservation Area that also are form a component of the regional population area would aim to reduce predation and competition pressures from invasive species.



***Criterion 8: introduce disease that may cause the species to decline?***

The Project would not lead to the introduction of any diseases that are potentially harmful to the Corben's Long-eared Bat. No mammalian diseases have been identified as a threat to the Corben's Long-eared Bat (Schulz & Lumsden 2012). The Project does not involve the movement of any animals, however it may involve the movement of biological products such as soil and seeds on the types of transport vehicles and when back-fill substrate is brought in. These products could harbour or transmit diseases that impact on wildlife. In general, no soil born disease is known to exist in the semi-arid region and as such should not be issue for the Corben's Long-eared Bat.

***Criterion 9: interfere substantially with the recovery of the species?***

The draft Recovery Plan for the Corben's Long-eared Bat (Schulz & Lumsden 2012) contains 12 objectives:

1. Clarify the current fine-scale distribution patterns and habitat requirements across the species' range.
2. Increase the understanding of critical aspects of the biology and ecology of the Corben's Long-eared Bat that will assist in the long-term management of the species.
3. Identify key populations and protect these from habitat loss and fragmentation.
4. Identify and implement appropriate fire regimes, and protect areas of old growth mallee and woodland from wildfire and fuel reduction burning.
5. Identify and minimise timber harvesting practices that may impact this species.
6. Identify impact of agrichemicals and reduce exposure where possible.
7. Identify impact of extractive industries, including coal seam gas and mineral sands exploration and extraction within forest areas and reduce exposure where possible.
8. Identify the extent of population fragmentation and instigate measures to increase habitat connectivity where recent isolation has occurred.
9. Identify and reduce the potential impact of feral species on key populations.
10. Based on results of ecological studies, conduct a threat analysis to identify key threatening processes.
11. Establish a long-term monitoring programme for key populations.
12. Build community support for the conservation of the Corben's Long-eared Bat.

The Project would be inconsistent with objectives 3 and 7. The exposure to impacts of habitat loss from extraction in the Project would be compensated through the protection and habitat enhancement of known and potential habitat within the offset area (15,830 ha) which incorporates a number of known localities of the species. The Project could potentially be inconsistent with objective 4. Mining and associated activities carry the risk of causing accidental wildfires and changing (increasing) the fire regime. However, a Fire Management Plan would be developed to minimise wildfire in the Project area and introduce appropriate regimes that benefit the Corben's Long-eared Bat and other wildlife species such as the Malleefowl (listed as vulnerable under the EPBC Act) in the offset area.

The offset would aim to compensate for habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes 15,830 ha of known and potential habitats. Improved fire management, integrated pest management and reduced grazing pressure would give considerable compensation to offset localised habitat loss. In these ways, The Project would assist with the implementation and success of the Recovery Plan. Further, the current surveys have assisted the draft Recovery Plan by identifying a new key population and contributing to the understanding of distribution patterns and habitat requirements for the species within south-western NSW. The Project would not interfere substantially with the recovery of the Corben's Long-eared Bat.

## Conclusion

The Atlas-Campaspe Mine study area is considered to be a component of an important population of the Corben's Long-eared Bat since capture rates of this species during the current surveys was amongst the highest recorded throughout this species' range (Schulz & Lumsden 2012) and is attributed to the large expanse of continuous habitat, much of which has remained unburnt for a long period of time (following Lumsden *et al.* 2008).

The Project is therefore considered likely to lead to a significant impact on the species according to EPBC Act criteria, on the basis that it would reduce the area of occupancy of the species and potentially lead to a small decrease in the size of the population.

The proposed offset area incorporates the majority of locality records of the species from outside the proposed development area and contains approximately 15,830 ha of potential habitat (four times that in the development footprint) that would be managed to enhance the species' viability. This would include management of wildfire, the protection of hollow-bearing and standing dead trees, reduced livestock grazing and integrated pest management. In this context the proposed mine would have only limited detrimental impacts on the regional population of the Corben's Long-eared Bat that would not lead to the extinction of the population.

Proposed compensation for any impacts through loss of habitat in the Atlas-Campaspe Mine footprint would include:

- Management of 15,830 ha of suitable habitats in the proposed offset area to improve their ecological viability.
- Implementation of integrated pest management in the Project area and proposed offset area to reduce impacts of heavy grazing on the habitat occupied by the Corben's Long-eared Bat
- Implementation of integrated pest management in the Project area and proposed offset area to reduce impacts of predation on the Corben's Long-eared Bat by the feral cat and fox.
- Reduced stock grazing in the Project area and proposed offset area to enhance foraging habitat and prey densities.
- Implementation of fire management to ensure the retention of broad scale unburnt areas.
- Progressive placement of bat roosts in post-mine rehabilitation areas.

The Ivanhoe Rail Facility would only result in a small loss of potential foraging habitat, which is unlikely to be important for a local population the species, were one to exist in the area.

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## Appendix E: Listed migratory species

Species listed as Migratory under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) predicted to have potential to occur within the locality for both the Atlas Campaspe Mine, Ivanhoe Rail Facility Study Area and surrounds.

**Note:** two listed migratory species which have been recorded within the Project area or surrounds, the Australian Painted Snipe and the Malleefowl, are also listed as threatened under the EPBC Act. These species have been assessed using the ‘significant impact criteria’ for vulnerable species, as required in the *Significant Impact Guidelines 1.1: Matters of National Environmental Significance* (Commonwealth Department of the Environment, Water, Heritage and the Arts, 2009).

| Common Name             | Scientific Name               | Status within the Project area and surrounds                         | Distribution and Breeding Biology                                 | Significant Impact Criteria  |   |  |   |
|-------------------------|-------------------------------|--|---|--|---|--|---|
|                         |                               |  |   | Substantially modify, destroy or isolate an area of important habitat?   | Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat?  | Seriously disrupt the life cycle of an ecologically significant proportion of the population?  | Conclusion  |
| Cattle Egret            | <i>Ardea ibis</i>             | Predicted  | Widespread throughout Australia. Breeding occurs in colonies.     | a) Potential habitat is extremely limited in the Project area and surrounds. Species might occur occasionally during suitable conditions, but not a significant proportion of the national population.   | The Project would not result in an invasive species becoming established in the area.   | The floodplain areas could provide habitat for these species during favourable conditions, but are unlikely to constitute important breeding or feeding habitat for a significant portion of the population. Further, the migration or resting behaviour would not be disrupted. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of these migratory species. | No significant impact is expected from the Project. |
| Great Egret             | <i>Ardea alba</i>             | Predicted / Recorded near the Ivanhoe Rail Facility study area only. | Widespread throughout Australia. Breeding occurs in colonies.     | b) No colonial breeding sites in the study area suitable for these species, so habitat not important for a significant proportion of the national population.<br>c) Widely distributed species, not at the limit of their ranges.<br>d) Species are not listed as threatened, therefore are not considered to be in decline.   | No ‘important habitat’ for the listed migratory species under consideration exists in the study area.   |  |   |
| White-bellied Sea-Eagle | <i>Haliaeetus leucogaster</i> | Predicted / Database record from locality.                           | Widespread throughout Australia, in close proximity to waterways. | a) Only small, widely dispersed numbers potentially in the locality, so not a significant proportion of the national population.<br>b) Breeding very unlikely to occur in the locality as this species stays in close proximity to main waterways.<br>c) Widely distributed species, not at the limits of its range.<br>d) Habitat that would be removed is not in an area where the species is decline. | The Project would not result in any invasive species becoming established in the area.<br><br>No ‘important habitat’ for the listed migratory species under consideration exists in the locality. | The study area does not support important breeding or feeding habitat, and would not disrupt the migration or resting behaviour of any migratory species. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of this migratory species.   | No significant impact is expected from the Project. |

| Common Name               | Scientific Name              | Status within the Project area and surrounds                            | Distribution and Breeding Biology  | Significant Impact Criteria  |   |   |   |
|---------------------------|------------------------------|---|--|--|---|---|---|
|                           |                              |   |  | Substantially modify, destroy or isolate an area of important habitat?   | Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat?  | Seriously disrupt the life cycle of an ecologically significant proportion of the population?   | Conclusion  |
| White-throated Needletail | <i>Hirundapus caudacutus</i> | Predicted   | Widespread migrant to Australia (Oct-Mar). Breeds in Asia. Aerial species, travelling large distances and not reliant on specific terrestrial habitats.                      | a) Only small, widely dispersed numbers potentially in the locality, so not a significant proportion of the national population.<br>b) No breeding occurs in the study area, so habitat not important for a significant proportion of the national population.   | The Project would not result in any invasive species becoming established in the area.<br><br>No 'important habitat' for the listed migratory species under consideration exists in the locality. | The study area does not support important breeding or feeding habitat, and would not disrupt the migration or resting behaviour of these migratory species. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of these migratory species.   | No significant impact is expected from the Project. |
| Fork-tailed Swift         | <i>Apus pacificus</i>        | Predicted   | Widespread migrant to eastern and northern Australia (Oct-Mar). Breeds in Asia. Aerial species, travelling large distances and not reliant on specific terrestrial habitats. | c) Widely distributed species, not at the limits of their ranges.<br>d) Species are not listed as threatened and therefore are not considered to be in decline.  |   |   |   |
| Latham's Snipe            | <i>Gallinago hardwickii</i>  | Predicted   | Non-breeding migrant to south eastern Australia. Habitat includes wetlands with dense ground cover.  | a) Only small numbers potentially in floodplain areas during suitable conditions, but not a significant proportion of the national population.<br>b) No breeding occurs in the study area, so habitat not important for a significant proportion of the national population.<br>c) Widely distributed species, not at the limits of their ranges.<br>d) The habitat to be removed is not the preferred breeding or feeding habitat and would therefore not increase the decline of this species. | The Project would not result in any invasive species becoming established in the area.<br><br>No 'important habitat' for the listed migratory species under consideration exists in the locality. | The floodplain areas could provide foraging habitat for this species during favourable conditions, but are unlikely to constitute important habitat. The species is a non-breeding migrant, and the Project is unlikely to disrupt the migration or resting behaviour of this species. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of this migratory species. | No significant impact is expected from the Project. |
| Common Greenshank         | <i>Tringa nebularia</i>      | Database record from the locality of the Atlas-Campaspe Mine footprint. | Non-breeding migrant to Australia. Habitat includes mudflats, estuaries, lake margins, saltmarshes and wetlands.   | a) This species could occur in small numbers in floodplain areas during suitable conditions, but unlikely to constitute a significant proportion of the national population.<br>b) No breeding occurs in the study area, so habitat not important for a significant proportion of the national population.<br>c) Widely distributed species, not at the limits of its range.<br>d) Species is not listed as threatened, therefore are not considered to be in decline.                           | The Project would not result in any invasive species becoming established in the area.<br><br>No 'important habitat' for the listed migratory species under consideration exists in the locality. | The floodplain areas could provide foraging habitat for this species during favourable conditions, but are unlikely to constitute important habitat. The species is a non-breeding migrant, and the Project is unlikely to disrupt the migration or resting behaviour of this species. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of this migratory species. | No significant impact is expected from the Project. |

| Common Name       | Scientific Name       | Status within the Project area and surrounds                          | Distribution and Breeding Biology  | Significant Impact Criteria  |   |  |   |
|-------------------|-----------------------|---|--|--|---|--|---|
|                   |                       |   |  | Substantially modify, destroy or isolate an area of important habitat?   | Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat?  | Seriously disrupt the life cycle of an ecologically significant proportion of the population?  | Conclusion  |
| Rainbow Bee-eater | <i>Merops ornatus</i> | Recorded within the Atlas-Campaspe Mine study footprint or surrounds. | Widespread over most of Australia. Breeds mostly in northern Australia, in excavated burrows in sandy banks. | a) The species is likely to forage throughout the study area, in widely dispersed numbers, mostly as non-breeding migrant. Breeding could occur in small numbers, but not a significant proportion of the national population.<br>b) Breeding could occur in the study area but not a significant proportion of the national population as breeding locations are known to be widespread throughout Australia.<br>c) Widely distributed species, not at the limits of its range.<br>d) Habitat that would be removed is not in an area where the species is decline. | The Project would not result in any invasive species becoming established in the area.<br><br>No 'important habitat' for the listed migratory species under consideration exists in the locality. | The species could potentially breed in the study area, but given breeding locations are widespread throughout Australia, the study area is unlikely to constitute 'important' breeding habitat for a significant proportion of the national population. Therefore, the Project would not disrupt the life cycle of an ecologically significant proportion of a population of this migratory species. | No significant impact is expected from the Project. |

Note: This table summarises the impact assessment for migratory species listed under the EPBC Act that were recorded or predicted to potentially occur in the study area. The impact assessment follows the 'significant impact criteria' as outlined in the EPBC Act, *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (Commonwealth Department of the Environment, Water, Heritage and the Arts, 2009).

Appendix F: Habitat assessment data

Appendix Table F-1: Habitat assessment data collected throughout the Atlas-Campaspe Mine footprint, Mineral Concentrate Transport Route, the proposed offset area and Mungo National Park.

| Site           | Easting | Northing | Fire | Clearing | Logging | Grazing | Weeds | Tracks | Soil Depth | Soil type | Dom ground layer                         | Tree layer % | Ave Tree height | Age structure | Shrub layer % | Avg Shrub Height % | Ground layer % | Crypto crust % | % cover veg | % cover log > 15 cm | % cover bare soil | % cover litter | Litter depth (cm) | No. Large Dead Trees | Trees with hollows | Bark score | Small Hollows | Medium Hollows | Large Hollows | Basal Hollows | Fissures | Stumps | Fallen Branches | Spinifex Condition/ Density | lg logs |
|----------------|---------|----------|------|----------|---------|---------|-------|--------|------------|-----------|--|--------------|-----------------|---------------|---------------|--------------------|----------------|----------------|-------------|---------------------|-------------------|----------------|-------------------|----------------------|--------------------|------------|---------------|----------------|---------------|---------------|----------|--------|-----------------|-----------------------------|---------|
| RD3            | 721745  | 6247960  | 0    | 0        | 0       | 0-1     | 0     | 0-1    | 1          | 3         | Tussock/ Grass & Lichen                  | 30           | 8               | E-M-O         | 2             | 2                  | 20             | 60             | 75          | 11                  | 20                | 5              | 0.5               | 30                   | 50                 | 0          | 100           | 15             | 0             | 0             | Absent   | 0      | 5               | 0                           | 130     |
| RD4            | 722245  | 6242369  | 0-1  | 1        | 2       | 0-1     | 0     | 0-1    | 1          | 1         | Tussock/Grass                            | 30           | 9               | M             | 0             |                    | 50             |                | 70          | 100                 | 15                | 15             | 1.5               | 50                   | 6                  | 3          | 6             | 0              | 0             | 0             | Abundant | 4      | 5               | 0                           | 50      |
|                |         |          |      |          |         |         |       |        |            |           |  |              |                 |               |               |                    |                |                |             |                     |                   |                |                   |                      |                    |            |               |                |               |               |          |        |                 |                             |         |
| RD1 West       | 734941  | 6243034  | 0    | 0        | 0       | 3       | 0-1   | 0      | 1          | 3         | Herb/Grass                               | 0            |                 |               | 0             |                    | 50             | 2              | 55          | 0                   | 45                | 0              |                   | 1                    |                    | 0          |               |                |               | Absent        | 0        | 1      | 0               | 0                           |         |
| RD1 North      | 736596  | 6243781  | 0    | 0        | 0       | 3       | 0-1   | 2      | 1          | 2         | Herb/Grass                               |              |                 |               |               |                    | 60             |                | 70          |                     | 25                | 5              | 0.1               | 0                    |                    | 0          |               |                |               |               | 0        | 0      | 0               |                             |         |
| RD2 South      | 737156  | 6248474  | 0    | 0        | 0       | 1       | 0-1   | 0-1    | 1          | 2         | Herb/Grass                               | 0            |                 |               | 0             | 1                  | 90             | 80             | 90          |                     | 10                | 3              | <0.1              | 0                    |                    | 0          |               |                |               |               |          | 0      | 0               | 0                           |         |
| RD2 East       | 738792  | 6249845  | 0    | 0        | 0       | 1       | 0-1   | 0-1    | 1          | 2         | Herb/Grass                               |              |                 |               |               |                    | 70             | 5              | 70          | 0                   | 25                | 5              | 0.1               | 0                    |                    | 0          |               |                |               |               |          | 0      | 0               | 0                           |         |
| RD1            | 736176  | 6242503  |      |          |         | 3       | 0-1   | 3      | 1          | 3         | Herb/Grass                               | 0            |                 |               | 0             |                    | 5              | 5              | 80          | < 1                 | 10                | 10             |                   | 0                    |                    | 0          |               |                |               |               |          | 0      |                 |                             |         |
| RD2            | 737456  | 6249826  | 0    | 0        | 0       | 2       | 0-1   | 1      | 1          | 2         | Tussock/Grass & Lichen & Chenopod Shrubs | 0            |                 |               | 0             |                    | 85             |                | 85          | 0                   | 1-2               | 0              | 0                 | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             | Absent   | 0      | 0               | 0                           | 0       |
| CR3 C          | 720200  | 6253681  | 1    | 0        | 0       | 0-1     | 0     | 0-1    | 1          | 3         | Hummock/ Grass & Herb/ Grass             | 30           | 8               | E-M           | 1             | 1.5                | 50             | 70             | 75          | 0                   | 20                | 5              | 0.5               | 3                    | 3                  | 1          | 6             | 0              | 0             | 0             | Rare     | 0      | 3               | 0                           | 15      |
| HACamp         | 722154  | 6246224  | 0    | 0        | 0       | 1       | 0-1   | 1      | 1          | 3         | Tussock/Grass                            | 20           | 8               | M-L-O         |               |                    | 50             | 30             | 80          | 11                  | 25                | 25             | 0.5               | 30                   | 3                  | 3          | 10            | 1              | 0             | 0             | Abundant | 0      | 5               | 0                           | 45      |
| Haul Rd Admin  | 721713  | 6248405  | 0    | 0        | 0       | 0-1     | 0-1   | 0      | 1          | 3         | Tussock/Grass & Cryptogamic crust        | 50           | 8               | E-M-O-L       | 1             | 2                  | 60             | 30             | 60          | 1                   | 15                | 5              |                   | 13                   | 20                 | 3          | 39            | 0              | 0             | 2             | Abundant | 0      | 5               | 0                           | 200     |
| BB1 400W       | 717215  | 6256576  | 0    | 0        | 1       | 3       | 1     | 3      | 1          | 2         | Herb/Grass                               | 10           | 10              | E-M-L-O       |               |                    | 70             |                | 80          | 6                   | 15                | 5              | < 0.5             | 27                   | 10                 | 1          | 45            | 2              | 0             | 1             | Common   | 0      | 4               | 0                           | 5       |
| AC1            | 719709  | 6245055  | 0    | 0        | 0       | 1       | 0-1   | 1      | 1          | 3         | Tussock/Grass                            | 45           | 10              | E-M-O         |               |                    | 20             | 3              | 40          | 0                   | 55                | 5              | 0.5               | 10                   | 2                  | 2          | 2             | 0              | 0             | 0             | Common   | 0      | 4               | 0                           | 2       |
| AR3            | 717410  | 6248715  | 1    | 0        | 0       | 0       | 0     | 0      | 1          | 3         | Tussock/Grass & Herb/Grass               | 15           | 15              | E-M-L-O       |               |                    | 20             | 60             | 30          | 12                  | 68                | 2              | 0.5               | 3                    | 0                  | 0          | 0             | 0              | 0             | 1             | Abundant | 0      | 4               | 0                           | 12      |
| YS1            | 714610  | 6251361  | 0    | 3        | 0       | 1       | 0-1   |        | 1          | 3         | Herb/Grass                               | 0            |                 |               | 0.5           | 1.5                | 80             | 10             | 90          |                     | 5                 | 5              |                   |                      | 0                  | 0          | 0             | 0              | 0             | 0             |          | 0      | 2               | 0                           | 0       |
| Hautilities    | 720723  | 6249594  | 0    | 0        | 0       | 0-1     | 0-1   | 0      | 1          | 3         | Tussock/Grass                            | 60           | 4               | Y-E           | 5             | 1.5                | 30             | 50             | 70          | 0                   | 30                | 30             |                   | 2                    | 1                  | 1          | 1             | 0              | 0             | 0             | Absent   | 0      | 2               | 2                           | 0       |
| MFTOP1         | 710898  | 6252909  | 0    | 0        | 0       | 1       | 0     | 1      | 1          | 3         | Spinifex                                 |              | 4               | M             |               | 2                  |                |                | 50          | 5                   | 30                | 15             | 1                 | 0                    | 2                  | 2          | 2             | 0              | 0             | 0             | Rare     | 0      | 5               | 4                           | 0       |
| CM4            | 718204  | 6256069  | 0    | 0        | 0       | 1       | 0     |        | 1          | 1         | Hummock/ Grass                           | 35           | 4               |               |               |                    | 60             |                | 60          | 1                   | 30                | 0              |                   | 0                    | 4                  | 1          | 5             | 0              | 0             | 0             | Absent   | 0      | 0               | 4                           | 45      |
| 160m N CR3     | 720197  | 6253933  | 0    | 0        | 0       | 0-1     | 0     |        | 1          | 1         | Tussock/Grass                            | 70           | 4.5             | E-M           | 5             | 2                  | 15             | 30             | 75          | 0                   | 20                | 5              | 0.1-0.2           | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent   | 0      | 1               | 1                           | 0       |
| IR2            | 247974  | 6355097  | 0    | 3        | 0       | 1       | 2     | 2      | 3          | 2         | Herb/Grass                               | 0            |                 |               | 0.5           | 2.5                | 95             |                | 95          |                     | 4.5               | 0.5            | 0.05              |                      | 0                  | 0          | 0             | 0              | 0             | 0             |          | 0      | 0               | 0                           | 0       |
| IR1            | 246383  | 6355325  | 0    | 2        | 0       | 0       |       | 2      |            | 2         | Herb/Grass                               | 0            |                 | M-E-O         | 5             |                    | 85             | 3              | 85          |                     | 10                | 5              | 0.05              | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             |          | 0      | 0               | 0                           | 7       |
| MBR2           | 703634  | 6261692  | 0    | 0        | 1       | 0       | 0     | 1      | 1          | 3         | Lichen                                   | 60           | 10              | E-M-L         |               |                    | 40             | 70             | 75          | 40                  | 20                | 5              | 0.5               | 3                    | 3                  | 2          | 3             | 0              | 0             | 0             | Abundant | 1      | 4               | 0                           | 5       |
| MBR1           | 703322  | 6257699  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 3         | Tussock/Grass & Lichen                   | 25           | 15              | M-L O-E       | 0             |                    | 60             | 20             | 60          | 85                  | 10                | 20             | 2                 | 6                    | 2                  | 2          | 4             | 0              | 0             | 1             | Abundant | 0      | 3               | 0                           | 85      |
| HABr11         | 706372  | 6268082  | 0    | 0        | 2       | 0       | 0     | 0      | 1          | 3         | Herb/Grass                               | 25           | 12              | E-L-M         | 5             |                    | 60             | 5              | 70          | 23                  | 5                 | 15             | 1.5               | 2                    | 1                  | 1          | 1             | 0              | 0             | 0             | Rare     | 1      | 4               | 0                           | 0       |
| HASM1          | 703045  | 6265845  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Herb/Grass                               | 20           | 8               | E-M-L         | 1             | 2                  | 60             | 70             | 70          | 0                   | 20                | 10             | 1                 | 2                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent   | 0      | 3               | 0                           | 0       |
| HASM4          | 705217  | 6261360  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Herb/Grass                               | 50           | 10              | E-L-M         |               |                    | 30             | 10             | 60          | 5                   | 30                | 10             |                   | 2                    | 0                  | 3          | 2             | 0              | 0             | 0             | Rare     | 0      | 4               | 0                           | 5       |
| SMAA           | 712085  | 6250474  | 0    | 0        | 0       | 1       | 0     | 1      | 1          | 1         | Saltbush                                 | 40           | 5               | E-M           | 10            | 2                  | 40             |                | 60          | 0                   | 25                | 15             | 1                 | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent   | 0      | 5               | 0                           | 0       |
| SM1 Mungo NP   | 701942  | 6266037  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Tussock/Grass & Herb/Grass & Lichen      | 20           | 7               | E-M-L         |               |                    | 50             | 30             | 70          | 0                   | 5                 | 5              | 0.5               | 1                    | 0                  | 1          | 1             | 0              | 0             | 0             | Rare     | 0      | 1               | 0                           | 0       |
| MDM2           | 701853  | 6268230  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass Herb/ Grass               | 5            | 8               | E-L           | 1             | 2                  | 70             | 5              | 75          | 1                   |                   | 15             | 10                | 1                    | 1                  | 0          | 1             | 0              | 0             | 0             | Absent   | 0      | 1               | 4                           | 0       |
| MDM1           | 701691  | 6260819  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Tussock/Grass & Hummock/ Grass           | 20           | 8               | M-L           | 1             | 1.5                | 30             | 20             | 50          | 0                   | 40                | 10             |                   | 11                   | 1                  | 3          | 5             | 0              | 0             | 0             | Absent   | 0      | 1               | 5                           | 3       |
| near MT7 Start | 700812  | 6267292  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Lichen & Hummock/ Grass                  | 30           | 7               | M-L           |               |                    | 60             | 10             | 70          |                     | 20                | 10             | 0.1               | 3                    | 3                  | 3          | 3             | 0              | 0             | 0             | Absent   | 0      | 3               | 4                           | 0       |
| MT-3- Middle   | 702672  | 6266234  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass & Lichen                  | 15           | 10              | E-M           | 0             |                    | 50             | 10             | 70          | 0                   | 20                | 10             | 1                 | 0                    | 0                  | 3          | 0             | 0              | 0             | 0             | Absent   | 0      | 2               | 4                           | 0       |

| Site         | Easting | Northing | Fire | Clearing | Logging | Grazing | Weeds | Tracks | Soil Depth | Soil type | Dom ground layer                           | Tree layer % | Ave Tree height | Age structure | Shrub layer % | Avg Shrub Height % | Ground layer % | Crypto crust % | % cover veg | % cover log > 15 cm | % cover bare soil | % cover litter | Litter depth (cm) | No. Large Dead Trees | Trees with hollows | Bark score | Small Hollows | Medium Hollows | Large Hollows | Basal Hollows | Fissures | Stumps | Fallen Branches | Spinifex Condition/ Density | lg logs |
|--------------|---------|----------|------|----------|---------|---------|-------|--------|------------|-----------|--|--------------|-----------------|---------------|---------------|--------------------|----------------|----------------|-------------|---------------------|-------------------|----------------|-------------------|----------------------|--------------------|------------|---------------|----------------|---------------|---------------|----------|--------|-----------------|-----------------------------|---------|
| MSM1         | 704814  | 6266447  | 0    | 0        | 0       | 0       | 0     | 1      | 1          | 1         | Herb/Grass                                 | 30           | 4               | E             | 5             | 1.5                | 50             | 5              | 60          | 0                   | 30                | 10             |                   | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent   | 0      | 2               | 2                           | 0       |
| Grassy Site  | 701525  | 6259054  | 0    | 2        | 0       | 1       | 0     | 0      | 1          | 3         | Tussock/Grass                              | 5            | 11              | M-L           | 2             | 2                  | 60             | 10             | 70          | 2                   | 10                | 15             | 1.5               | 1                    | 2                  | 0          | 2             | 0              | 0             | Rare          | 0        | 2      | 0               | 11                          |         |
| BRH1         | 717101  | 6246209  | 0    | 1        | 0       | 1       | 0     | 0      | 2          | 3         | Other (Shrubs) subdominant Lichen          | < 5          | 15              | L             |               | 1                  | 20             |                | 70          | 2                   | 25                | 5              | 1                 | 0                    | 3                  | 0          | 7             | 1              | 0             | 0             | Absent   | 0      | 5               | 0                           | 40      |
| OWL 4        | 713175  | 6255839  | 0    | 0        | 0       | 1       | 1     | 0      | 1          | 2         | Herb/Grass                                 | 30           | 15              | M             | 2             | 4                  | 30             |                | 45          | 3                   | 15                | 33             | < 0.50            | 1                    | 3                  | 1          | 5             | 0              | 0             | Rare          | 0        | 3      | 0               | 5                           |         |
| BR1 S offset | 714944  | 6256141  | 0    | 0        | 0       | 1       | 0     | 0      | 1          | 2         | Herb/Grass                                 | 15           | 11              | L             | 5             | 5                  | 22             |                | 50          | 2                   | 23                | 25             | 0.5               | 0                    | 3                  | 0          | 3             | 0              | 0             | Rare          | 0        | 5      | 0               | 3                           |         |
| Gilbert      | 712583  | 6251437  | 0    | 0        | 0       | 1       | 0     | 1      | 2          | 3         | Saltbush                                   | 20           | 18              | M             | 5             | 2                  | 40             |                | 60          | 10                  | 10                | 20             | 1                 | 2                    | 2                  | 1          | 2             | 0              | 0             | Rare          | 0        | 5      | 0               | 50                          |         |
| BB1          | 717238  | 6253472  | 0    | 3        | 0       | 2       | 1     | 0      | 1          | 2         | Herb/Grass                                 | 6            | 10.5            | E             | 2             | 1                  | 20             |                | 25          | 1                   | 10                | 65             | < 0.5             | 0                    | 7                  | 1          | 36            | 0              | 0             | 1             | Rare     | 0      | 5               | 0                           | 4       |
| BB1-Flood    | 712979  | 6246025  | 0    | 3        | 0       | 3       | 3     | 2.3    |            |           | Herb/Grass                                 | 15-20        |                 | Y-E some L    | 2-5           |                    | 10             |                | 20          | 0                   | 60                | 2-5            | > 0.1             | 3                    | 3                  | 1          | 15            | 1              | 0             | 1             | Rare     | 0      | 3               | 0                           | 0       |
| BR3          | 713266  | 6259829  | 1    | 2        | 2       | 2-3     | 1     |        | 3          |           | Other (Bluebush & needles)                 | 15-20        | 7               | M-L           | 10-15         | 0.75               | 10             |                | 20          | 3                   | 30                | 10             | 0.1               | 0                    | 0                  | 1          | 0             | 0              | 0             | Rare          | 4        | 2      | 0               | 1-2                         |         |
| BR2          | 712043  | 6250158  | 0    | 2-3      | 0       | 2-3     | 1     | 1      |            |           |  |              |                 | E-M some L    |               |                    |                |                | 20          | 0                   | 40                | 10             | 0.1               | 1                    | 2                  | 1          | 2             | 0              | 0             | 1             | Rare     | 0      | 2               | 0                           | 0       |
| BR1          | 714928  | 6256162  | 0    | 1-2      | 0       | 1-2     | 1     | 1      | 2          | 1         | Hummock/ Grass & Herb/ Grass               | 35           |                 | M-L           |               |                    |                |                | 65          | 0                   | 15                | 15-20          | 0.1-0.2           | 3                    | 6                  | 0          | 6             | 0              | 0             | 0             | Rare     | 0      | 4               | 0                           | 0       |
| Offset BR2   | 712020  | 6250160  | 1    | 0        | 0       | 1       | 0     | 2      | 2          | 3         | Tussock/Grass & Lther (Chenopod/ saltbush) | 10           | 10              | M             |               | 1.5                |                |                | 50          | 5                   | 30                | 15             | < 1               | 1                    | 2                  | 1          | 2             | 1              | 0             | 2             | Common   | 0      | 5               | 0                           | 15      |
| DMH7         | 718118  | 6245815  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | 15           | 5               | Y             | < 2           | 1                  | 15             |                | 15          | < 1                 | 50                | 35             | 0-2               | 0                    | 0                  | 3          | 0             | 0              | 0             | 0             | Absent   | 0      | 3               | 4                           | 3       |
| SM HAB3      | 711141  | 6264986  | 0    | 1        | 0       | 1       | 2     | 1      | 1          | 1         | Tussock/Grass                              | 40           | 4               | E             | 10            |                    | 30             | 5              | 30          | 0                   | 40                | 20             | 1-2               | 0                    | 9                  | 2          | 0             | 0              | 0             | 11            | Rare     | 0      | 5               | 2                           | 0       |
| SMHAB1       | 706998  | 6267334  | 0    | 0        | 0       | 2       | 2     | 1      | 1          | 1         | Tussock/Grass                              | 15           | 7               | Y-M           | 10            |                    | 40             | 20             | 40          | < 5                 | 30                | 30             | 3                 | 0                    | 7                  | 2          | 7             | 1              | 0             | 6             | Common   | 0      | 5               | 1                           | 10      |
| SMBB         | 714401  | 6248062  | 0    | 0        | 0       | 1       | 0     | 1      | 1          | 1         | Tussock/Grass & Saltbush                   | 10           | 8               | M             | 5             | 2                  | 40             |                | 55          | 2                   | 15                | 28             | 1.3               | 15                   | 4                  | 3          | 10            | 2              | 0             | 0             | Rare     | 0      | 5               | 0                           | 15      |
| OWL 6        | 714392  | 6249086  | 0    | 0        | 0       | 1       | 0     | 1      | 1          | 1         | Saltbush                                   | 10           | 4               | M             | 1             | 3                  | 50             |                | 55          | 2                   | 30                | 13             | 0.1               | 2                    | 3                  | 0          | 6             | 0              | 0             | 0             | Absent   | 0      | 5               | 0                           | 6       |
| SPH2         | 705225  | 6259788  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 3         | Tussock/Grass                              | 10           | 7               | L             | < 5           | 0.5                | 20             |                | 35          | 3                   | 60                | 5              | 0-2               | 8                    | 5                  | 3          | 9             | 0              | 0             | 0             | Rare     | 0      | 5               | 0                           | 60      |
| SPH3         | 706927  | 6260143  | 0    | 2        | 0       | 1       | 0     | 2      | 1          | 3         | Tussock/Grass & Lichen                     | 20           | 8               | E-M           | < 5           | 0.5                | < 5            |                | 35          | < 5                 | 35                | 30             | 0-3               | 4                    | 3                  | 3          | 1             | 3              | 0             | 0             | Rare     | 0      | 5               | 0                           | 69      |
| SPH1         | 706026  | 6257122  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 2-Mar     | Chenopods                                  | 15           | 8               | M             | 2             | 1.5                | 47             |                | 65          | 2                   | 8                 | 25             | < 0.5             | 10                   | 0                  | 3          | 10            | 0              | 0             | Absent        | 0        | 5      | 0               | 5                           |         |
| DM6 N        | 710130  | 6266848  | 0    | ?        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | 30           | 4               | Y-L           | 30            | 1.5                | 20             | 10             | 30          | 0                   | 40                | 30             | 0.5               | 0                    | 5                  | 3          | 0             | 0              | 0             | 7             | Absent   | 0      | 5               | 5                           | 0       |
| DM7 N        | 716141  | 6268594  | 3    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | < 5          | 2               | Y-L           | 40            | 2                  | 5              | 10             | 40          | 0                   | 50                | < 5            | < 1               | 0                    | 0                  | 1          | 0             | 0              | 0             | Rare          | 0        | 5      | 5               | 0                           |         |
| DM7 OPP      | 713225  | 6268441  | 3    | 0        | 0       | 1       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | 10           | 3               | Y             | 5             | 1.5                | 20             | 20             | 40          | 0                   | 40                | < 5            | < 1               | 0                    | 0                  | 2          | 0             | 0              | 0             | Rare          | 0        | 5      | 4               | 0                           |         |
| DMHAB1       | 712783  | 6266056  | 0    | ?        | 0       | 1       | 0     | 1      | 1          | 1         | Hummock/ Grass                             | 10           | 4               | Y-L           | 10            | 3                  | 20             | 10             | 30          | 0                   | 60                | 10             | < 1               | 1                    | 7                  | 1          | 0             | 0              | 0             | 13            | Rare     | 0      | 5               | 5                           | 0       |
| DMHAB3       | 707550  | 6268617  | 0    | 0        | 0       | 1       | 1     | 1      | 1          | 1         | Hummock/ Grass                             | 30           | 7               | E-M           | 15            | 2                  | 20             | 10             | 20          | 0                   | 60                | 20             | 1-2               | 1                    | 4                  | 2          | 0             | 0              | 0             | 6             | Rare     | 0      | 5               | 4                           | 10      |
| DMHAB4       | 710906  | 6267993  | 0    | 0        | 0       | 1       | 1     | 0      | 1          | 1         | Hummock/ Grass                             | 30           | 5               | E             | < 5           | 1.5                | 30             | 10             | 40          | 0                   | 50                | 10             | 0-4               | 0                    | 7                  | 2          | 0             | 0              | 0             | 8             | Rare     | 0      | 5               | 4                           | 0       |
| DM1          | 710239  | 6259948  | 0    | 1        | 0       | 1       | 0     | 1      | 1          | 1         | Hummock/ Grass                             | 30           | 4               | E-M           | 5-10          | 1                  | 40             |                | 30          | 8                   | 5-10              | 20             | 0.2-0.3           | 0                    | 0                  | 3          | 0             | 0              | 0             | Rare          | 0        | 3      | 4               | 0                           |         |
| DM2          | 711518  | 6272074  | 0    | 0        | 0       | 1-2     | 0     | 1      |            | 1         | Hummock/ Grass                             | 25-30        | 4               |               | 20            | 1.25               | 20             |                |             |                     |                   |                |                   | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent   | 0      | 5               | 3                           | 0       |
| DM3          | 712031  | 6256983  | 0    | 1        | 0       | 1       | 1     | 1      | 1          | 1         | Hummock/ Grass                             | 25           |                 | E-M           | 5             |                    | 30             |                | 75          | 0                   | 25                | 25             | 0.2               | 0                    | 0                  | 3          | 0             | 0              | 0             | 0             | Absent   | 0      | 4               | 4                           | 0       |
| DM4          | 705742  | 6263349  | 0    | 0        | 0       | 1       | 0     | 0      | 1          |           | Hummock/ Grass                             | 30           |                 |               | 20            |                    | 35-40          |                |             | 0                   | 20                |                | 0.1-0.2           | 0                    | 1                  | 2          | 0             | 0              | 0             | Absent        | 1        | 4      | 4               | 0                           |         |
| DM5          | 715688  | 6246786  | 0    | 1        | 0       | 1       | 1     | 1      | 1          | 1         | Hummock/ Grass                             | 35           | 4               | E-M some L    | 5             | 0.5                | 40             |                | 50-55       | 0                   | 15-20             | 20             | 0.1-0.2           | 0                    | 2                  | 3          | 0             | 0              | 0             | Rare          | 0        | 3      | 4               | 0                           |         |
| DMH4         | 712699  | 6255603  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | 15           | 5               | Y-E-M-L       | 2             | 1                  | 45             |                | 45          | < 1                 | 30                | 15             | 0-5               | 6                    | 6                  | 3          | 7             | 0              | 0             | 0             | Rare     | 0      | 3               | 4                           | 27      |
| DMH3         | 706958  | 6256399  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Tussock/Grass                              | 15           | 5               | E             | 1             | 1                  | 35             |                | 30          | 1                   | 50                | 20             | 0-2               | 3                    | 0                  | 3          | 0             | 0              | 0             | Absent        | 0        | 4      | 4               | 28                          |         |
| BR3          | 713266  | 6259829  | 1    | 2        | 2       | 2-3     | 1     |        | 3          |           | Other (Bluebush & needles)                 | 15-20        | 7               | M-L           | 10-15         | 0.75               | 10             |                | 20          | 3                   | 30                | 10             | 0.1               | 0                    | 0                  | 1          | 0             | 0              | 0             | Rare          | 4        | 2      |                 | 1-2                         |         |
| DMH2         | 708324  | 6255267  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Tussock/Grass                              | 10           | 6               | E             | 1             | 1                  | 45             |                | 55          | 0                   | 5                 | 40             | < 0.5             | 3                    | 3                  | 3          | 3             | 0              | 0             | 0             | Absent   | 0      | 5               | 4                           | 0       |
| DMH1         | 709132  | 6254198  | 0    | 0        | 0       | 0       | 0     | 0      | 1          | 1         | Hummock/ Grass                             | 10           | 5               | M-L           | 5             | 1                  | 20             |                | 40          | 1                   | 80                | 30             | 0.5               | 0                    | 0                  | 3          | 0             | 0              | 0             | Rare          | 0        | 5      | 4               | 11                          |         |
| DM3 S        | 712077  | 6256992  | 0    | 0        | 0       | 1       | 0     | 0      | 1          | 1         | Hummock/ Grass & Lichen                    | 5            | 5               | L             | 1             | 1.5                | 45             |                | 45          | 0                   | 10                | 45             | < 0.5             | 8                    | 8                  | 3          | 12            | 0              | 0             | 0             | Rare     | 0      | 1               | 4                           | 0       |
| DMH6         | 719093  | 6249701  | 0    | 0        | 0       | 1       | 0     | 0      | 1          | 1         | Hummock/ Grass & Lichen                    | 10           | 5               | Y             | 1             | 1                  | 15             |                | 40          | < 5                 | 40                | 20             | 0-2               | 5                    | 2                  | 3          | 3             | 0              | 0             | 0             | Rare     | 0      | 4               | 4                           | 41      |
| DMH5         | 705507  | 6261634  | 0    | 1        | 0       | 0       | 0     | 0      | 1          | 1         | Tussock/Grass                              | 10           | 7               | E             | 5             | 2                  | 20             |                | 35          | 0                   | 50                | 15             | < 0.5             | 21                   | 21                 | 3          | 36            | 13             | 4             | 0             | Absent   | 0      | 5               | 5                           | 0       |

| Site            | Easting | Northing | Fire | Clearing | Logging | Grazing | Weeds | Tracks      | Soil Depth | Soil type | Dom ground layer                              | Tree layer % | Ave Tree height | Age structure | Shrub layer % | Avg Shrub Height % | Ground layer % | Crypto crust % | % cover veg | % cover log > 15 cm | % cover bare soil | % cover litter | Litter depth (cm) | No. Large Dead Trees | Trees with hollows | Bark score | Small Hollows | Medium Hollows | Large Hollows | Basal Hollows | Fissures          | Stumps | Fallen Branches | Spinifex Condition/ Density | lg logs |
|-----------------|---------|----------|------|----------|---------|---------|-------|-------------|------------|-----------|---|--------------|-----------------|---------------|---------------|--------------------|----------------|----------------|-------------|---------------------|-------------------|----------------|-------------------|----------------------|--------------------|------------|---------------|----------------|---------------|---------------|-------------------|--------|-----------------|-----------------------------|---------|
| DMBB            | 712197  | 6258163  | 0    | 0        | 0       | 1       | 0     | 1           | 1          | 1         | Spinifex                                      | 30           | 4               | E-M           | 5             | 1                  | 40             |                | 55          | 1                   | 20                | 24             | 1                 | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent            | 0      | 5               | 4                           | 0       |
| DMCC            | 712606  | 6261037  | 0    | 0        | 0       | 1       | 0     | 1           | 1          | 1         | Spinifex                                      |              | 4               | E-M           |               | 1                  |                |                | 40          | 0                   | 25                | 35             | 1                 | 0                    | 0                  | 3          | 0             | 0              | 0             | 0             | Absent            | 0      | 5               | 4                           | 0       |
| DMDD            | 708891  | 6260014  | 0    | 0        | 0       | 1       | 0     | 1           | 1          | 1         | Spinifex                                      |              | 4               | E-M           |               |                    |                |                | 55          | 0                   | 30                | 15             | 1                 | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent            | 0      | 5               | 4                           | 0       |
| HADM26          | 705997  | 6260271  | 0    | 0        | 1       | 0       | 0     | 1           | 1          | 1         | Spinifex                                      | 30           | 5               | E-M           | 5             | 1                  | 40             |                | 60          | 0                   | 25                | 15             |                   | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Absent            | 0      | 5               | 5                           | 0       |
| T12DM           | 711889  | 6256013  | 0    | 0        | 0       | 1       | 0     | 1           | 1          | 1         | Spinifex                                      | 20           | 5               | M             | 10            | 2                  |                |                | 60          | 2                   | 20                | 18             | 1                 | 2                    | 1                  | 3          | 1             | 0              | 0             | 0             | Absent            | 0      | 5               | 5                           | 3       |
| DMAA            | 711163  | 6251509  | 0    | 0        | 0       | 1       | 0     | 1           | 1          | 1         | Spinifex                                      | 10           | 4               | E-M           | 5             | 2                  |                |                | 55          | 0                   | 25                | 20             | 1                 | 0                    | 0                  | 2          | 0             | 0              | 0             | 0             | Rare              | 0      | 5               | 5                           | 0       |
| DM5 offset area | 715700  | 6246869  | 0    | 0        | 0       | 1       | 0     | Goat tracks | 1          | 1         | Hummock/ Grass & Spinifex                     | 20           | 6               | E-M           | 1             | 1                  | 25             |                | 25          | 2                   | 20                | 53             | 2-4               | 1                    | 1                  | 2          | 1             | 1              | 0             | 0             | Rare              | 0      | 5               | 5                           | 4       |
| HADM28          | 712993  | 6262598  | 0    | 0        | 0       | 1       | 0     | 2           | 1          | 1         | Hummock/ Grass & Spinifex                     | 50           | 4               | E-M           | 0             |                    | 30             |                | 60          | 0                   | 30                | 20             | 1                 | 0                    | 0                  | 3          | 0             | 0              | 0             | 0             | Absent            | 0      | 5               | 4                           | 0       |
| SM3 N           | 713314  | 6266830  | 0    | 0        | 0       | 2       | 1     | 0           | 1          | 1         | Tussock/Grass                                 | 30           | 5               | Y-L           | < 5           | 1.5                | 20             | 5              | 30          | 0                   | 50                | 20             | 0.2               | 0                    | 111                | 1          | 0             | 0              | 0             | 10            | Rare              | 0      | 5               | 5                           | 6       |
| DMHAB2          | 706575  | 6268398  | 0    | ?        | 0       | 1       | 1     | 0           | 1          | 1         | Tussock/Grass & Hummock/ Grass                | 30           | 8               | M             | 10            | 3                  | 30             | 20             | 40          | 0                   | 20                | 20             | < 1               | 0                    | 5                  | 1          | 0             | 0              | 0             | 9             | Rare              | 0      | 5               | 5                           | 0       |
| SM1             | 705210  | 6259297  | 0    | 1-2      | 0       |         | 1     | 1           | 1          | 1         | Tussock/Grass & Herb & Other Chenopod         | 30           | 4               | M-L           | 25            |                    | 40             |                | 70          | 6                   | 30                | 20             | 0.1-0.2           | 4                    | 6                  | 3          | 4             | 2              | 0             | 0             | Common            | 0      | 4               | 0                           | 6       |
| SM2             | 707226  | 6272662  | 0    | 2        | 2       | 2       | 0     | 1-2         | 2          |           | Tussock/Grass & Other (saltbush)              | 20           | 4               | E-Y           | 15-20         | 0.77               | 30-40          |                |             |                     |                   |                | 3                 | 3                    | 3                  | 0          | 4             | 0              | 0             |               | 0                 | 4      | 0               | 0                           |         |
| CYPHAB1         | 707019  | 6265903  | 0    | 0        | 0       | 2       | 2     | 0           | 1          | 1         | Tussock/Grass                                 | 30           | 14              | M             | 5             |                    | 20             | 20             | 20          | < 5                 | 70                | 10             | 1                 | 7                    | 0                  | 3          | 0             | 0              | 0             | 0             | Abundant          | 0      | 4               | 0                           | 25      |
| CYP N           | 706586  | 6266666  | 0    | ?        | 0       | 3       | 1     | 1           | 1          | 1         | Tussock/Grass                                 | 15           | 20              | L             | < 5           | 0.5                | 30             | 30             | 60          |                     | 40                | 10             | < 1               | 8                    | 0                  | 3          | 2             | 0              | 0             | 0             | Abundant in stags | 0      | 5               | 0                           | 15      |
| YSREG2          | 716943  | 6255666  | 0    | 3        | 0       | 2       | 1     | 1           | 1          | 2         | Herb/Grass                                    | 0.1          | 11              | M             | 12            | 4                  | 40             |                | 40          | 0                   | 5                 | 55             | 0.5               | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             | Absent            | 0      | 2               | 0                           | 0       |
| YSREG2          | 716886  | 6255685  | 0    | 2-3      | 0       | 2-3     | 2     | 1-2         | 2          | 3         | Tussock/Grass & Herb                          | 0            |                 | Y-E           | 5-10          |                    | 65             |                | 65          | 0                   | 5-10              | 2              | 0.1               | 3                    | 2                  | 0          | 0             | 0              | 0             | 0             | Absent            | 0      | 1               | 0                           | 0       |
| Y5 - dis 1      | 717415  | 6252926  | 1    | 3        | 0       | 3       | 1     | 1-2         | 2          | 3         | Tussock/Grass & Other (chenopod small shrubs) | 1            |                 |               | 5             |                    | 55             |                | 55          | 0                   | 20-25             | 5-10           | 0                 | 0                    | 1                  | 1          |               |                |               | Absent        | 1                 | 1      | 0               | 0                           |         |

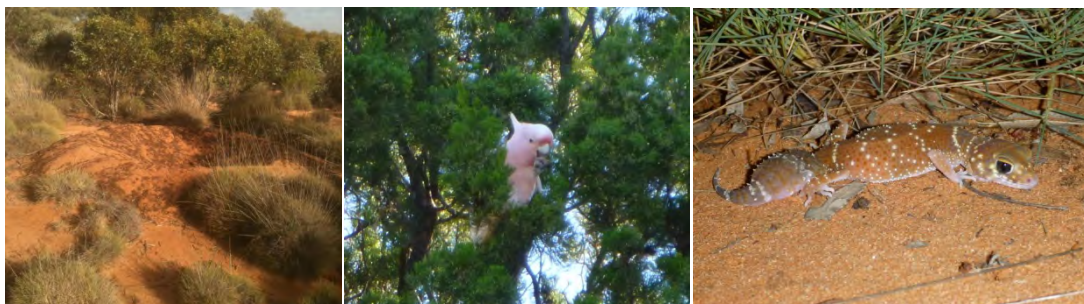
Appendix Table F-2: Habitat assessment data collected throughout the Ivanhoe Rail Facility study area.

| Site  | Easting | Northing | Fire | Clearing | Logging | Grazing | Weeds | Tracks | Soil Depth | Soil type      | Dom ground layer | Tree layer % | Ave Tree height | Age structure | Shrub layer % | Avg Shrub Height % | Ground layer % | Crypto crust % | % cover veg | % cover log > 15 cm | % cover bare soil | % cover litter | Litter depth (cm) | No. Large Dead Trees | Trees with hollows | Bark score | Small Hollows | Medium Hollows | Large Hollows | Basal Hollows | Fissures | Stumps | Fallen Branches | Spinifex Condition/Density | lg logs |
|-------|---------|----------|------|----------|---------|---------|-------|--------|------------|----------------|------------------|--------------|-----------------|---------------|---------------|--------------------|----------------|----------------|-------------|---------------------|-------------------|----------------|-------------------|----------------------|--------------------|------------|---------------|----------------|---------------|---------------|----------|--------|-----------------|----------------------------|---------|
| IRHA1 | 243883  | 6355190  | 0    | 0        | 0       | 1       | 3     | 3      | Deep       | Sand over clay | Herb/grass       | 20           | 10              | E             | 5             | 0.7                | 60             |                | 50          | 0                   | 25                | 25             |                   | 3                    | 1                  | 1          | 4             | 0              | 0             | 0             | Rare     | 0      | 2               | 0                          | 18      |
| IRHA2 | 242552  | 6355211  | 0    | 0        | 1       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 15           | 4               | M             | 20            | 2                  | 65             | 25             | 36          | 0                   | 24                | 40             | 0.2               | 0                    | 1                  | 1          | 3             | 1              | 0             | 1             | Absent   | 0      | 2               | 0                          | 9       |
| IRHA3 | 243410  | 6355184  | 0    | 0        | 0       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 5            | 10              | ME            | 1             | 2.5                | 80             | 0              | 88          | 1                   | 8                 | 4              | 0.3               | 1                    | 2                  | 0          | 2             | 0              | 0             | 1             | Rare     | 0      | 2               | 0                          | 11      |
| IRHA4 | 242825  | 6355260  | 0    | 0        | 0       | 0       | 2     | 0      | Deep       | Clay           | Herb/grass       | 15           | 3.5             | M             | 1             | 0.8                | 70             | 0              | 56          | 0                   | 8                 | 36             | 0.1               | 1                    | 1                  | 0          | 6             | 0              | 0             | 1             | Rare     | 0      | 3               | 0                          | 17      |
| IRHA5 | 243697  | 6353208  | 0    | 0        | 0       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 0            | 0               |               | 0.5           | 0.9                | 85             | 20             | 80          | 0                   | 4                 | 16             | 0.3               | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             | Absent   | 0      | 0               | 0                          | 0       |
| IRHA6 | 243728  | 6353395  | 0    | 0        | 0       | 2       | 0     | 0      | Deep       | Clay           | Herb/grass       | 15           | 4               | ME            | 15            | 0.9                | 80             | 5              | 76          | 0                   | 24                | 0              | 0                 | 0                    | 0                  | 1          | 0             | 0              | 0             | 0             | Rare     | 0      | 2               | 0                          | 4       |
| IRHA7 | 243280  | 6354555  | 0    | 0        | 0       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 0            | 0               |               | 0.5           |                    | 70             | 5              | 52          | 0                   | 24                | 24             | 0.5               | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             | Absent   | 0      | 0               | 0                          | 0       |
| IRHA8 | 245607  | 6355144  | 0    | 0        | 1       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 35           | 10              | LM            | 70            | 1.5                | 50             | 0              | 68          | 0                   | 32                | 0              | 0                 | 5                    | 9                  | 1          | 15            | 14             | 2             | 3             | Common   | 0      | 5               | 0                          | 0       |
| IRHA9 | 244103  | 6354679  | 0    | 0        | 0       | 0       | 1     | 0      | Deep       | Clay           | Herb/grass       | 0            | 0               |               | 60            | 1.5                | 70             | 0              | 92          | 0                   | 8                 | 0              | 0                 | 0                    | 0                  | 0          | 0             | 0              | 0             | 0             | Absent   | 0      | 0               | 0                          | 5       |



## **Appendix G: Atlas-Campaspe Mineral Sands Project - fauna survey of the properties east of Mungo National Park**

# Atlas-Campaspe Mineral Sands Project – Fauna Survey of the Properties East of Mungo National Park



Prepared by Australian Museum Business Services  
for Cristal Mining Australia Limited

Final Report

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## Executive Summary

Australian Museum Business Services were commissioned by Cristal Mining Australia Limited to undertake a study of terrestrial fauna on leasehold properties east of Mungo National Park. The study included a desktop review, targeted fauna surveys and assessments of fauna habitats. Field surveys were performed between February and May 2012. The study was focussed on terrestrial vertebrate fauna and any terrestrial invertebrate fauna listed as threatened species under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

A total of 54 threatened fauna species listed under the TSC Act and/or EPBC Act are known or predicted to occur in the Lower Murray/Darling Basin CMA sub-region, South Olary Plain, Murray Basin Sands (Part B). These 54 species are comprised of two frogs, six reptiles, 36 birds and 10 mammals (Table 3).

A total of 25 threatened species have been recorded within a 20 km radius of the study area (OEH 2012a, Australian Museum 2012, Birds Australia 2012), comprised of seven mammals, two reptiles and 16 birds (Table 3).

A total of 179 vertebrate fauna species were recorded during the surveys comprising two frogs, 39 reptiles, 115 birds and 23 mammals (Appendix C). Six of the species recorded are introduced species. All six were mammals and all were classified as being common or abundant in the study area, other than dogs, which were only recorded infrequently.

Twenty species recorded in the study area during the surveys are listed as threatened under the TSC Act and/or EPBC Act. Threatened species that were positively recorded in the study area include the Bardick, Jewelled Gecko, Mallee Worm-lizard, Spinifex Slender Blue-tongue, Chestnut-backed Quail-thrush, Gilbert's Whistler, Hooded Robin, Little Eagle, Major Mitchell's Cockatoo, Malleefowl, Pied Honeyeater, Regent Parrot (eastern subspecies), Spotted Harrier, Varied Sitella, White-fronted Chat, South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form) (south-eastern form), Inland Forest Bat, Little Pied Bat, Yellow-bellied Sheath-tail Bat and Southern Ningau. The Rainbow Bee-eater, which is listed as migratory on the EPBC Act, was also recorded within the study area.

The study area contains known and potential habitat for a range of threatened fauna. Broad habitat types include Linear Dune Mallee, Sandplain Mallee, Belah-Rosewood Woodland, Black Box Floodplain Woodland, Black Box Woodland Wetland, Grass and Herbland Depressions, Acacia Woodland/Shrubland, Disturbed Shrubland and Cleared Land. A number of threatened species (such as Western Pygmy-possum) have been recorded in other studies nearby the study area, have potential habitat within the study area and are considered likely to occur. The Mallee communities provide potential habitat for a range of threatened fauna associated with spinifex and hollows, fissures and decorticated bark and the mature parts of the Black Box Woodland contain large hollows. Features such as fallen logs were distributed throughout most of the study area.

The condition of fauna habitat varied. Communities such as the Cleared Land were highly disturbed; communities located close to depressions that fill with water after rain (such as Black Box Woodland) had the ground layers disturbed; and Belah-Rosewood Woodland and Sandplain Mallee were affected by grazing. The Linear Dune Mallee communities within the study area were in relatively good condition.

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# 1 Introduction

## 1.1 Background

Australian Museum Business Services (AMBS) was commissioned by Cristal Mining Australia Limited, formally known as Bemax Resources Limited, to undertake surveys of terrestrial vertebrate fauna in a broad area to the east of Mungo National Park. The purpose of the surveys was to obtain data and information regarding the fauna and fauna habitats present. The scope of this study included:

- a ‘desktop’ investigation to assess threatened fauna potentially occurring in the study area;
- field surveys targeting vertebrate fauna in the study area;
- collection of habitat data; and
- description and mapping of broad fauna habitat types and assessment of their condition.

## 1.2 Study Area

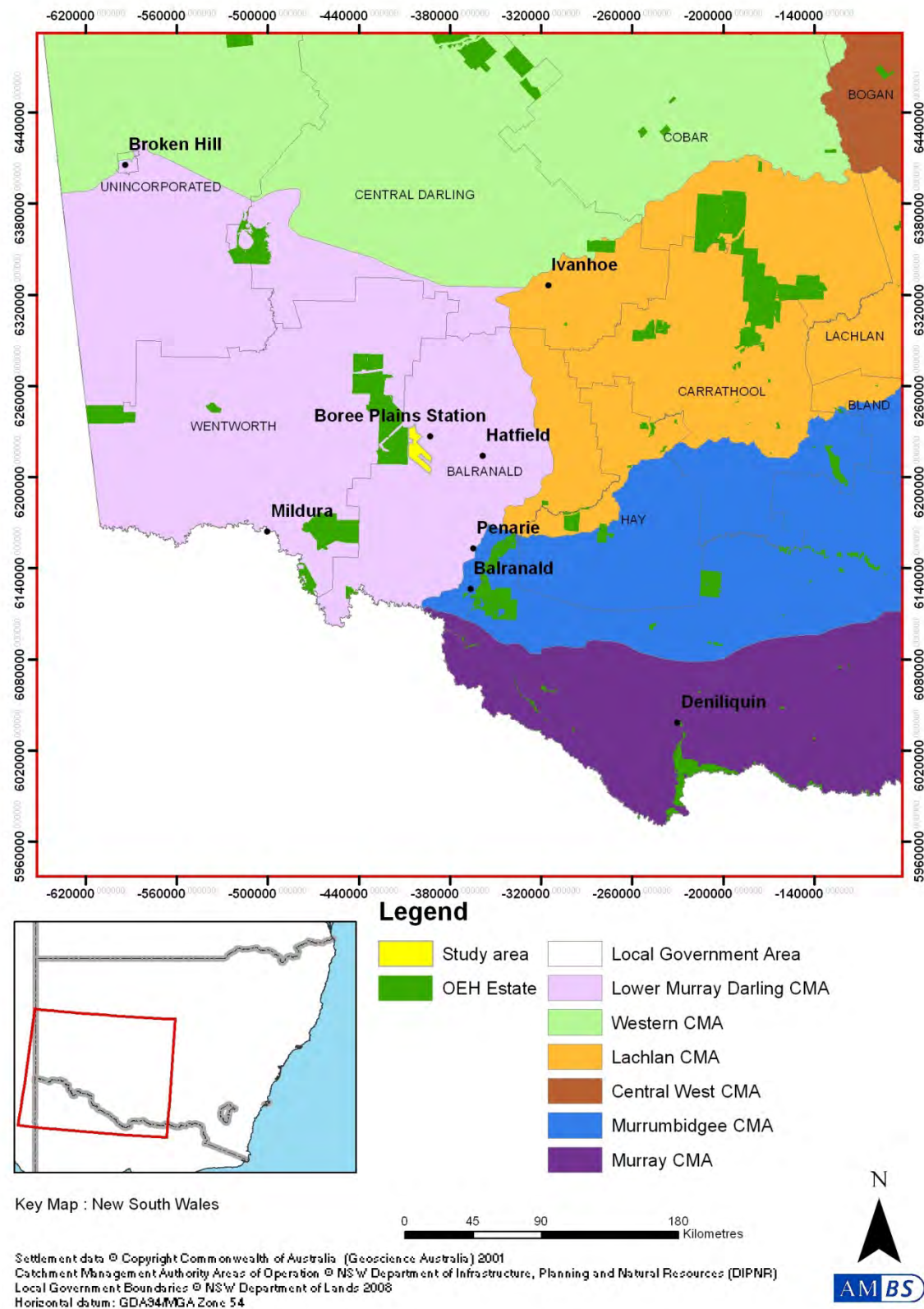
The study area is located in south-west New South Wales (NSW) within the Lower Murray Darling Catchment Management Authority (CMA) area (Figure 1) and the CMA sub-region - South Olary Plain, Murray Basin Sands (Part B). The study area is covered by the Pooncarie 1:250,000 and Turlee 1:100,000 topographical survey sheets. It is situated approximately 80 kilometres (km) north of the township of Balranald and 270 km south-east of Broken Hill, and is within the Balranald Local Government Area (LGA). It is located on leasehold land (Wampo and Boree Plains) that is currently used for agriculture (mainly grazing, with some cropping). Mungo National Park adjoins the study area to the west (Figure 2). The study area is located within The Murray Darling Depression Bioregion.

The study area encompasses approximately 22,000 hectares (ha) of semi-arid vegetation occurring on tertiary and quaternary sediments. The geomorphology of the area consists primarily of Aeolian dune fields and sandplains overlaying clay. Soils are of red and orange sands in the dune fields and sandplains to grey, brown or red calcareous clay sediments that underlie the sand deposits and are exposed in low-lying areas and depressions (Porteners *et al.* 1997). The dunes, which occupy a considerable proportion of the area, are relatively low in height with gentle slopes, however some higher steep-sided dunes occasionally occur.

Long-term, monthly average daily maximum and minimum temperatures from the Pooncarie Mail Agency, Balranald (RSL) and Ivanhoe Post Office meteorological stations show that temperatures are warmest from November to March and coolest in the winter months of June, July and August (BoM 2012).

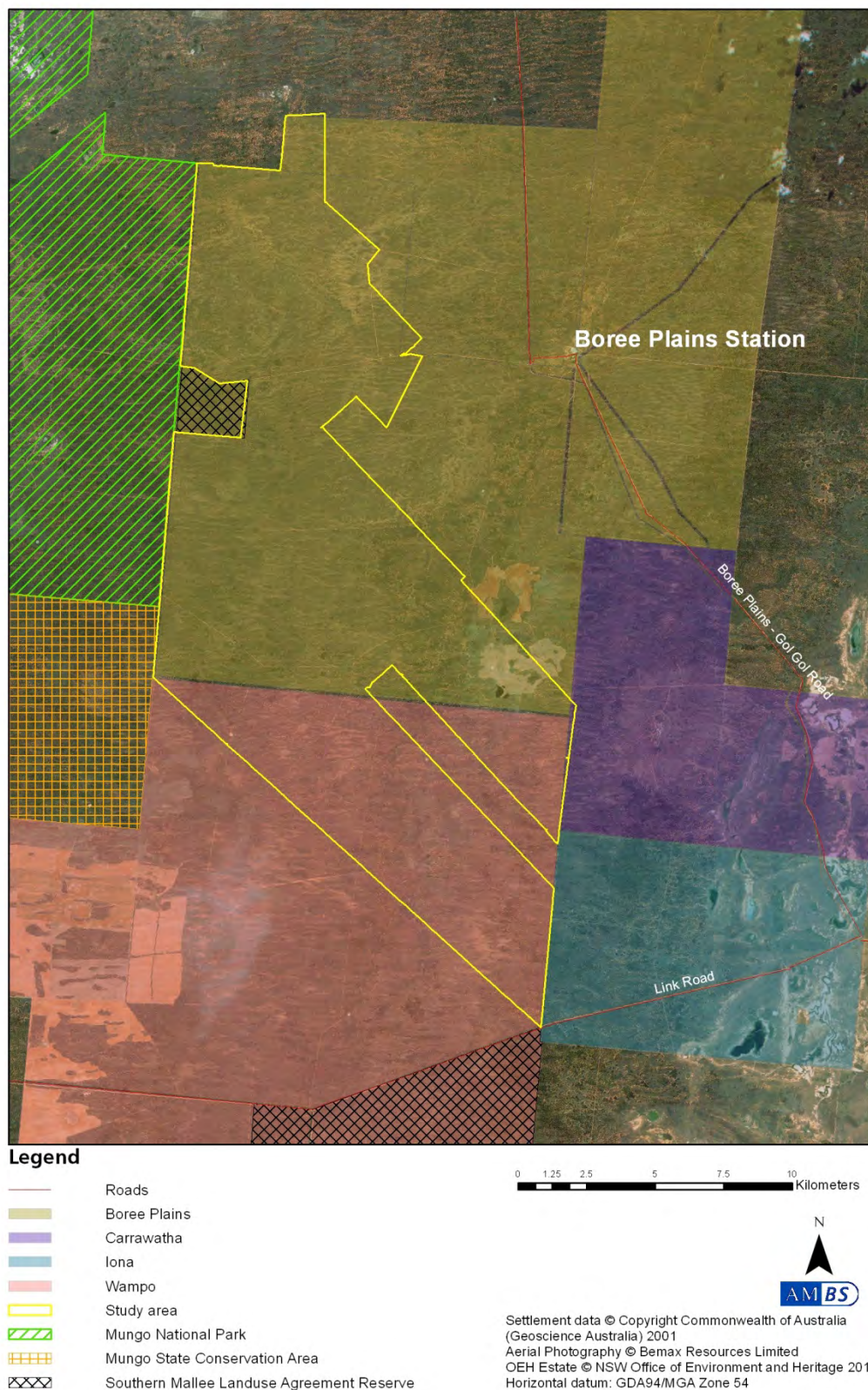
The long-term average annual rainfall at meteorological stations proximal to (i.e. less than 50 km) from the study area varies from approximately 267.7 mm at the Pooncarie (Top Hut) meteorological station to approximately 323.2 mm at the Oxley (Walmer Downs) meteorological station (BoM, 2012). Average monthly rainfall is relatively uniform throughout the year and no seasonal variation is obvious (BoM, 2012).

The study area has been grazed by sheep and cattle for the past 100 years and in the recent past sections have been cleared for cropping. A travelling stock route is located in the southeast corner of the study area. Feral goats and rabbits occur in high numbers across the area.



**Figure 1: The Geographic position of the study area.**





**Figure 2: The study area.**

Nearby conservation areas include Mungo National Park to the west, a private conservation area on Boree Plains adjoining the National Park to the east and another private conservation area to the south on Wampo Station. The private conservation areas have been established as the Southern Mallee Conservation Agreement.

### 1.3 Authorship and Acknowledgements

Fauna survey work was undertaken by Dr Ulrike Kloecker, Narawan Williams, Dr Martin Schulz, Melina Budden, Dr Terry O'Dwyer, Mark Semeniuk, George Madani and Glenn Muir. Identification of ultrasonic microbat calls was undertaken by Dr Martin Schulz, Narawan Williams and Greg Ford. Identification of scats, hair funnel and hair tube samples was undertaken by Barbara Triggs (Dead Finish Pty Ltd) and Georgeanna Story (Scats Alive). Data management was undertaken by Ulrike Kloecker and Terry O'Dwyer with assistance with data entry provided by Laura Sothern. This report was prepared by Glenn Muir, Melina Budden, Mark Semeniuk and Terry O'Dwyer. Cover photographs were taken by Terry O'Dwyer (Malleefowl [*Leipoa ocellata*] mound) and Ulrike Kloecker (Thick-tailed Gecko [*Underwoodisaurus milii*] and Major Mitchell's Cockatoo [*Lophochroa leadbeateri*]).

## 2 Methods

The surveys included a desktop review and targeted surveys conducted during late summer and autumn. Methods for these surveys are described in the following sections.

### 2.1 Desktop Review

A desktop review of existing information regarding fauna within the study area and locality was undertaken. Information sources included:

- a search of the OEH Atlas of NSW Wildlife database for records of threatened fauna species listed under the NSW *Threatened Species Conservation Act, 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) (OEH 2012a);
- a search of the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) Protected Matters database for matters of national environmental significance listed under the EPBC Act (SEWPaC 2012);
- a list of the threatened species known and predicted to occur within the Lower Murray/Darling Basin CMA sub-region, South Olary Plain, Murray Basin Sands (Part B) (OEH 2012a);
- a search of the Australian Museum (2012) and Birdlife Australia (2012) databases;
- topographic and aerial photographs of the locality; and
- previous flora survey reports (AMBS 2012) and data from surveys from the wider study area (e.g. records from Mungo National Park and recovery plans for threatened species).

### 2.2 Field Surveys

Site investigations to determine the presence of fauna and their habitat and to ascertain stratification unit types and potential sites for fauna surveys were performed in February and March 2012 (15 to 19 February 2012 and 28 February to 1 March 2012). Fauna surveys were performed during three periods from March to May 2012 (28 March to 3 April 2012, 17 to 24 April 2012 and 10 to 18 May 2012). A range of survey techniques were used, including pitfall traps, Elliott A traps, funnel traps, harp traps, hair tubes, camera monitoring, diurnal bird surveys, water bird surveys, Malleefowl transects, diurnal reptile searches, frog searches, call-playback, scat and track searches, opportunistic records, spotlighting and the use of ANABAT detectors. The methods and survey effort are summarised in Table 1. Survey locations are shown in Figure 3 to Figure 7. Co-ordinates of survey sites are included in Appendix A.

**Table 1: Fauna survey techniques and effort.**

| Technique             | Sites | Number deployed per site | Survey effort/description  |
|-----------------------|-------|--------------------------|--|
| Elliott A Traps       | 16    | 25 or 10                 | Traps were checked every morning for four days. Each trap contained universal bait, cotton wool or leaf litter. Spacing between traps was approximately 10 metres (m) depending on suitable habitat. Ten traps were deployed at five sites and 25 traps were deployed at 11 sites.   |
| Funnel Traps          | 17    | 4                        | Two funnel traps were paired 1 m in from each end of a 30 m polyethylene drift fence. Traps were checked every morning for four days (16 trap nights at each site).  |
| Hair Tubes            | 14    | 20                       | Hair tubes were left <i>in-situ</i> for 10 days as a minimum and longer when survey periods enabled it (200 trap nights at each site, as a minimum). Hair tubes were baited with universal bait. Spacing between tubes was 20 m. Tubes were placed in trees and on the ground.   |
| Pitfall Traps         | 17    | 6                        | Three buckets (400 millimetres [mm] diameter x 280 mm deep) and three pipes (150 mm diameter x 600 mm deep) were equally spaced along a 30 m polyethylene drift fence. Traps were checked each morning for four days. Leaf litter and bark were placed inside the traps along with a small piece of polystyrene as a flotation device in case of rain. |
| Nocturnal Frog Search | 1     | n/a                      | Two nocturnal spotlighting searches of 30 minutes each were performed at the wetland near the Black Box Woodland site. All species observed or heard were identified. Call playbacks were also performed for Southern Bell Frogs ( <i>Litoria raniformis</i> ).  |

| Technique                              | Sites | Number deployed per site | Survey effort/description  |
|--|-------|--------------------------|--|
| Diurnal Bird Census (3 repetitions)    | 3     | n/a                      | Standard searches (3 x 20 minutes) were performed within 3 hours of dawn. All birds observed or heard were recorded.   |
| Diurnal Bird Census (2 repetitions)    | 14    | n/a                      | Standard searches (2 x 20 minutes) were performed within 3 hours of dawn. All birds observed or heard were recorded.   |
| Diurnal Bird Census (1 repetition)     | 7     | n/a                      | Standard searches (1 x 20 minutes) were performed within 3 hours of dawn. All birds observed or heard were recorded.   |
| Diurnal Reptile Search (3 repetitions) | 1     | n/a                      | Active searches of potential reptile habitat were performed for 90 person minutes at each site (3 x 30 minute searches) during appropriate weather conditions (i.e. warm, sunny weather between 10.00 am - 2.00 pm).   |
| Diurnal Reptile Search (2 repetitions) | 16    | n/a                      | Active searches of potential reptile habitat were performed for 30 person minutes at each site (2 x 30 minute searches) during appropriate weather conditions (i.e. warm, sunny weather between 10.00 am - 2.00 pm).   |
| Diurnal Reptile Search (1 repetition)  | 27    | n/a                      | Active searches of potential reptile habitat were performed for 60 person minutes at each site (1 x 30 minute searches) during appropriate weather conditions (i.e. warm, sunny weather between 10.00 am - 2.00 pm).   |
| Malleefowl Transects                   | 19    | n/a                      | Surveys were performed in Malleefowl habitat (predominantly Linear Dune Mallee with some Sandplain Mallee). Four people formed a human chain spaced 30 m apart and walked through suitable habitat for 1 km searching for Malleefowl tracks or mounds.   |
| Waterbird Survey                       | 1     | n/a                      | Two waterbird surveys (1 hour each) were performed at a wetland that occurs within the study area.   |
| Nocturnal Call Playback (5 nights)     | 8     | n/a                      | Each session included an initial listening period (10 minutes) followed by call broadcast of Barking Owl ( <i>Ninox connivens</i> ). Each broadcast was for 5 minutes followed by 5 minutes of listening. A 10 minute spotlighting session was conducted following the final listening period. All species observed or heard were recorded. Five nights of broadcasts were performed at each site. Call playback for Bush Stone-curlew ( <i>Burhinus grallarius</i> ) was performed at a sub-sample of four sites within the study area. |
| Nocturnal Call Playback (1 night)      | 1     | n/a                      | Each session included an initial listening period (10 minutes) followed by call broadcast of Barking Owl. Each broadcast was for 5 minutes followed by 5 minutes of listening. A 10 minute spotlighting session was conducted following the final listening period. All species observed or heard were recorded.   |
| Spotlighting (2 repetitions)           | 16    | n/a                      | Active searches for nocturnal species, including amphibians, reptiles and mammals were performed for 80 person minutes at each site (2 x 20 minute searches with 2 people). All species observed or heard were identified and recorded.  |
| Spotlighting (1 repetition)            | 3     | n/a                      | Active searches for nocturnal species, including amphibians, reptiles and mammals were performed for 40 person minutes at each site (1 x 20 minute searches with 2 people). All species observed or heard were identified and recorded.  |
| Harp Trapping                          | 16    | 2                        | Harp traps were erected for two nights at two different locations within each site for two days (four trap nights at each site). Traps were checked each morning.  |
| ANABAT                                 | 16    | 2                        | ANABATS were left overnight for two nights at two different locations within each site for two days (four trap nights at each site).   |
| Remote Cameras                         | 16    | 1                        | All cameras were pointed at a bait station (universal bait) and left <i>in-situ</i> for a minimum of 14 days.  |
| Scats and Tracks                       | 16    | n/a                      | Two people walked for a minimum of 1 km along a track nearby each fauna trapping site. Observations of tracks were made and predator-scats were collected for analysis. Additional opportunistic track searches were carried out in some locations.  |
| Opportunistic Records                  | n/a   | n/a                      | Opportunistic observations of fauna were recorded throughout the study area and surrounds.   |

## 2.3 Habitat Assessments

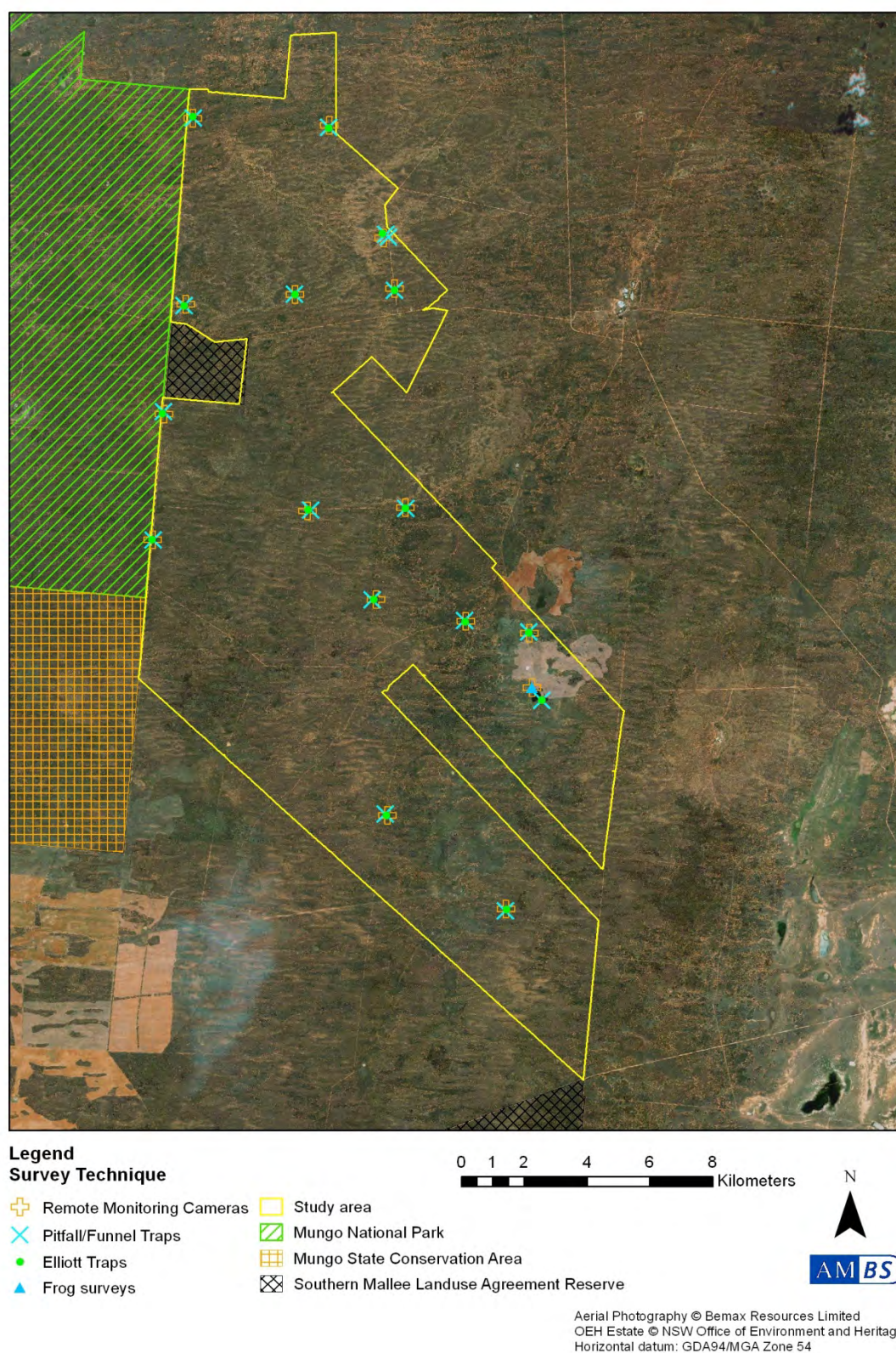
Habitat assessments were conducted at a range of sites throughout the study area and surrounds. Vegetation mapping and ‘scoping surveys’ of the study area were used to determine broad habitat types within the study area. Survey effort was stratified according to broad habitat type. In general, a habitat assessment was undertaken for every 400 ha of stratification unit.



At each standard site, the following features were recorded within an area of 50 x 100 m:

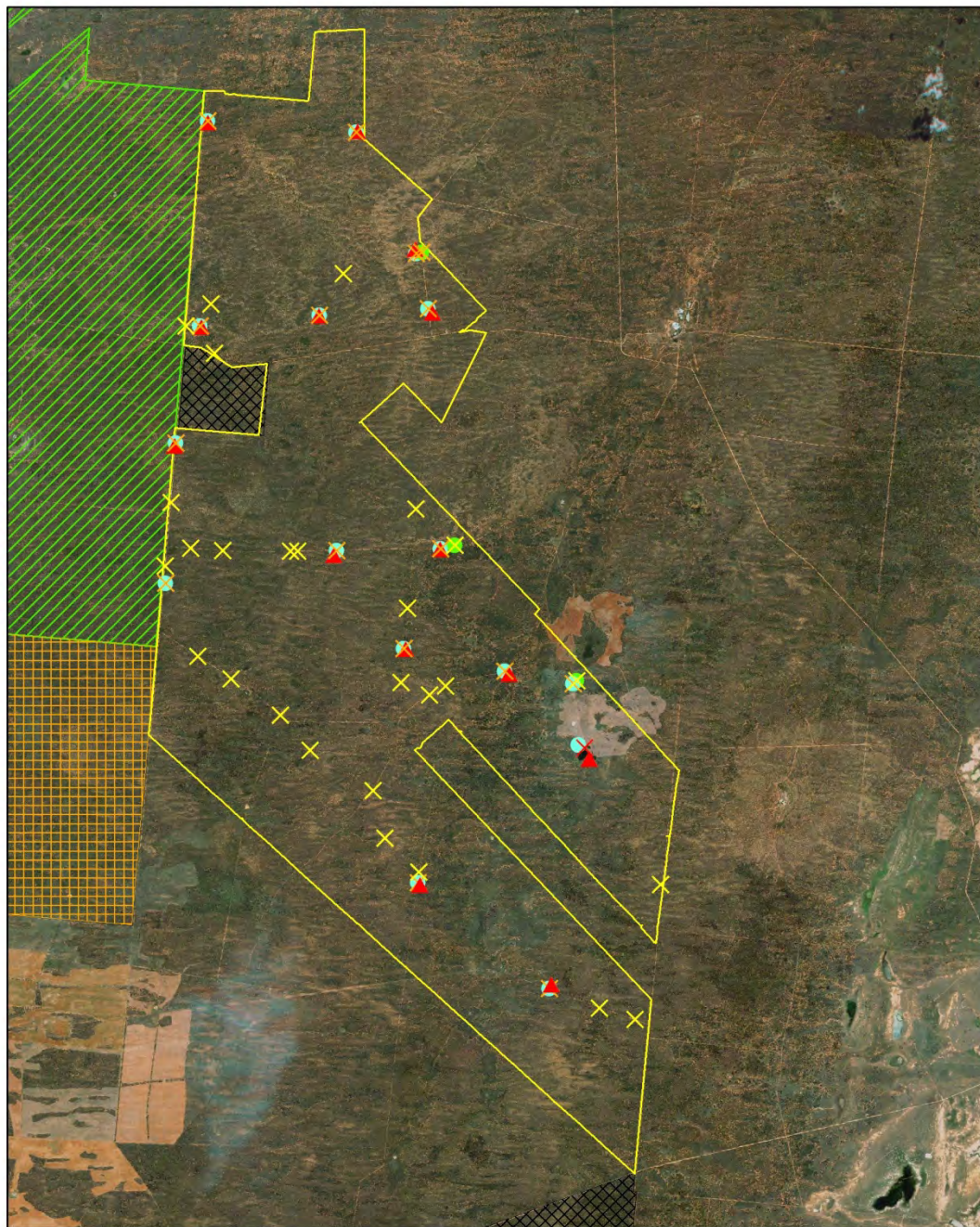
- broad habitat type;
- estimated age structure (where possible);
- predominant topography;
- altitude;
- disturbance history (e.g. fire, grazing);
- dominant shrub growth;
- dominant ground layer;
- litter/humus depth;
- abundance of particular plants (e.g. *Acacia* spp., saltbush);
- abundance of weeds;
- flowering or seeding resources;
- spinifex size and condition;
- ground layer features (percent [%] cover vegetation, soil, litter, logs);
- number of dead trees or dead limbs;
- number of trees with hollows;
- number of hollows (small <10 centimetres (cm), medium 10-30 cm, large >30 cm, basal hollows or central trunk hollow);
- abundance of decorticating bark;
- number of logged stumps, fallen branches;
- length of large (>15 cm) logs; and
- waterbody type and feature (if present).

The results of the habitat assessments are provided in Appendix B.



**Figure 3: Locations of pitfall/funnel traps, Elliot traps, frog surveys and remote cameras.**





**Legend**  
**Survey Technique**

- ✕ Diurnal reptile search (1 repetition)
- ✕ Diurnal reptile search (2 repetitions)
- ✕ Diurnal reptile search (3 repetitions)
- Spotlighting (1 repetition)
- Spotlighting (2 repetitions)
- ▲ Hair Tube
- Study area
- ▨ Mungo National Park
- ▨ Mungo State Conservation Area
- ▨ Catchment management Authority Reserve

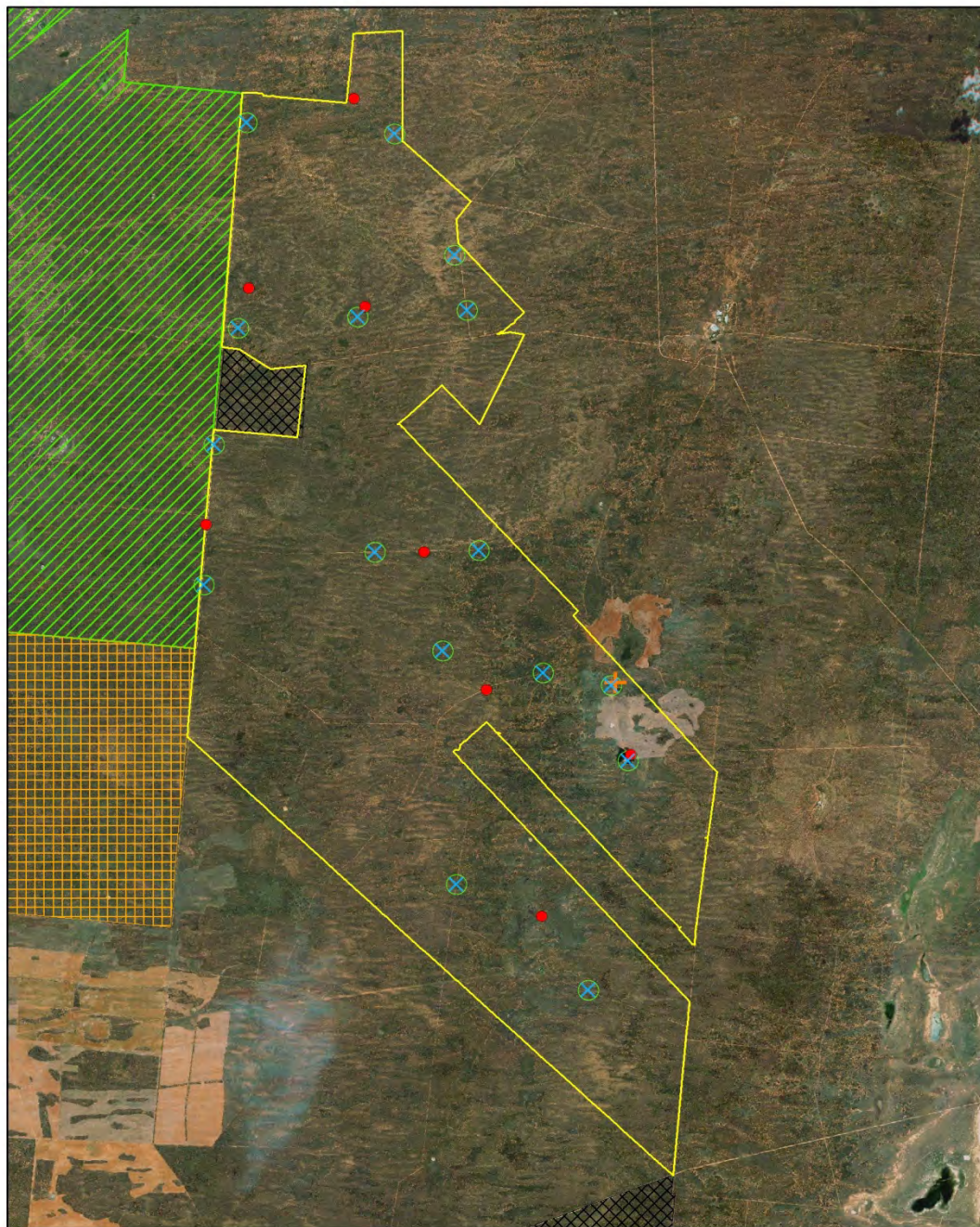
0 1 2 4 6 8 Kilometers



Aerial Photography © Bemax Resources Limited  
OEHS Estate © NSW Office of Environment and Heritage 2012  
Horizontal datum: GDA94/MGA Zone 54

**Figure 4: Locations of hair tubes, diurnal reptile searches and spotlight surveys.**





**Legend**

**Survey Technique**

○ ANABAT

+ 1 Call Playback Night

● 5 Call Playback Nights

× Harp Traps

□ Study area

▨ Mungo National Park

▤ Mungo State Conservation Area

▩ Southern Mallee Landuse Agreement Reserve

0 1 2 4 6 8 Kilometers

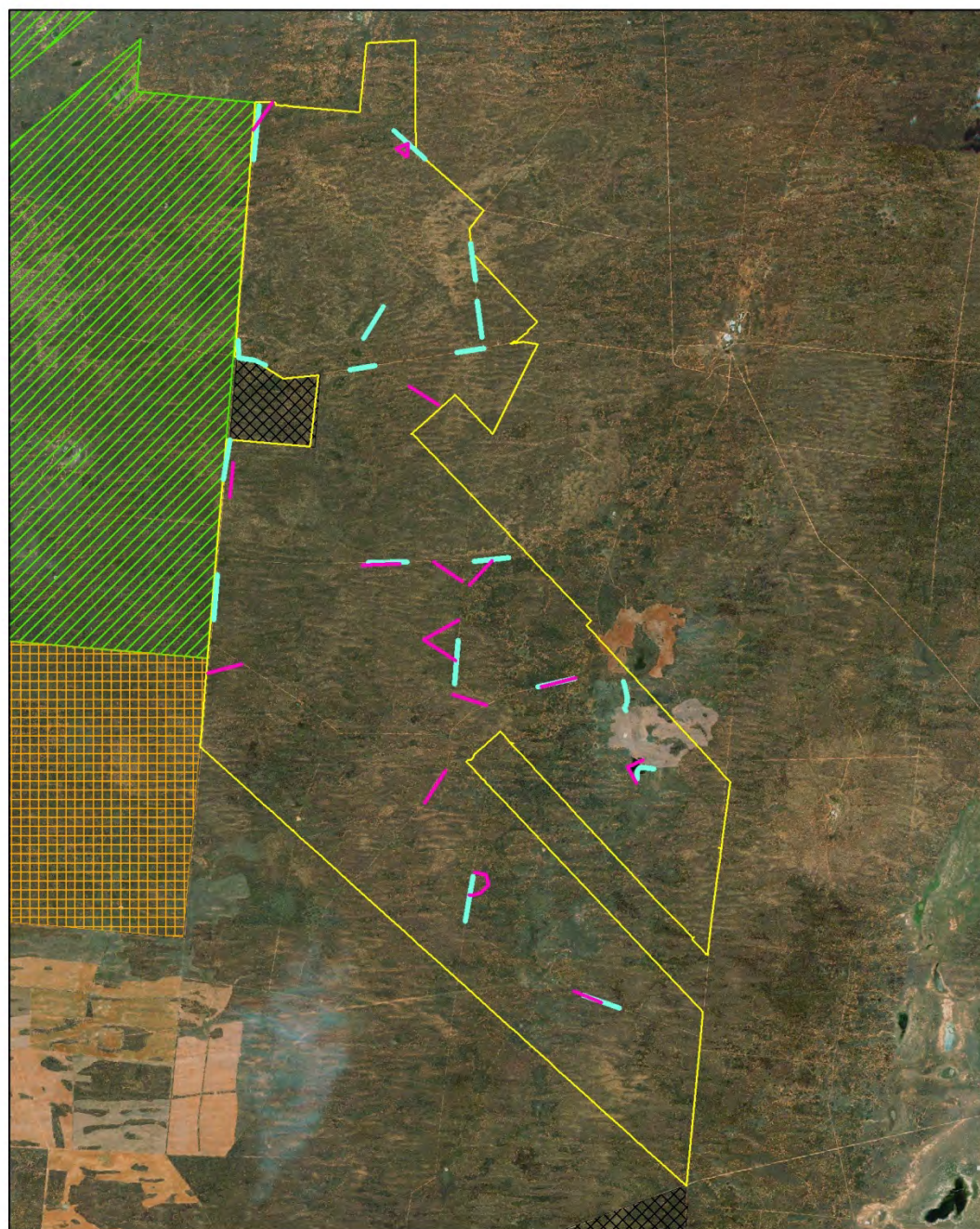
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Aerial Photography © Bemax Resources Limited  
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Horizontal datum: GDA94/MGA Zone 54

**Figure 5: Harp trap, ANABAT and call-playback locations.**





**Legend**

**Survey Technique**

- Scat Transects
- Malleefowl Transect
- Study area
- Mungo National Park
- Mungo State Conservation Area
- Southern Mallee Landuse Agreement Reserve

0 1 2 4 6 8 Kilometers

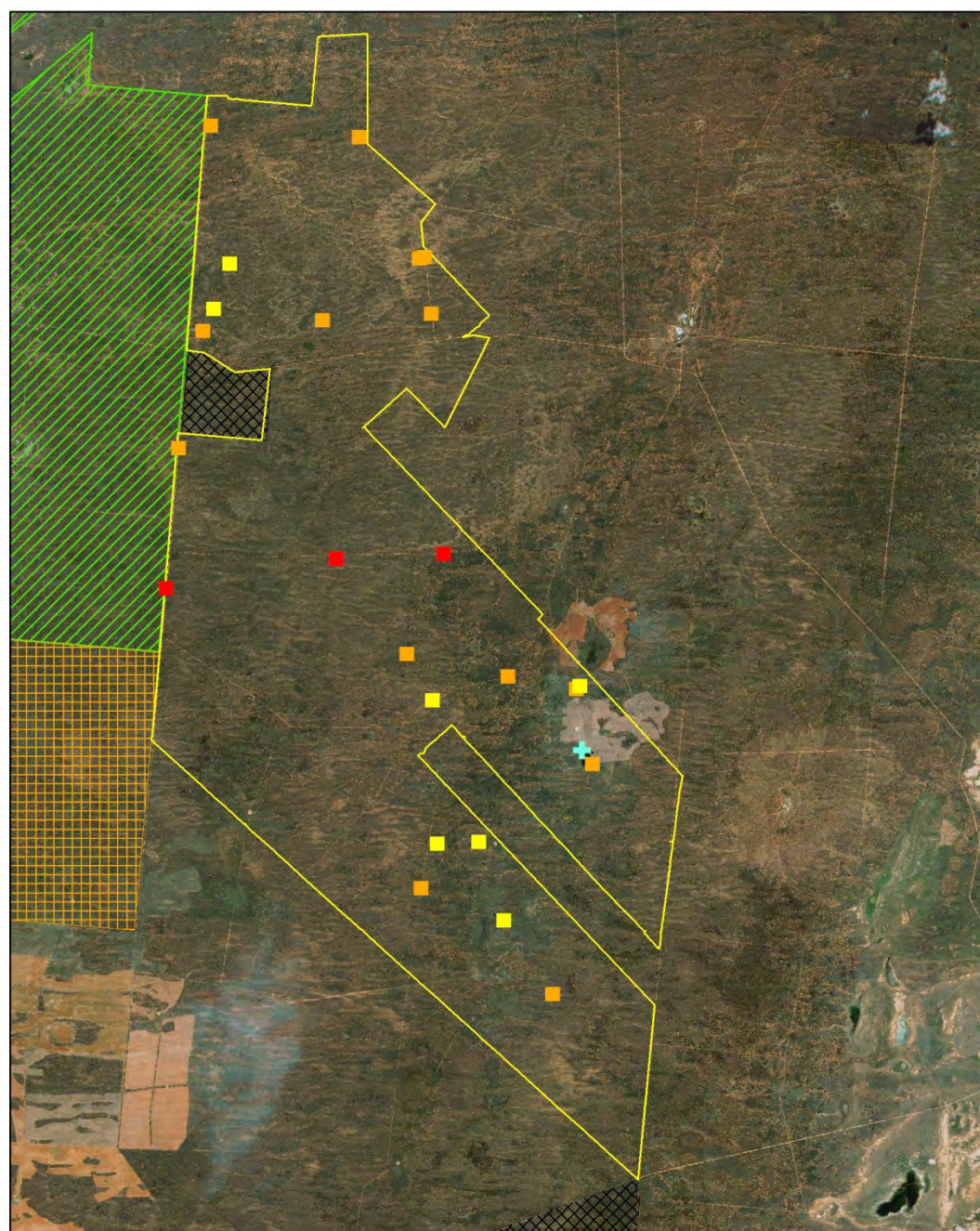


AMBS

Aerial Photography © Bemax Resources Limited  
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 Horizontal datum: GDA94/MGA Zone 54

**Figure 6: Malleefowl searches and scat transects.**





**Legend**  
**Survey Technique**

- Bird census (1 repetition)
- Bird census (2 repetitions)
- Bird census (3 repetitions)
- + Waterbird survey
- Study area
- Mungo National Park
- Mungo State Conservation Area
- Southern Mallee Landuse Agreement Reserve

0 1 2 4 6 8 Kilometers



Aerial Photography © Bemax Resources Limited  
OEH Estate © NSW Office of Environment and Heritage 2012  
Horizontal datum: GDA94/MGA Zone 54

**Figure 7: Diurnal bird surveys.**



## 2.4 Weather Conditions

Weather conditions during the survey period are summarised in Table 2. Minimum temperatures ranged from 2.8 to 24.2°C, while maximum temperatures were between 15.8 to 40.0°C (Table 2). There was heavy rainfall during the period 28 February 2012 to 1 March 2012 and flooding of the site throughout much of March. It is important to note that the climate data shown in Table 2 is a combination of statistical data obtained from Bureau of Meteorology (BoM) meteorological stations up to 80 km from the study area and surrounds. The automatic weather station installed at Boree Plains near the study area was not in operation at the time of the survey. Consequently some of the data is not fully reflective of the actual weather conditions present during survey periods. As shown in Table 2 the second survey period coincided with a large rainfall event in the region (i.e. up to 52 mm fell in one day at Pooncarie).

**Table 2: Climate data for the survey periods.**

| Date       | Temperature (°C) min/max Balranald RSL* | Temperature(°C) min/max Pooncarie Mail Agency* | Rainfall (mm) Pooncarie (Tarcoola)* | Rainfall (mm) Oxley (Walmer Downs)* | Moon phase <sup>†</sup>     |
|------------|---|--|-------------------------------------|-------------------------------------|-----------------------------|
| 15/02/2012 | 18.3/36.0                               | 17.5/37.8                                      | 0                                   | 0                                   | 3 <sup>rd</sup> Quarter 52% |
| 16/02/2012 | 22.6/35.0                               | 24.2/37.4                                      | 0                                   | 0                                   | Waning Crescent 41%         |
| 17/02/2012 | 16.8/35.0                               | 21.0/38.2                                      | 0                                   | 0                                   | Waning Crescent 30%         |
| 18/02/2012 | 17.4/36.2                               | 21.3/39.8                                      | 0                                   | 0                                   | Waning Crescent 20%         |
| 19/02/2012 | 19.6/35.3                               | 23.8/40.0                                      | 0                                   | 0                                   | Waning Crescent 12%         |
| 28/02/2012 | 22.4/27                                 | 23.2/25  | 32                                  | 0                                   | Waxing Crescent 27%         |
| 29/02/2012 | 17.7/22.0                               | 20.4/24.0                                      | 21                                  | 0                                   | Waxing Crescent 36%         |
| 01/03/2012 | 16.9/23.2                               | 15.5/22.8                                      | 52                                  | 44                                  | 1 <sup>st</sup> Quarter 45% |
| 28/03/2012 | 10.7/NA                                 | 12.2/29  | 0                                   | 0                                   | Waxing Crescent 20%         |
| 29/03/2012 | NA/NA                                   | 11.8/31.1                                      | 0                                   | 0                                   | Waxing Crescent 29%         |
| 30/03/2012 | NA/30.8                                 | 14.3/31.6                                      | 0                                   | 0.6                                 | Waxing Crescent 38%         |
| 31/03/2012 | 15.8/33.5                               | 18.0/34.8                                      | 2                                   | 0                                   | 1 <sup>st</sup> Quarter     |
| 01/04/2012 | 13.4/25.8                               | 14.8/26.9                                      | 0                                   | 0                                   | Waxing Gibbous 57%          |
| 02/04/2012 | 10.6/30.9                               | 12.8/32.4                                      | 0                                   | 0                                   | Waxing Gibbous 68%          |
| 03/04/2012 | 16.3/29.3                               | 18.9/31.0                                      | 1                                   | 0                                   | Waxing Gibbous 77%          |
| 17/04/2012 | 12.1/27.2                               | 12.8/30.8                                      | 0                                   | 0                                   | Waning Crescent 28%         |
| 18/04/2012 | 11.8/27.0                               | 12.2/27.9                                      | 0                                   | 0                                   | Waning Crescent 13%         |
| 19/04/2012 | 17.0/21.0                               | 12.8/28.3                                      | 0                                   | 0                                   | Waning Crescent 7%          |
| 20/04/2012 | 13.7/26.0                               | 11.9/29.5                                      | 0                                   | 8                                   | Waning Crescent 3%          |
| 21/04/2012 | 12.6/25.7                               | 12.5/28.4                                      | 0                                   | 0                                   | Waning Crescent 1%          |
| 22/04/2012 | 15.9/27.0                               | 13.7/28.2                                      | 0                                   | 0.4                                 | New Moon 0%                 |
| 23/04/2012 | 9.7/21.7                                | 12.2/23.0                                      | 0                                   | 0                                   | Waxing Crescent 1%          |
| 24/04/2012 | 5.0/15.6                                | 8.0/17.8                                       | 1                                   | 1                                   | Waxing Crescent 5%          |
| 10/05/2012 | 10.3/24                                 | 11.4/27.0                                      | 0                                   | 0                                   | Waning Gibbous 84%          |
| 11/05/2012 | 7.3/19.0                                | 11.5/25.0                                      | 0                                   | 0                                   | Waning Gibbous 74%          |
| 12/05/2012 | NA/NA                                   | 7.9/18.1                                       | 0                                   | 0                                   | Waning Gibbous 64%          |
| 13/05/2012 | NA/15.8                                 | 6.1/17.0                                       | 0                                   | 0                                   | 3 <sup>rd</sup> Quarter 53% |
| 14/05/2012 | 4.2/17.8                                | 7.6/18.4                                       | 0                                   | 0                                   | Waning Crescent 43%         |
| 15/05/2012 | 4.3/18.6                                | 6.6/19.0                                       | 0                                   | 0                                   | Waning Crescent 33%         |
| 16/05/2012 | 4.6/20.1                                | 2.8/20.8                                       | 0                                   | 0                                   | Waning Crescent 24%         |
| 17/05/2012 | 2.9/20.0                                | 2.8/21.4                                       | 0                                   | 0                                   | Waning Crescent 17%         |
| 18/05/2012 | 3.6/22.9                                | 4.5/23.0                                       | 0                                   | 0                                   | Waning Crescent 10%         |

\* Source: BoM (2012). Balranald RSL weather station is 80 km south-southeast of the Project and the Pooncarie Mail Agency weather station is 80 km north-west. Pooncarie (Tarcoola) weather station is 80 km north-west and Oxley (Walmer Downs) weather station is 70 km south-east of the Project.

† Source: Willy Online Pty Ltd (2012).

## 2.5 Limitations

Sample sites were located to cover as much of the study area and habitat types as possible; however, some sections of the study were difficult to access due to a lack of vehicle tracks, overgrown areas, fallen trees etc. Extreme weather conditions prevented surveys being undertaken at particular times (e.g. severe flooding for a period of 4 to 7 weeks). As such, portions of the study area were not viewed on-ground, and fauna habitat within these areas has been assessed from vegetation mapping and aerial photographs.

## 3 Results

The following sections display the results from the desktop review (Section 3.1), targeted fauna surveys (Section 3.2) and habitat descriptions (Section 3.3).

### 3.1 Desktop Review

A total of 54 threatened fauna species listed under the TSC Act and/or EPBC Act are known or predicted to occur in the Lower Murray/Darling Basin CMA sub-region, South Olary Plain, Murray Basin Sands (Part B). These 54 species are comprised of two frogs, six reptiles, 36 birds and 10 mammals (Table 3).

A total of 25 threatened species have been recorded within a 20 km radius of the study area (OEH 2012a, Australian Museum 2012, Birds Australia 2012), comprised of seven mammals, two reptiles and 16 birds (Table 3).

### 3.2 Fauna Surveys

A total of 179 vertebrate fauna species were recorded during the surveys comprising two frogs, 39 reptiles, 115 birds and 23 mammals (Appendix C). Each species was assigned an abundance category based on the frequency and numbers in which they were observed. Each species was classed as either rare (one sighting only), uncommon (more than one sighting but encountered only infrequently), common (encountered frequently but not in high numbers relative to other species abundance), or abundant (encountered frequently and in large numbers relative to other species abundance). Microbats identified only from ANABAT units were assigned an abundance category assuming that one individual was present when the species was recorded.

A total of 20 species recorded within the study area during the surveys are listed as threatened under the TSC Act and/or EPBC Act (Table 4). One species, the Rainbow Bee-eater, is listed as migratory under the EPBC Act. The locations of where they were recorded are shown in Figures 8-12. Six of the species recorded are introduced species. All six were mammals and all were classified as being common or abundant in the study area, other than dogs, which were only encountered infrequently (Appendix C).

### 3.3 Habitat Descriptions

Classification of broad fauna habitat types was based on information from a combination of sources, including:

- the vegetation type mapping and classification from the *Atlas-Campaspe Mineral Sands Project – Flora Surveys of the Properties East of Mungo National Park* (AMBS 2012) report;
- descriptions and classifications of vegetation from Benson *et al.* (2006);
- descriptions and classifications of broad vegetation units from Keith (2006); and
- survey results for this report.

The vegetation types from AMBS (2012) are displayed in Figure 13. Some vegetation types from the AMBS (2012) report have been combined to create a single broad fauna type, based on the structural features of the vegetation and the availability of habitat resources within these vegetation types. The broad habitat types and corresponding vegetation communities according to Benson *et al.* (2006) and Keith (2006) are described in Table 5 below. The condition and availability of resources within each broad habitat type are described in the following sections. The distribution of each broad habitat type is displayed in Figure 14 (entire area) and as a series of close ups in Figure 15 to Figure 18.

**Table 3: Threatened species previously recorded or predicted to have potential to occur within the study area based on a desktop review.**

| Common Name                                 | Scientific Name   | Conservation Status <sup>1</sup> |          | Data Record Source     |                          |                                |                              |                                 |
|---|---|----------------------------------|----------|------------------------|--------------------------|--------------------------------|------------------------------|---------------------------------|
|   |   | TSC Act                          | EPBC Act | OEH Atlas <sup>2</sup> | EPBC Report <sup>3</sup> | Australian Museum <sup>4</sup> | Birds Australia <sup>5</sup> | OEH CMA sub-region <sup>6</sup> |
| <b>Frogs</b>                                |   |                                  |          |                        |                          |                                |                              |                                 |
| Painted Frog                                | <i>Neobatrachus pictus</i>  | E                                | -        |                        |                          |                                |                              |                                 |
| Southern Bell Frog                          | <i>Litoria raniformis</i>   | E                                | V        |                        |                          |                                |                              | ✓                               |
| <b>Reptiles</b>                             |   |                                  |          |                        |                          |                                |                              |                                 |
| Jewelled Gecko                              | <i>Strophurus elderi</i>  | V                                | -        | ✓                      |                          | ✓                              |                              | ✓                               |
| Mallee Worm-lizard                          | <i>Aprasia inaurita</i>   | E                                | -        | ✓                      |                          |                                |                              | ✓                               |
| Marble-faced Delma                          | <i>Delma australis</i>  | E                                | -        |                        |                          |                                |                              | ✓                               |
| Spinifex Slender Blue-tongue                | <i>Cyclodomorphus melanops elongatus</i>  | E                                | -        |                        |                          |                                |                              | ✓                               |
| Western Blue-tongue                         | <i>Tiliqua occipitalis</i>  | V                                | -        |                        |                          |                                |                              | ✓                               |
| Bardick                                     | <i>Echiopsis curta</i>  | E                                | -        |                        |                          |                                |                              | ✓                               |
| <b>Birds</b>                                |   |                                  |          |                        |                          |                                |                              |                                 |
| Malleefowl                                  | <i>Leipoa ocellata</i>  | E                                | V        | ✓                      | ✓                        |                                | ✓                            | ✓                               |
| Magpie Goose                                | <i>Anseranas semipalmata</i>  | V                                | -        |                        |                          |                                |                              | ✓                               |
| Freckled Duck                               | <i>Stictonetta naevosa</i>  | V                                | -        |                        |                          |                                |                              | ✓                               |
| Blue-billed Duck                            | <i>Oxyura australis</i>   | V                                | -        |                        |                          |                                |                              | ✓                               |
| Australasian Bittern                        | <i>Botaurus poiciloptilus</i>   | E                                | E        |                        | ✓                        |                                |                              | ✓                               |
| Grey Falcon                                 | <i>Falco hypoleucos</i>   | E                                | -        |                        |                          |                                |                              | ✓                               |
| Square-tailed Kite                          | <i>Lophoictinia isura</i>   | V                                | -        |                        |                          |                                |                              | ✓                               |
| Black-breasted Buzzard                      | <i>Hamirostra melanosternon</i>   | V                                | -        |                        |                          |                                |                              | ✓                               |
| Spotted Harrier                             | <i>Circus assimilis</i>   | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Little Eagle                                | <i>Hieraaetus morphnoides</i>   | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Australian Bustard                          | <i>Ardeotis australis</i>   | E                                | -        | ✓                      |                          |                                |                              | ✓                               |
| Brolga                                      | <i>Grus rubicunda</i>   | V                                | -        |                        |                          |                                |                              | ✓                               |
| Bush Stone-curlew                           | <i>Burhinus grallarius</i>  | E                                | -        |                        |                          |                                |                              | ✓                               |
| Australian Painted Snipe                    | <i>Rostratula australis</i>   | E                                | V        |                        | ✓                        |                                |                              | ✓                               |
| Black-tailed Godwit                         | <i>Limosa limosa</i>  | V                                | -        |                        |                          |                                |                              | ✓                               |
| Red-tailed Black-Cockatoo (inland species)  | <i>Calyptorhynchus banksii samueli</i>  | V                                | -        |                        |                          |                                |                              | ✓                               |
| Major Mitchell's Cockatoo                   | <i>Lophochroa leadbeateri</i>   | V                                | -        | ✓                      |                          | ✓                              | ✓                            | ✓                               |
| Purple-crowned Lorikeet                     | <i>Glossopsitta porphyrocephala</i>   | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Regent Parrot (eastern subspecies)          | <i>Polytelis anthopeplus monarchoides</i>                                       | E                                | V        |                        |                          |                                | ✓                            | ✓                               |
| Barking Owl                                 | <i>Ninox connivens</i>  | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Thick-billed Grasswren (eastern subspecies) | <i>Amytornis textilis modestus</i>  | CE                               | V        |                        | ✓                        |                                |                              |                                 |
| Shy Heathwren                               | <i>Calamanthus cautus</i><br>(Also known as <i>Hylacola cautus</i> (OEH 2012a)) | V                                | -        |                        |                          |                                |                              | ✓                               |
| Redthroat                                   | <i>Pyrholaemus brunneus</i>   | V                                | -        |                        |                          |                                | ✓                            | ✓                               |
| Purple-gaped Honeyeater                     | <i>Lichenostomus cratitius</i>  | V                                | -        | ✓                      |                          |                                |                              | ✓                               |
| Black-eared Miner                           | <i>Manorina melanotis</i>   | CE                               | E        |                        |                          |                                |                              | ✓                               |
| Black-chinned Honeyeater                    | <i>Melithreptus gularis</i>   | V                                | -        |                        |                          |                                |                              | ✓                               |

| Common Name   | Scientific Name   | Conservation Status <sup>1</sup> |          | Data Record Source     |                          |                                |                              |                                 |
|---|---|----------------------------------|----------|------------------------|--------------------------|--------------------------------|------------------------------|---------------------------------|
|   |   | TSC Act                          | EPBC Act | OEH Atlas <sup>2</sup> | EPBC Report <sup>3</sup> | Australian Museum <sup>4</sup> | Birds Australia <sup>5</sup> | OEH CMA sub-region <sup>6</sup> |
| Painted Honeyeater (eastern subspecies)   | <i>Grantiella picta</i>   | V                                | -        |                        |                          |                                |                              |                                 |
| Pied Honeyeater   | <i>Certhionyx variegatus</i>                                      | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| White-fronted Chat  | <i>Epthianura albifrons</i>                                       | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Hooded Robin (south-eastern form)   | <i>Melanodryas cucullata cucullata</i>                            | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Flame Robin   | <i>Petroica phoenicea</i>   | V                                | -        |                        |                          |                                | ✓                            | ✓                               |
| Southern Scrub-robin  | <i>Drymodes brunneopygia</i>                                      | V                                | -        |                        |                          |                                |                              | ✓                               |
| Chestnut-backed Quail-thrush  | <i>Cinclosoma castanotum</i>                                      | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Varied Sittella   | <i>Daphoenositta chrysoptera</i>                                  | V                                | -        | ✓                      |                          | ✓                              | ✓                            | ✓                               |
| Gilbert's Whistler  | <i>Pachycephala inornata</i>                                      | V                                | -        | ✓                      |                          |                                | ✓                            | ✓                               |
| Diamond Firetail  | <i>Stagonopleura guttata</i>                                      | V                                | -        |                        |                          |                                | ✓                            | ✓                               |
| <b>Mammals</b>  |   |                                  |          |                        |                          |                                |                              |                                 |
| Southern Ningau   | <i>Ningau yvonneae</i>  | V                                | -        | ✓                      |                          | ✓                              |                              | ✓                               |
| Kultarr   | <i>Antechinomys laniger</i>                                       | E                                | -        |                        |                          |                                |                              | ✓                               |
| Western Pygmy Possum  | <i>Cercartetus concinnus</i>                                      | E                                | -        | ✓                      |                          | ✓                              |                              | ✓                               |
| Yellow-bellied Sheathtailed-bat   | <i>Saccolaimus flaviventris</i>                                   | V                                | -        |                        |                          |                                |                              | ✓                               |
| South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form) | <i>Nyctophilus corbeni</i> (also known as <i>N. timoriensis</i> ) | V                                | V        | ✓                      | ✓                        |                                |                              | ✓                               |
| Little Pied Bat   | <i>Chalinolobus picatus</i>                                       | V                                | -        | ✓                      |                          |                                |                              | ✓                               |
| Inland Forest Bat   | <i>Vespadelus baverstocki</i>                                     | V                                | -        | ✓                      |                          |                                |                              | ✓                               |
| Bolam's Mouse   | <i>Pseudomys bolami</i>   | E                                | -        | ✓                      |                          | ✓                              |                              | ✓                               |
| Desert Mouse  | <i>Pseudomys desertor</i>   | CE                               | -        |                        |                          |                                |                              | ✓                               |
| Long-haired Rat   | <i>Rattus villosissimus</i>                                       | V                                | -        | ✓                      |                          |                                |                              |                                 |

<sup>1</sup> Threatened fauna species status listed under the TSC Act and/or EPBC Act (current as of 25 July 2012).

CE = critically endangered, E = endangered, V = vulnerable

<sup>2</sup> OEHS Atlas of NSW Wildlife (OEHS 2012b).

<sup>3</sup> SEWPaC Protected Matters Search (SEWPaC 2012).

<sup>4</sup> Australian Museum (2012).

<sup>5</sup> Birds Australia (2012).

<sup>6</sup> OEHS CMA sub-region (Lower Murray Darling- South Olary Plain, Murray Basin Sands [Part B]) Threatened Species List (2012).

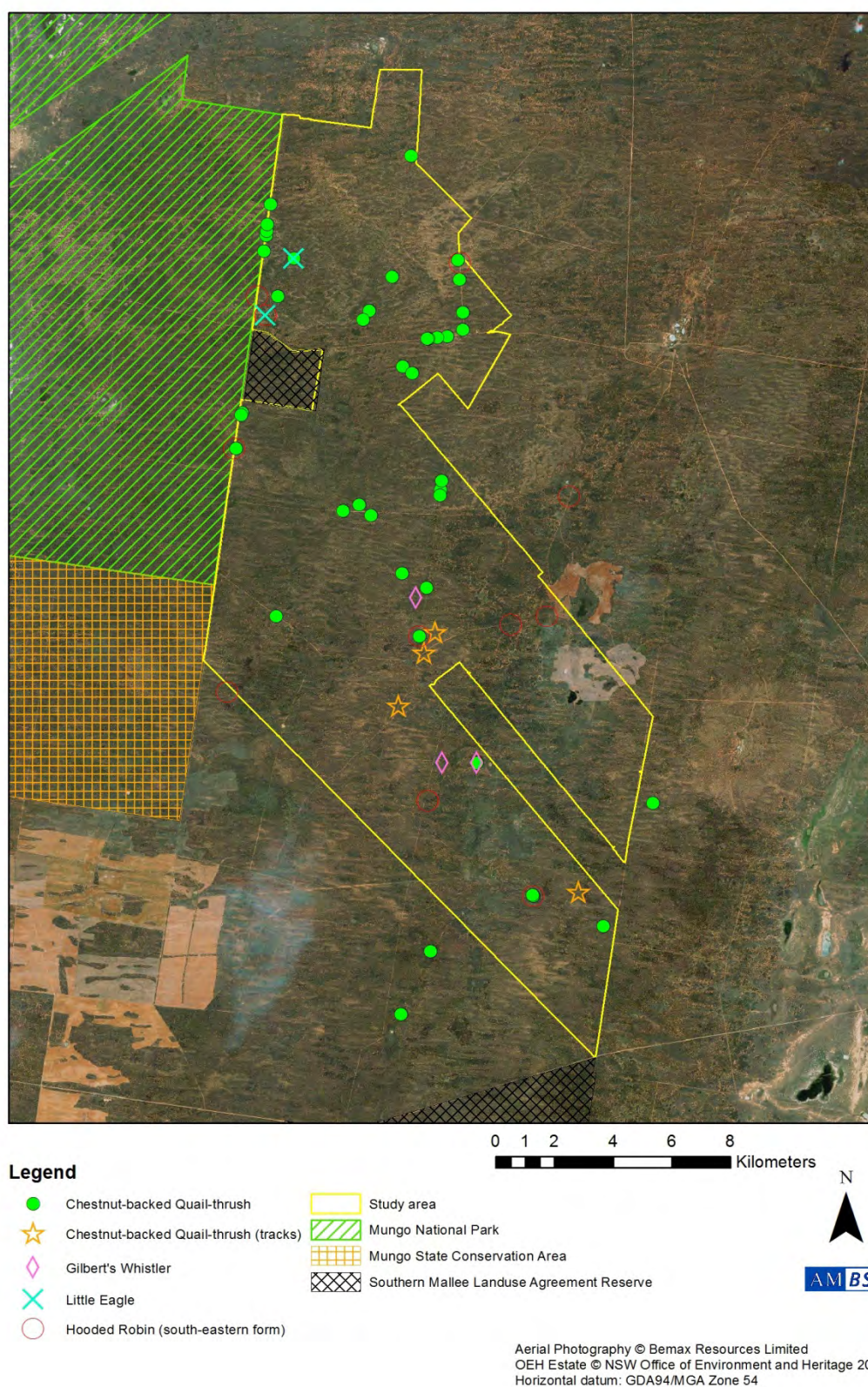
**Table 4: Threatened fauna species recorded in the study area.**

| Scientific name  | Common name                               | Conservation Status <sup>1</sup> |          |
|--|---|----------------------------------|----------|
|  |   | TSC Act                          | EPBC Act |
| <b>Reptiles</b>  |   |                                  |          |
| Jewelled Gecko   | <i>Strophurus elderi</i>                  | V                                | -        |
| Mallee Worm-lizard   | <i>Aprasia inaurita</i>                   | E                                | -        |
| Spinifex Slender Blue-tongue   | <i>Cyclodomorphus melanops elongatus</i>  | E                                | -        |
| Bardick  | <i>Echiopsis curta</i>                    | E                                | -        |
| <b>Birds</b>   |   |                                  |          |
| Malleefowl   | <i>Leipoa ocellata</i>                    | E                                | V        |
| Spotted Harrier  | <i>Circus assimilis</i>                   | V                                | -        |
| Little Eagle   | <i>Hieraaetus morphnoides</i>             | V                                | -        |
| Major Mitchell's Cockatoo  | <i>Lophochroa leadbeateri</i>             | V                                | -        |
| Regent Parrot (eastern subspecies)   | <i>Polytelis anthopeplus monarchoides</i> | E                                | V        |
| Pied Honeyeater  | <i>Certhionyx variegatus</i>              | V                                | -        |
| White-fronted Chat   | <i>Epthianura albifrons</i>               | V                                | -        |
| Hooded Robin (south-eastern form)  | <i>Melanodryas cucullata cucullata</i>    | V                                | -        |
| Chestnut-backed Quail-thrush   | <i>Cinclosoma castanotum</i>              | V                                | -        |
| Varied Sittella  | <i>Daphoenositta chrysoptera</i>          | V                                | -        |
| Gilbert's Whistler   | <i>Pachycephala inornata</i>              | V                                | -        |
| <b>Mammals</b>   |   |                                  |          |
| Southern Ningau  | <i>Ningau yvonneae</i>                    | V                                | -        |
| Yellow-bellied Sheathtailed-bat  | <i>Saccolaimus flaviventris</i>           | V                                | -        |
| Greater/Southern South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form) | <i>Nyctophilus timoriensis/corbeni</i>    | V                                | V        |
| Little Pied Bat  | <i>Chalinolobus picatus</i>               | V                                | -        |
| Inland Forest Bat  | <i>Vespadelus baverstocki</i>             | V                                | -        |

<sup>1</sup> Threatened fauna species status listed under the TSC Act and/or EPBC Act (current as of 25 July 2012).

V = Vulnerable, E = Endangered.





**Figure 8: Location of threatened bird species.**



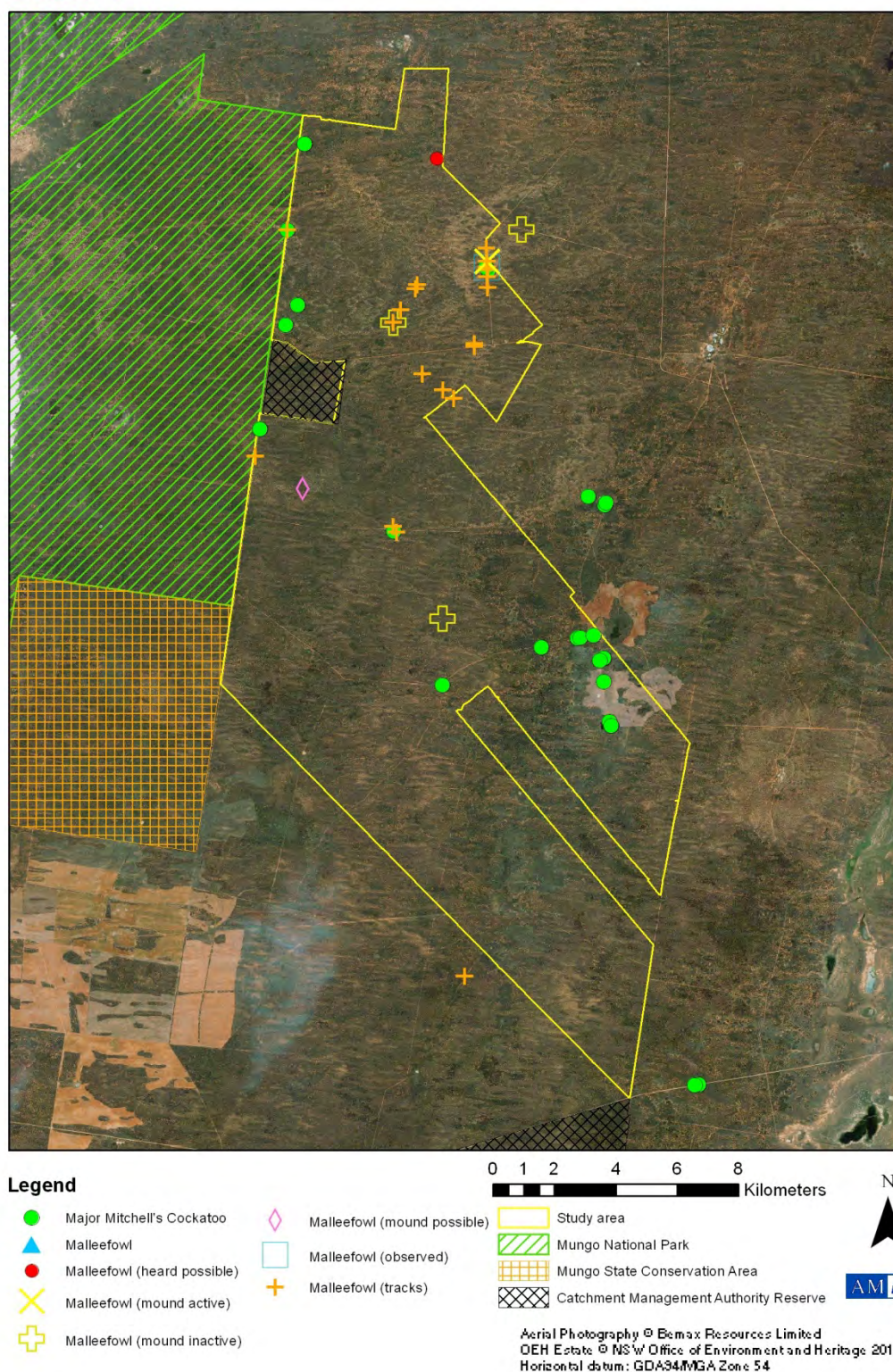
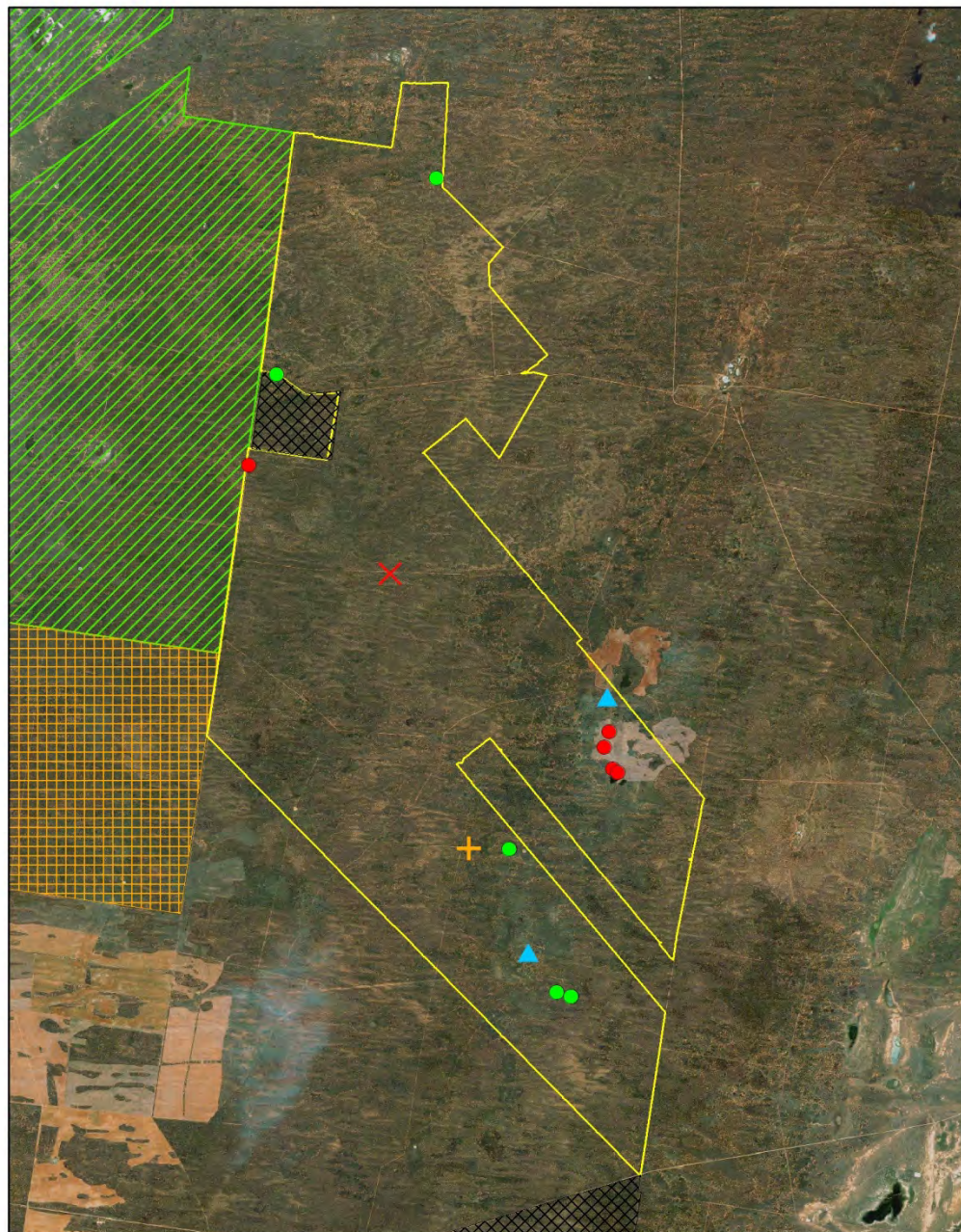


Figure 9: Location of threatened bird species.





**Legend**

- |   |                    |   |
|---|--------------------|---|
| × | Pied Honeyeater    | Study area                                |
| + | Regent Parrot      | Mungo National Park                       |
| ▲ | Spotted Harrier    | Mungo State Conservation Area             |
| ● | Varied Sittella    | Southern Mallee Landuse Agreement Reserve |
| ● | White-fronted Chat |   |

0 1 2 4 6 8  
Kilometers

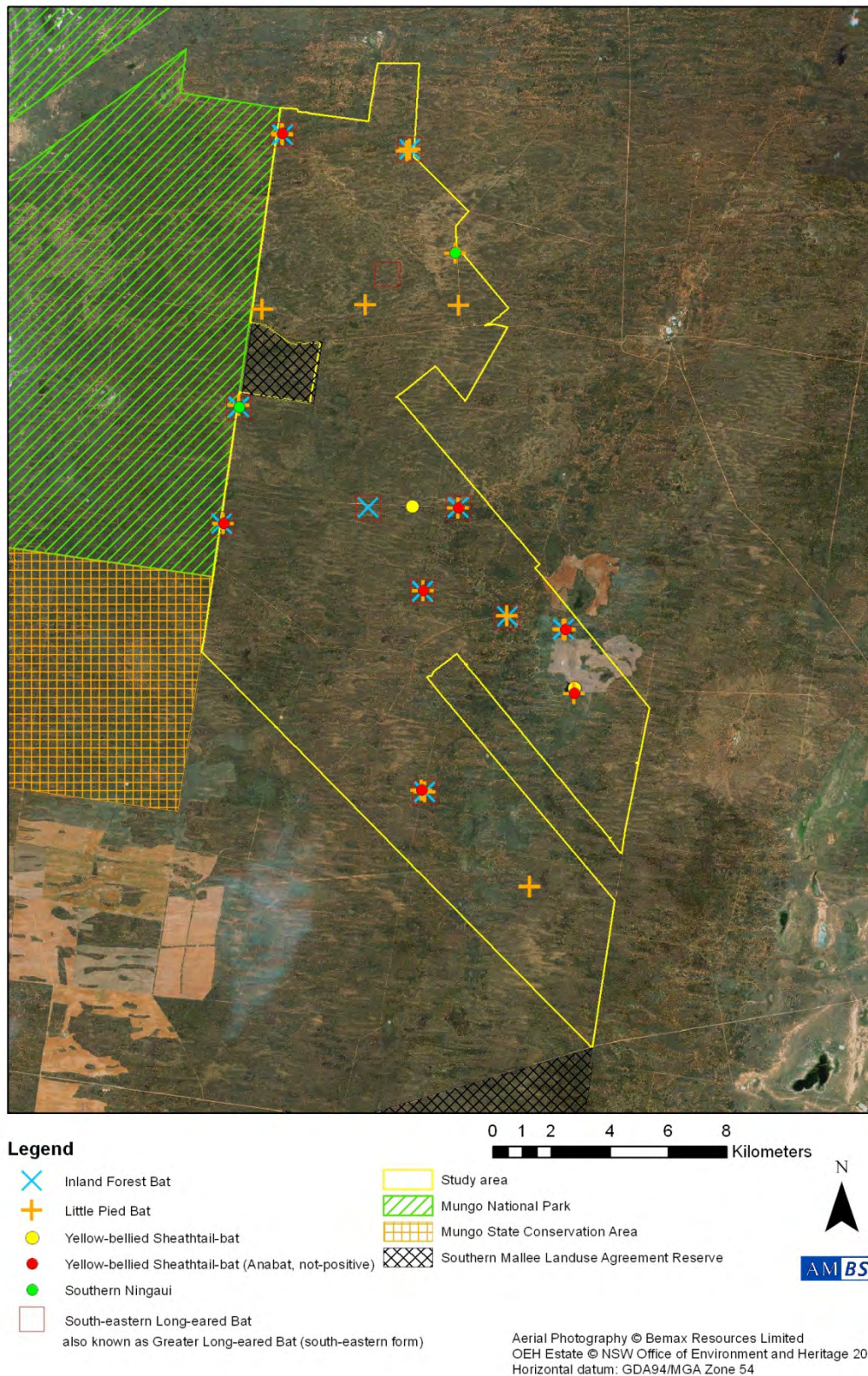


AMBS

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 Horizontal datum: GDA94/MGA Zone 54

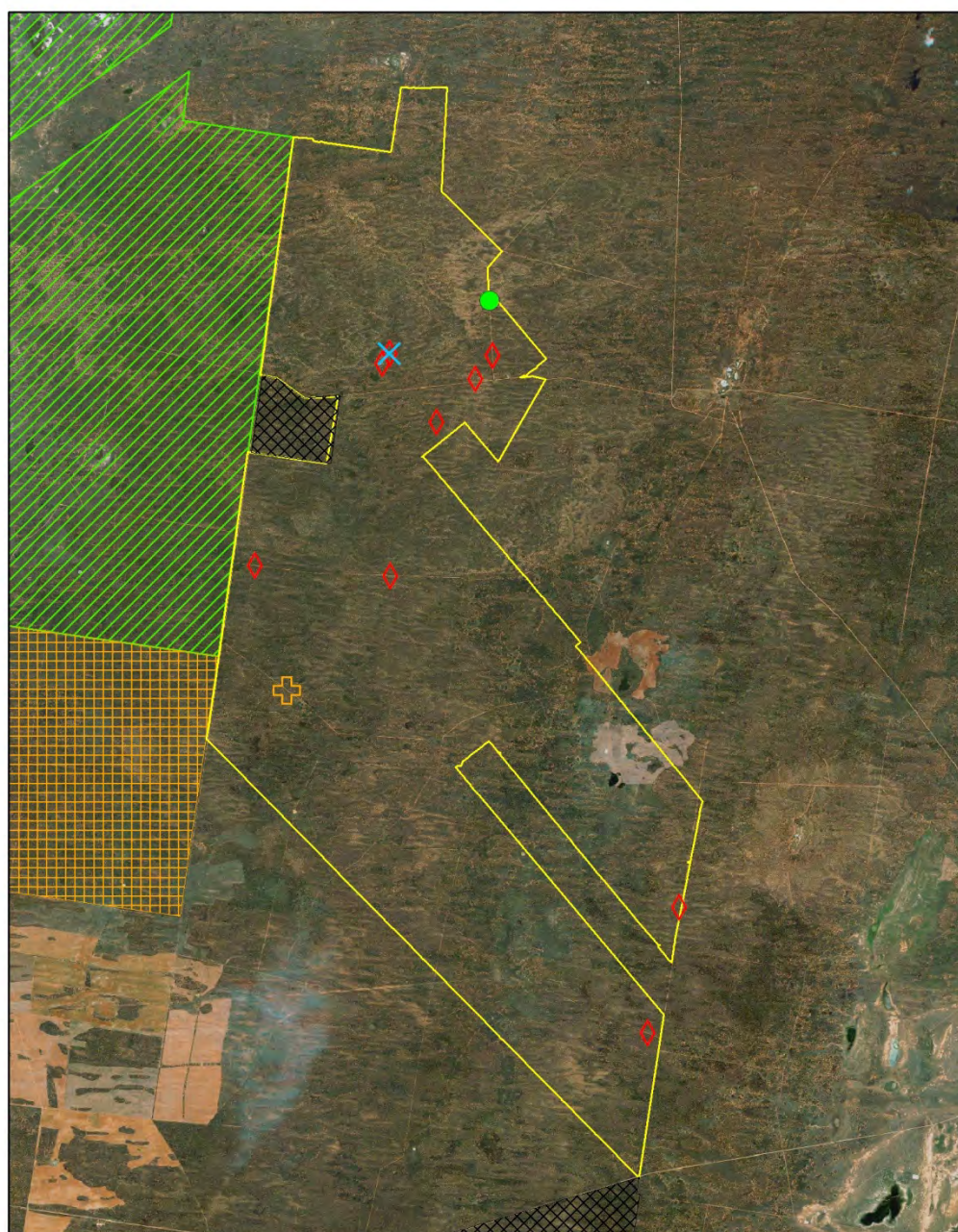
**Figure 10: Location of threatened bird species.**





**Figure 11: Location of threatened mammal species.**





# Legend

- Bardick
- ◊ Jewelled Gecko
- + Mallee Worm-lizard
- × Spinifex Slender Blue-tongue
- Study area
- Mungo National Park
- Mungo State Conservation Area
- Southern Mallee Landuse Agreement Reserve

0 1 2 4 6 8  
Kilometers

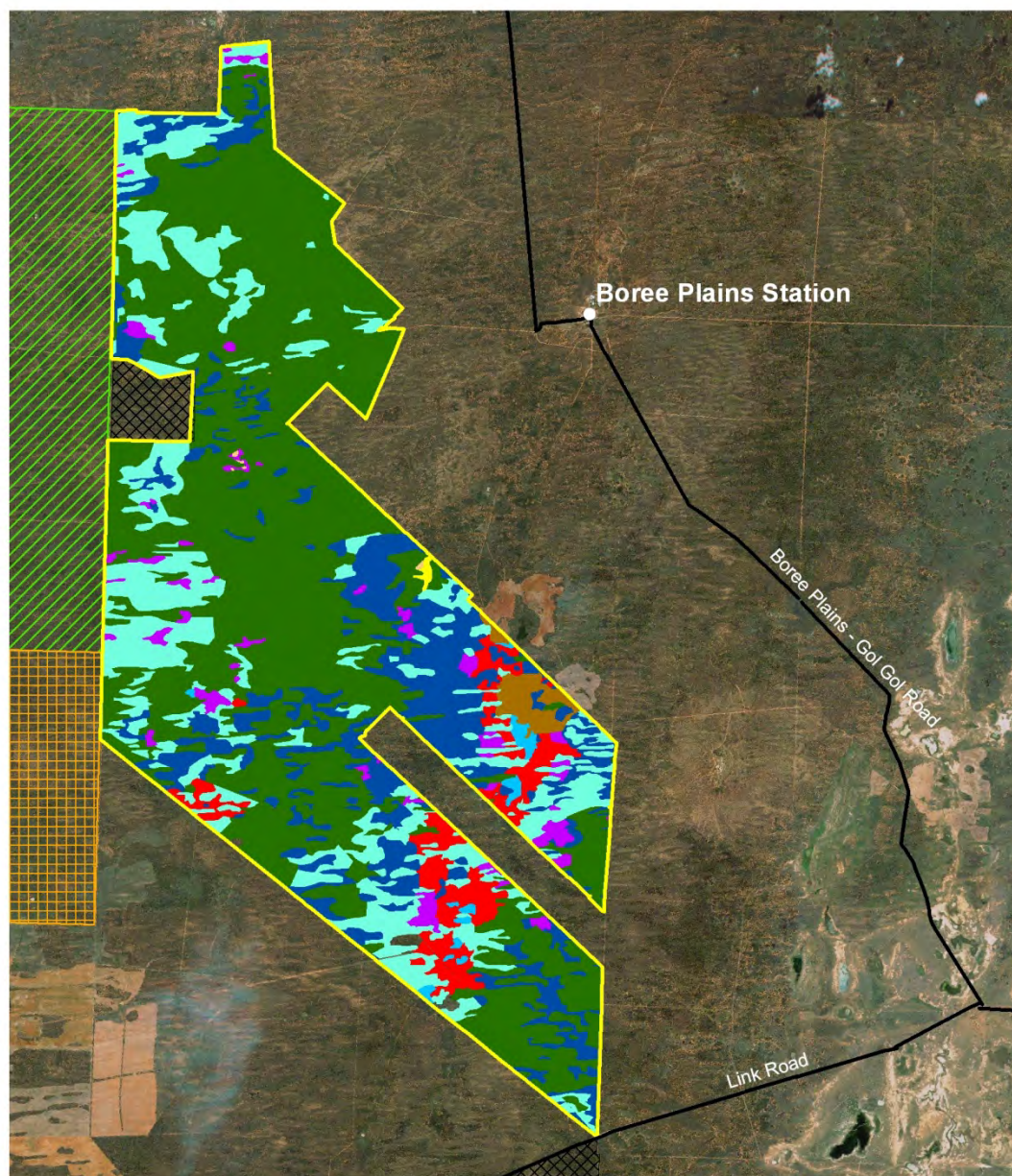


AMBS

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 Horizontal datum: GDA94/MGA Zone 54

**Figure 12: Location of threatened reptile species.**





### Legend

|   |                               |  |
|---|-------------------------------|--|
| Study Area                                | <b>Vegetation Communities</b> | Grass/Herbland of Drainage Depressions |
| Mungo National Park                       | Belah-Rosewood Woodland       | Disturbed Area Shrubland Complex A     |
| Mungo State Conservation Area             | Black Box Woodland            | Mulga Woodland                         |
| Southern Mallee Landuse Agreement Reserve | Cleared Land                  | Sandplain Mallee                       |
|   | Linear Dune Mallee            | Yarran Shrubland                       |

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 Horizontal datum: GDA94/MGA Zone 54

0 1.25 2.5 5  
 Kilometres



**Figure 13: Mapped distribution of all vegetation types within the study area (AMBS 2012).**

**Table 5: Fauna habitat types and corresponding vegetation types.**

| Broad Fauna Habitat Type      | AMBS (2012) Vegetation Communities      | Vegetation Map Unit (Benson <i>et al.</i> 2006)  | Description   | Broad Keith (2006) Vegetation Unit           |
|-------------------------------|---|--|---|--|
| Linear Dune Mallee            | Linear Dune Mallee                      | ID 171- Spinifex Linear Dune Mallee mainly of the Murray-Darling Depression Bioregion; and Deep Sand Mallee of irregular dunefields of the semi-arid (warm) zone.  | Woodland on sand dunes dominated by Mallee Eucalyptus species and <i>Triodia scariosa</i> (Porcupine Grass).  | Dune Mallee Woodlands                        |
| Sandplain Mallee              | Sandplain Mallee                        | ID 170- Chenopod Sandplain Mallee woodland/shrubland of the arid and semi-arid (warm) zones.   | Woodland on sandplains dominated by mallee Eucalyptus species and chenopod shrubs.  | Sandplain Mallee Woodlands                   |
| Belah-Rosewood Woodland       | Belah-Rosewood Woodland                 | ID 58- Black-Oak Rosewood open woodland on deep sandy loams of the Murray-Darling Depression and Riverina Bioregions; and ID 221- Black Oak-Pearl Bluebush open woodland of the sandplains of the semi-arid warm and arid climate zones. | Woodland on sandplains dominated by <i>Casuarina pauper</i> (Belah) and <i>Alectryon oleifolius</i> (Western Rosewood).   | Semi-arid Sandplain Woodlands                |
| Disturbed Shrubland           | Disturbed Area Shrubland Complex (A)    | ID 143- Narrow-leaved Hopbush-Scrub Turpentine-Senna shrubland of semi-arid and arid sandplains and dunes.   | Shrubland in disturbed areas dominated by non palatable shrub species such as <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> (Narrow-leaved Hopbush), <i>Eremophila sturtii</i> (Turpentine Bush) and <i>Senna</i> sp. (Cassia).                          | Structurally similar to North-west Shrubland |
| Acacia Woodland/Shrubland     | Mulga Woodland                          | ID 199- Hooked Needlewood-Needlewood-Mulga-Turpentine Bush open shrubland of the semi-arid and arid plains.  | Woodland in disturbed areas with a remnant canopy of <i>Acacia aneura</i> (Mulga).  | Sandplain Mulga Shrubland                    |
| Acacia Woodland/Shrubland     | Yarran Shrubland                        | ID 23- Yarran shrubland of the sandplains and plains of the semi-arid (warm) and arid climate zones.   | Shrubland in disturbed areas of non-palatable shrub species with occurrences of <i>Acacia melvillei</i> (Yarran).   | Sandplain Mulga Shrubland                    |
| Black Box Floodplain Woodland | Black Box Woodland                      | 15- Black Box open woodland with chenopod understorey mainly on the outer floodplains in south-western NSW.  | Woodland on clays in low lying areas dominated by <i>Eucalyptus largiflorens</i> (Black Box), <i>Lachnagrostis filiformis</i> , <i>Teucrium racemosum</i> (Forest Germander) and <i>Stemodia florulenta</i> (Blue-Rod).                                       | Inland Floodplain Woodland                   |
| Ephemeral Wetland             | Black Box Woodland                      | n/a  | n/a   | n/a  |
| Grass and Shrub Depressions   | Grass/Herblands of Drainage Depressions | n/a  | Small to large depressions in sandplains dominated by species such as <i>Marsilea drummondii</i> (Common Nardoo), <i>Teucrium racemosum</i> (Forest Germander), <i>Centipeda thespidioides</i> (Desert Sneezeweed) and <i>Stemodia florulenta</i> (Blue-Rod). | n/a  |
| Cleared land                  | Cropland                                | n/a  | Areas cleared and ploughed for cropping.  | n/a  |

### Mallee Woodland

A number of Mallee eucalypt species occur in various abundances and assemblages. The more prevalent are *Eucalyptus socialis* (Red Mallee), *E. dumosa* (White Mallee), *E. gracilis* (Yorrell), *E. costata* subsp. *murrayana* (Ridge-fruited Mallee) and less commonly *E. leptophylla* (Narrow-leaved Red Mallee) and *E. oleosa* (Red Mallee).

Two forms of this vegetation type occur within the study area and have been mapped as the two separate communities, namely, Linear Dune Mallee and Sandplain Mallee. These communities have been distinguished as separate, as one of the communities (Linear Dune Mallee) provides an important habitat resource for some ‘specialist’ species in the semi-arid zone. Several native and threatened species known to occur in the study area are limited in their geographic distribution by the presence or absence of *Triodia* sp. (*Spinifex*).

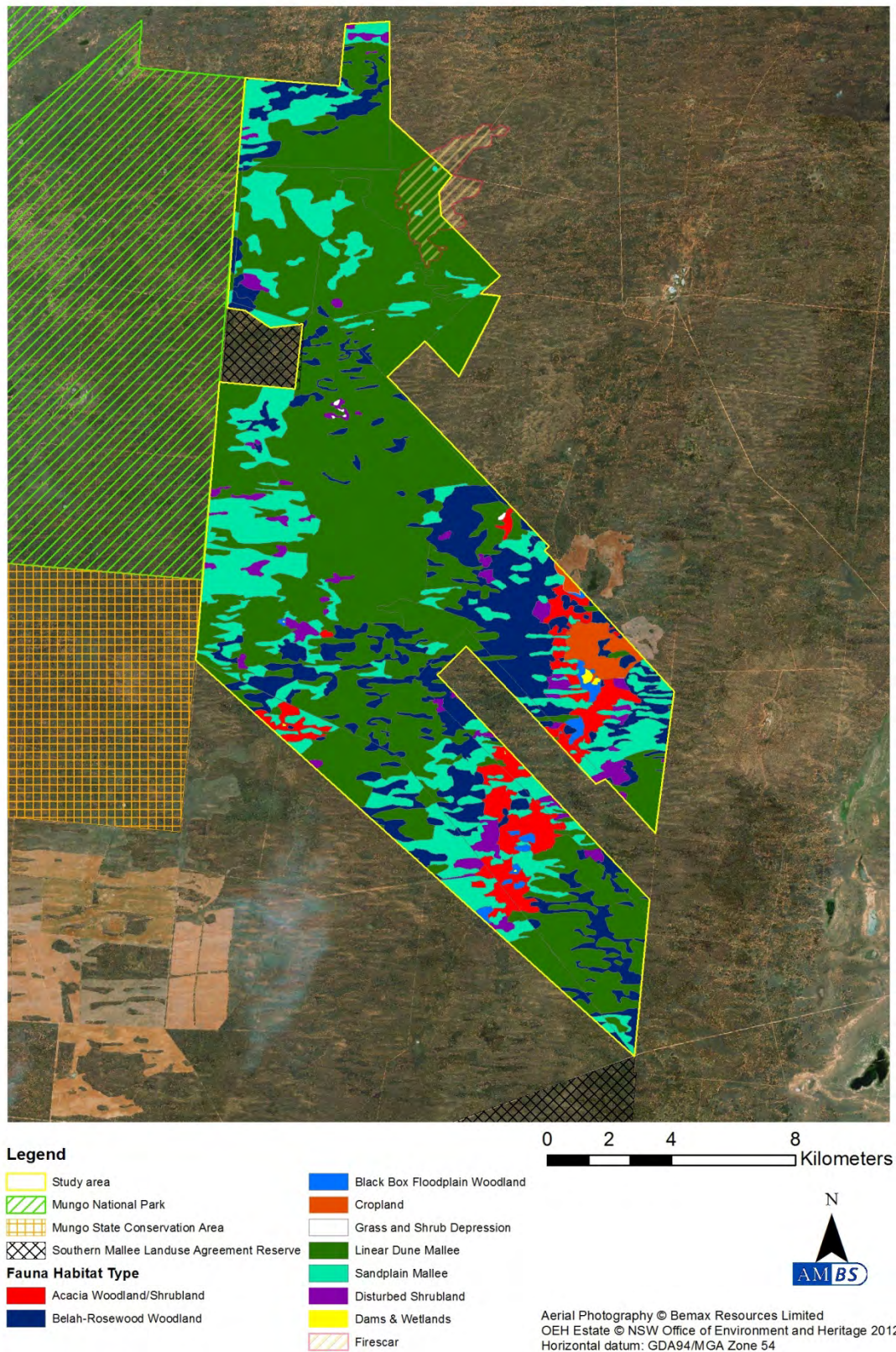
Linear Dune Mallee occurs on deeper dune sands with a ground layer dominated by *Spinifex* (*Triodia scariosa* ssp. *scariosa*), and Sandplain Mallee occurs on sandplains with a ground layer dominated by *Austrostipa nitida* and chenopod shrubs. Each community can occur as separate distinguishable vegetation types or as transitional mixed patches of both. Sandplain Mallee was often observed as small areas between the dunes in large expanses of Linear Dune Mallee and in areas predominantly covered by Sandplain Mallee patches of Linear Dune Mallee were often observed on small sandy rises. In transitional zones between the two communities *Spinifex* hummocks were often present but in lower abundance within the Sandplain Mallee.

### **Linear Dune Mallee**

The majority of the Linear Dune Mallee occurs as large continuous tracts of vegetation in the western and north-western sections of the study area (Figure 14 and Figures 15-18).

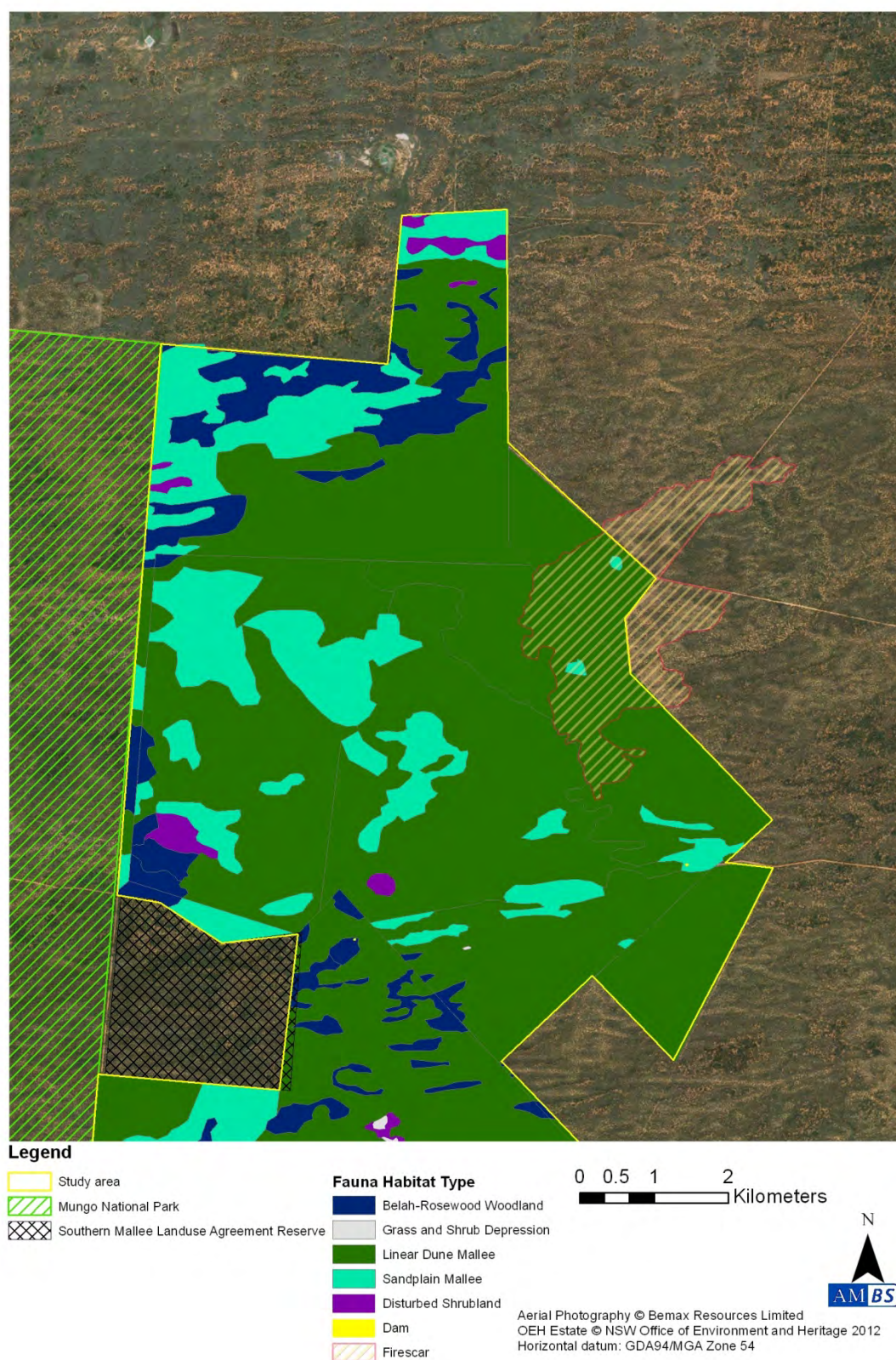
Linear Dune Mallee has a canopy dominated by *Eucalyptus socialis*, *E. gracilis*, with *E. leptophylla* and *E. costata* subsp. *murrayana* occurring less commonly.





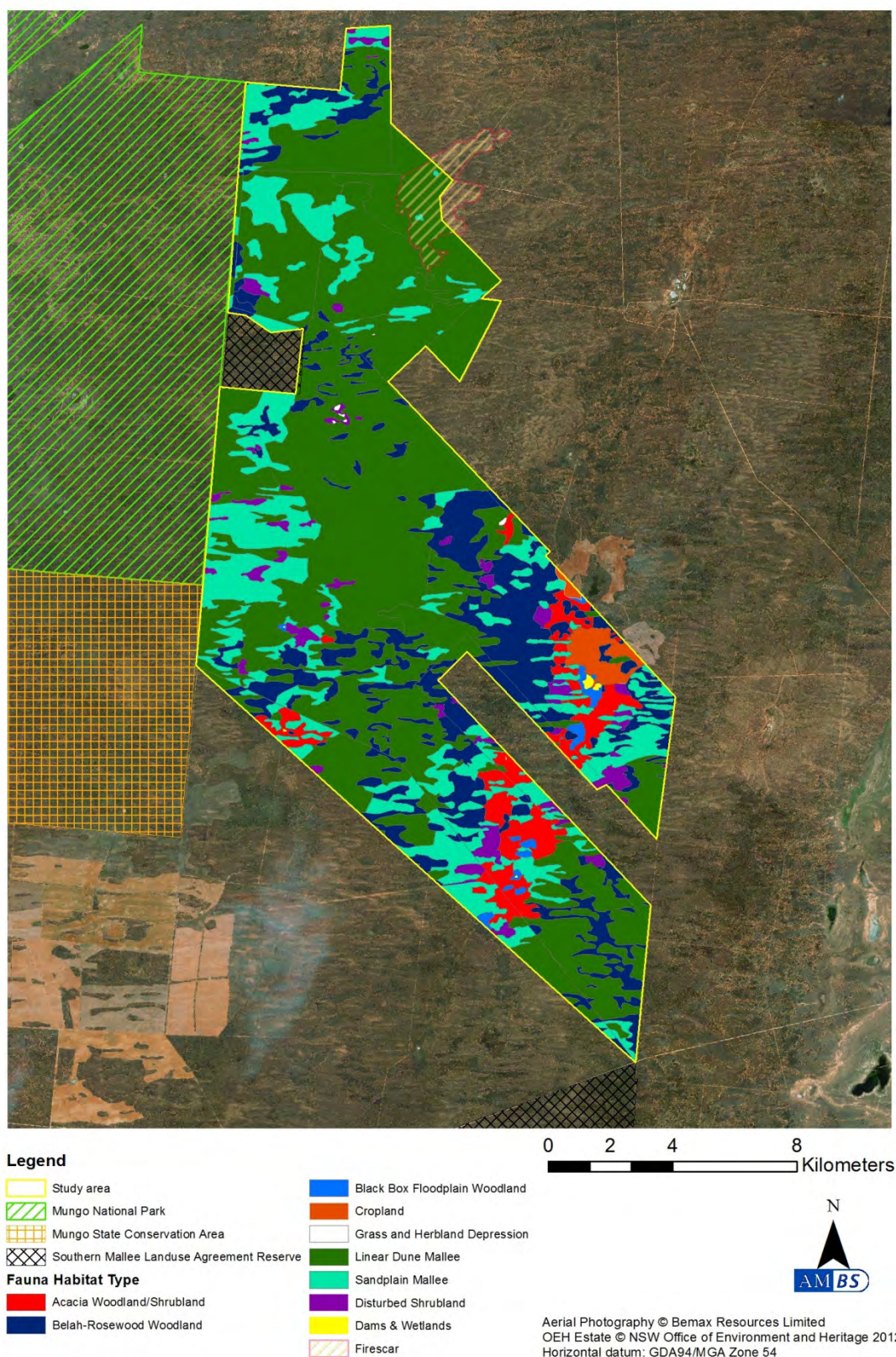
**Figure 14: Broad habitat types within the study area.**





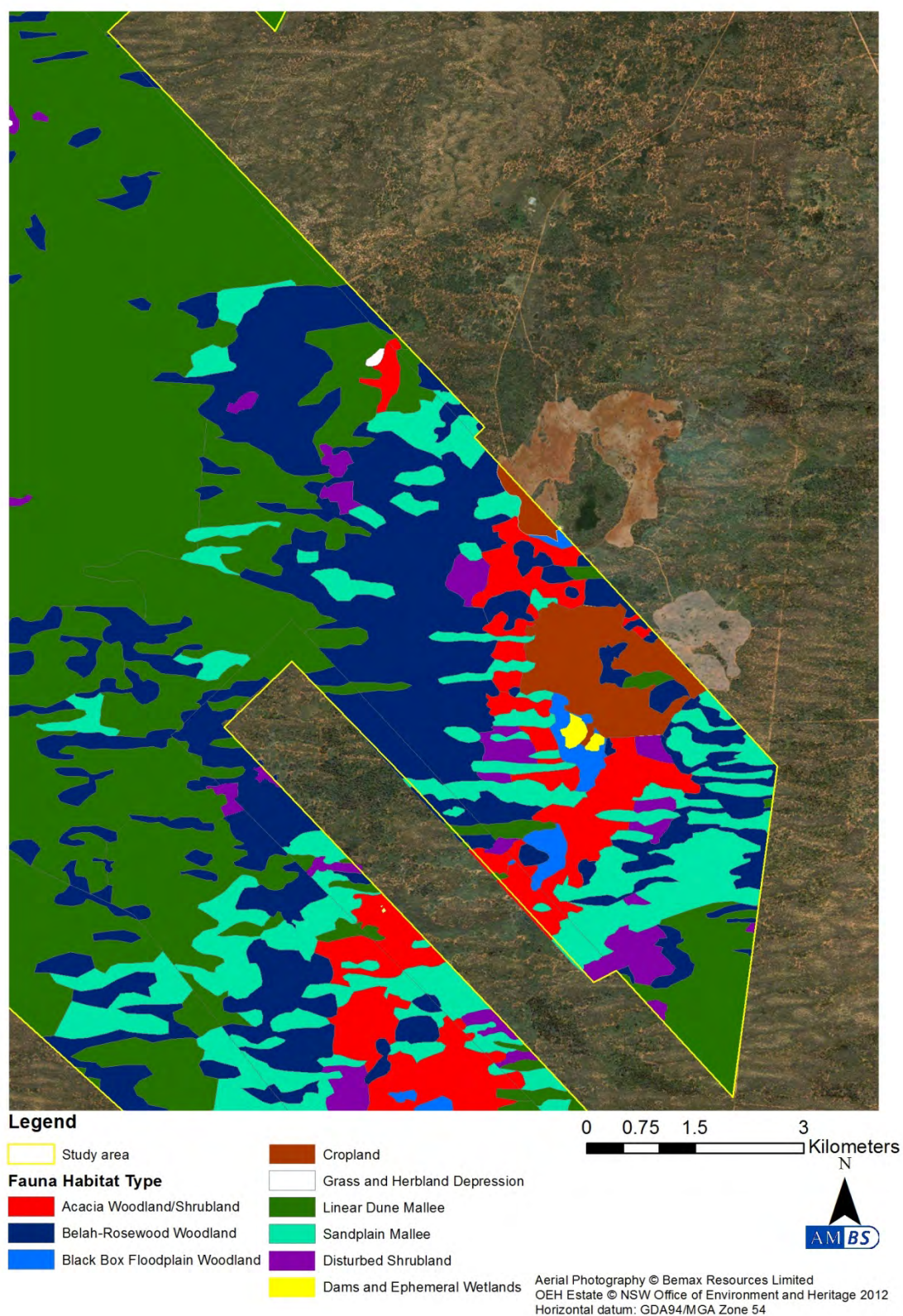
**Figure 15: Habitat types in the northern part of the study area.**





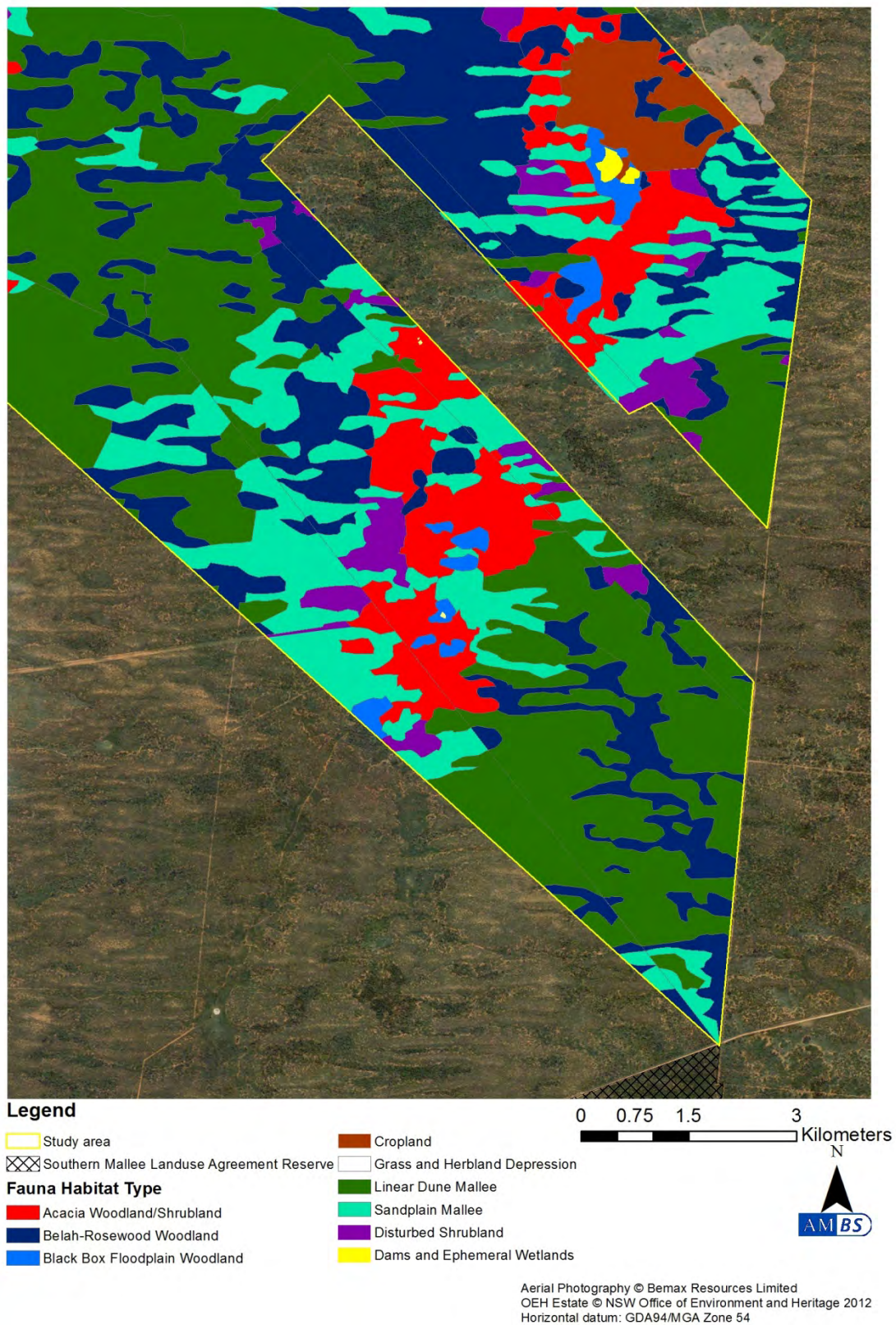
**Figure 16: Habitat types in the central part of the study area.**





**Figure 17: Broad habitat types in the eastern part of the study area.**





**Figure 18: Habitat types in the southern part of the study area.**

The shrub and ground layer has a mix of species including *Dodonaea viscosa* ssp. *Angustissima*, *Triodia scariosa* subsp. *scariosa*, *Schoenus subaphyllus* (Desert Bog-rush), *Sclerolaena diacantha* (Grey Copperburr), *Sclerolaena parviflora*, *Chenopodium desertorum*, *Halgania cyanea* (Rough Halgania) and *Maireana decalvans* (Black Cotton Bush). Linear Dune Mallee has a number of species particularly associated with it including *Lomandra effusa* (Scented Mat-rush), *Lomandra leucocephala* (Woolly Mat-rush), *Lomandra collina* (Pale Mat-rush), *Eremophila glabra* subsp. *murrayana*, *Callitris verrucosa* (Mallee Pine), *Scaevola depauperata* (Skeleton Fan-flower), *Leptospermum coriaceum* (Green Tea-tree), *Bossiaea walkeri* (Cactus Pea), *Acacia wilhelmiana* (Wilhem's Wattle), *Acacia rigens* (Needle Wattle), *Acacia brachybotrya* (Grey Mulga), *Schoenus subaphyllus*, *Dodonaea lobulata* and *Amphipogon caricinus* (Long Greybeard Grass).

Overall the Linear Dune Mallee in the study area and surrounds is in good condition. The type of vegetation, deep sand and distances from watering tanks reduce the visits to such areas by stock and goats. The *Triodia* spp. are considered to be less palatable to stock (Queensland Murray Darling Committee 2006) and with low nutritive value (Islam and Adams 1999). Weed species were seldom recorded in this habitat type.

The Linear Dune Mallee habitat type contains a number of trees with small hollows (<10cm) at an average density of 23 hollows per hectare in the older woodland sections (Appendix B). These hollows occur as anything from small fissures to hollow sections at the end of branches, to hollow trunks within a multi-stemmed mallee tree. Medium size hollows (10-30cm) are rare within this habitat type with an average of 5 hollows per hectare, and large hollows (>30cm) were rare with 1.4 hollows per hectare (Figure 19 and Appendix B). The presence of these hollows within this unit is dependent on the fire and disturbance history of each portion of the community. As a general observation, areas in the central and northern sections of the total study area (outside of the fire scar) were more mature and contained more hollows than some of the areas within the southern and eastern areas. Further this habitat types has the second highest number of total hollows per hectare (42.6) (Figure 20 and Appendix B).

When compared to the Sand plain Mallee within the study area, Linear Dune Mallee was recorded as having a slightly greater number of hollows per site than the Sandplain Mallee, but fewer trees with hollows (Figure 20).

Another key habitat resource available in high abundance within this habitat type is well developed Spinifex (*Triodia* spp.) hummocks. A number of threatened and native species are known or predicted to occur within the Project area and surrounds are 'spinifex specialists' (e.g. Southern Ningui). In general the Spinifex hummocks were abundant and well-developed in this habitat type (Plate 1).

Fallen timber also provides a valuable den/shelter habitat resource within the Linear Dune Mallee for small mammals such as the Common Dunnart (*Sminthopsis murina*). On average 60-90m of fallen timber was recorded per hectare of Linear Dune Mallee habitat (Figure 22 and Appendix B). Decorticating bark is in highest abundance within this habitat type than any of other habitat type (Figure 23 and Appendix B). High loads of decorticating bark provide shelter resources for small mammals (e.g. Western Pygmy Possum) and microbats (e.g. South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form)).



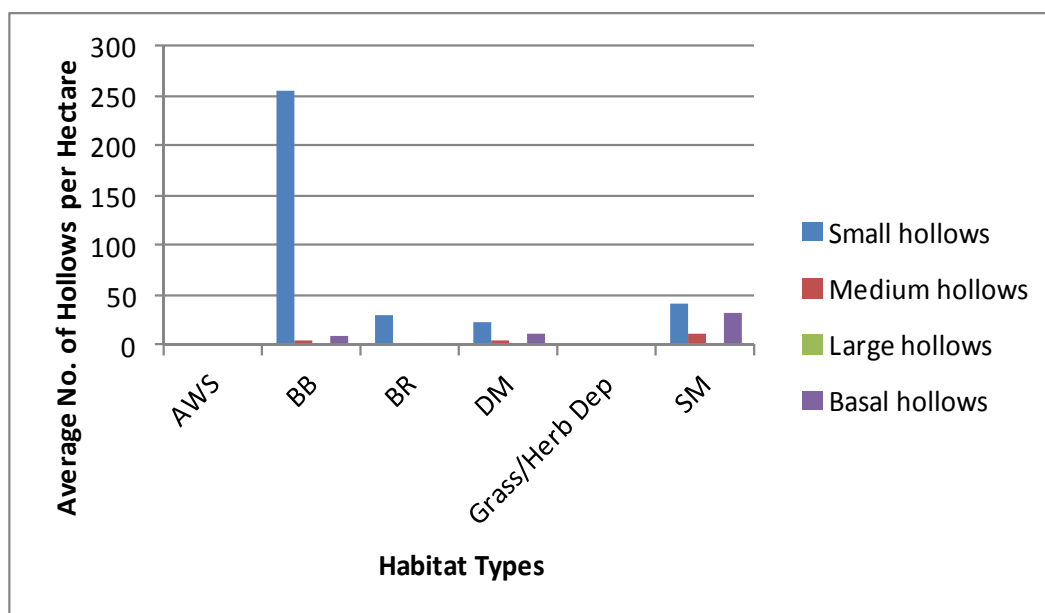


Figure 19: Average number of hollows (based on size) per hectare of habitat type.

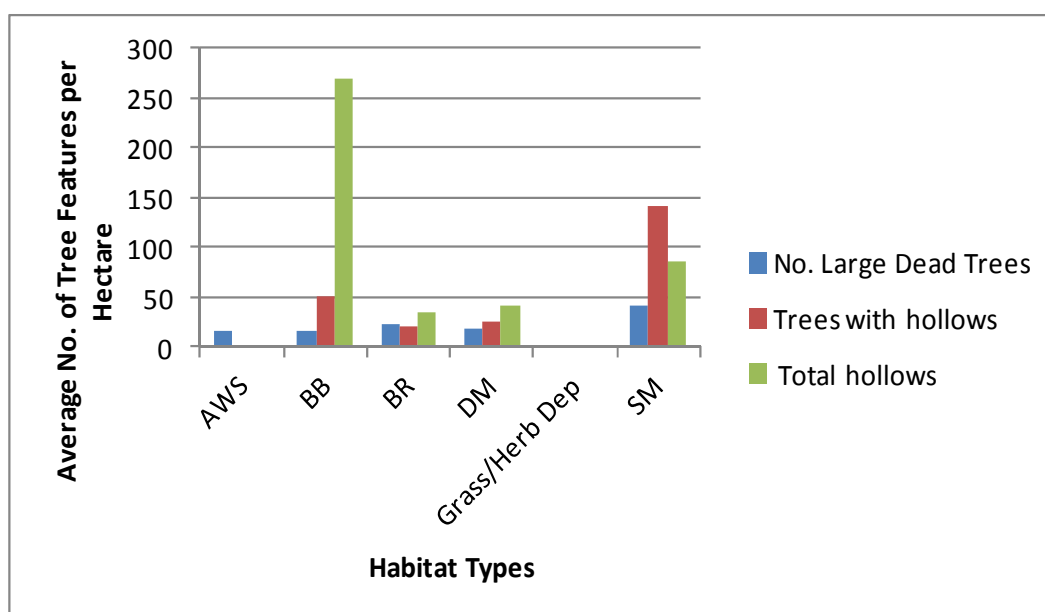


Figure 20: Average Number of tree features per hectare.



**Plate 1: Typical Linear Dune Mallee habitat.**

A number of threatened species were recorded within this habitat type during AMBS surveys. In particular, large continuous Linear Dune Mallee with inter-spacing between spinifex hummocks provides important breeding and foraging habitat for Malleefowl. Evidence of Malleefowl was found in several locations in Linear Dune Mallee within the study area. Linear Dune Mallee provides important habitat resources for a number of threatened species and is likely to be a significant resource in the semi-arid region given a number of species within the region are 'spinifex specialist' and spinifex doesn't occur in high abundance in any other communities. Some of the species that are more reliant on the presence of this habitat type include, but are not restricted to:

- Jewelled Gecko;
- Bardick;
- Spinifex Slender Blue-tongue; and
- Southern Ningui.

### **Sandplain Mallee**

The majority of the Sandplain Mallee occurs as continuous tracts of vegetation in the south-east sections of the study area and central (Figure 14 and Figure 15- 18). The remainder of the habitat occurs as smaller, less connected patches in the northern and south western sections of the study area (Figure 14 and Figure 15- 18).

Sandplain Mallee has a canopy dominated by *E. socialis*, *E. dumosa* and *E. gracilis*.

The shrub and ground layer has a mix of species including *Austrostipa nitida*, *Sclerolaena diacantha*, *Chenopodium desertorum*, *Olearia pimeleoides*, *Maireana georgei* (Slit-wing Bluebush), *Maireana triptera* (Three-wing Bluebush), *Maireana radiata*, *Enchylaena tomentosa* (Ruby Saltbush) and *Marsdenia australis* (Doubah). Sandplain Mallee shares many species with other vegetation communities in the offset study area.

Overall the Sandplain Mallee in the study area ranges from good to moderate condition depending on the degree of disturbance from grazing and clearing. Relatively few weed species were recorded in Sandplain Mallee.

Small (<10 cm), medium (10-20 cm) and basal hollows are present sporadically throughout this habitat type, with an average of 42, 11 and 32 hollows per hectare of each size/position, respectively (Figure 19 and Appendix B). No large hollows (>30 cm) were recorded in this habitat type. These hollows occur as anything from small fissures to hollow sections at the end of branches to hollow trunks within a multi-stemmed mallee tree. In general, the Sandplain Mallee showed more signs of disturbance (particularly grazing) than the Dune Mallee. Despite this there is still a relatively high amount of hollows within this unit that are likely to provide breeding/shelter/roosting habitat for a number of microbats, small marsupials and potentially some parrots known to use the area. When compared to the other broad habitat types within the Project area and surrounds, Sandplain Mallee contains more live trees with hollows than any of the other habitat type and the greatest number of large dead trees with hollows than any other habitat type (Figure 20 and Appendix B). Further this habitat type has the highest number of total hollows per hectare (86.4) (Figure 20 and Appendix B).



**Plate 2: Typical Sandplain Mallee habitat.**

Where saltbush understorey occurs in this type, it is also likely to provide food and shelter resources to several native and threatened species such as Western Blue-tongue, Chestnut backed Quail-thrush, Mallee Worm-lizard and Pied Honeyeater. Several raptors are also known to hunt in Sandplain Mallee with a saltbush understorey (e.g. Spotted Harrier).

Fallen timber also provides a valuable den/shelter habitat resource within the Sandplain Mallee for common and threatened small mammals similar to those likely to be present in Linear Dune Mallee. Some areas of this type were observed to have large loads of fallen timber, and large logs (>15cm diameter) were abundant in some areas with an average of 161 m of large fallen timber per hectare from some areas (Figure 23 and Appendix B). On average 100-190 m of fallen timber (all sizes) was recorded per hectare of Sandplain Mallee habitat (Figure 22 and Appendix B). This habitat type also contains an abundance of decorating bark, which is likely to provide shelter/roosting habitat for a number of microbats and small mammals. A number of threatened species were recorded within this habitat type during AMBS surveys. Sandplain Mallee provides habitat resources for a number of threatened species. Some of the species that use this habitat type include, but are not restricted to, Southern Ningau, Shy Heathwren and Southern Scrub Wren.



A number of threatened species were recorded within this habitat type during AMBS surveys. Sandplain Mallee provides important habitat resources for a number of threatened species. Some of the species that are more reliant on the presence of this habitat type include, but are not restricted to:

- Southern Ningui;
- Shy Heathwren; and
- Southern Scrub-robin.

### *Belah-Rosewood Woodland*

The majority of the Belah-Rosewood Woodland habitat type occurs as continuous tracts of vegetation in the south-east sections of the study area (Figure 14 and Figure 15-18). The remainder of the habitat type occurs as scattered isolated patches within large tracts of Linear Dune Mallee in the northern and southern sections of the study area (Figure 14 and Figure 15-18).

Belah-Rosewood Woodland occurs predominantly on level to undulating sandplains on calcareous soils mainly of red-brown loam to loamy sands; solonised brown soils to sandy red earths; reddish brown sands and duplex soils (Porteners *et al.* 1997).

The woodland canopy was generally dominated by *Casuarina pauper* and *Alectryon oleifolius* ssp. *canescens* usually between 10-15 m high. Other small trees up to 5 m high occurred throughout in varying densities, including *Geijera parviflora* (Wilga), *Callitris glaucophylla* (White Cypress Pine) and a number of Mallee eucalypt species. The groundcover was usually composed of grasses, herbs and low shrubs, with smaller areas of leaf litter and bare soil (Plate 3).



**Plate 3: Typical Belah-Rosewood Woodland habitat.**

There was little evidence of previous fire, and with the exception of a few locations, most areas had not been previously cleared. Evidence of goats (*Capra hircus*) was observed throughout most areas, noted by the presence of scats, and in some locations the habitat had been severely impacted by grazing. Key food sources such as *Acacia* sp. and *Eremophila* sp. were either rare or occasional throughout. Weeds were mostly rare.

This habitat type contains a number of trees with small hollows (<10 cm) at an average density 23 hollows per hectare in the older woodland sections (Figure 19 and Appendix B). Medium size hollows (10-30cm) are also present on occasion with an average of 2 hollows per hectare (Figure 19 and Appendix B). When compared to the other broad habit types within the Project area and surrounds, Belah- Rosewood Woodland contains the second highest number of dead trees with hollows and has the third highest number of total hollows per hectare (34) (Figure 20 and Appendix B).

Fallen timber also provides a valuable den/shelter habitat resource within the Belah-Rosewood Woodland for common and threatened small mammals and reptiles. Fallen branches are very abundant, and this habitat type contains the highest load of large fallen logs (with a diameter greater than 15cm) (Figure 23 and Appendix B). On average 100-190 m of fallen timber was recorded per hectare of habitat and 170 m of large logs per hectare (Figure 22 and Appendix B). Decorticating bark was present in moderate amounts when compared to the other units. Overall the fauna habitat was in moderate to good condition in areas away from farm infrastructure such as tanks and feeding areas for cattle. In general, these latter areas had higher levels of disturbance to the ground layer.

Overall the fauna habitat was in moderate to good condition in areas away from farm infrastructure such as tanks and feeding areas for cattle. In general, these latter areas had higher levels of disturbance to the ground layer. A number of threatened species were recorded within this habitat type during AMBS surveys. Belah-Rosewood Woodland provides habitat resources for a number of threatened species (e.g. Little Pied Bat). A number of threatened species were recorded within this habitat type during AMBS surveys. Belah-Rosewood Woodland provides important habitat resources for a number of threatened species. Some of the species that are more reliant on the presence of this habitat type include, but is not restricted to the Little Pied Bat.

### *Black Box Woodland*

The majority of the Black Box Woodland type occurs as scattered patches in the south-eastern sections of the study area (Figure 14 and Figure 15-18).

This habitat type has a limited distribution in the region and only occurs in low-lying areas where water accumulates after rain and where the soils are clay based. Black Box Woodland occurs on silty or cracking grey and brown clays in floodplains.

The woodland canopy was dominated by *Eucalyptus largiflorens*, up to about 15 m high. The understorey was low, being composed of a variety of grasses, herbs and chenopod shrubs. Most areas were classified as early mature, but larger mature trees remained in some locations (Plate 4).



**Plate 4: Typical Black Box Woodland habitat.**

There was no evidence of previous fire but evidence of previous vegetation clearing was present. Evidence of land degradation was noted throughout, with contributing species including cattle, goats and rabbits (*Oryctolagus cuniculus*). Potential food sources such as *Acacia* spp. and *Eremophila* spp. were rare or absent, however some areas of the unit contain a good cover of chenopod shrubs that would also provide food sources and shelter to some common and threatened species such as Bolam's Mouse and several *Egernia* reptiles. Weeds were present in varying abundances.

This habitat type contains a number of trees with small hollows (<10 cm) at an average density of 255 hollows per hectare (with each tree containing around 5 hollows) in the older woodland sections (Figure 19 and Appendix B). Medium size hollows (10-30cm) are also present on occasion with an average of 5 hollows per hectare (Figure 19 and Appendix B). When compared to the other broad habit types within the Project area and surrounds, Black Box Woodland contains the third highest number of dead trees with hollows, the highest number of trees with hollows, and the highest number of total hollows per hectare (270) (Figure 20 and Appendix B). Large hollows were observed to be present within mature sections of this habitat. Large hollows are a limited resource within the locality and would provide essential nesting/breeding habitat for large hollow dependent species such as the Major Mitchell Cockatoo.

Fallen timber also provides a valuable den/shelter habitat resource within the Black Box Woodland for common and threatened small mammals and reptiles. Fallen branches were abundant, while large fallen logs (with a diameter greater than 15cm) were uncommon except in over mature sections of the habitat (Figure 23 and Appendix B). On average 100-190 m of fallen timber and 20 m of large logs were recorded per hectare of habitat (Figure 22 and Appendix B). Decorticating bark was uncommon in this unit (Figure 24 and Appendix B).

Overall the fauna habitat was in poor to good condition. Much of the ground cover has been impacted by land clearing and ongoing disturbance (e.g. grazing). Old growth features of the mature *Eucalyptus largiflorens* such as large fallen logs and large hollows of the mature Black Box trees provide important habitat features for a variety of native fauna.



Several threatened species were recorded within this habitat type during AMBS surveys. Black Box Woodland provides important habitat resources for a number of threatened species. Some of the species that are more reliant on the presence of this habitat type include, but are not restricted to the Grey Falcon and Major Mitchell's Cockatoo.

### **Ephemeral Wetland**

Ephemeral Wetland is a sub-category of the Black Box Woodland and is located in one patch of the Black Box Woodland in the south-eastern section of the study area and (Figure 14). In the study area it occurs as a semi-permanent to ephemeral waterbody where the clay-based soils are at a low point and surface run-off accumulates. The ephemeral wetland is surrounded by both mature and semi-mature *E. largiflorens* on all sides (Plate 5). During the surveys the ephemeral wetland contained water. In areas closest to cleared lands, the ground-layer and mid-layer are completely absent due to movement of cattle to and from the wetlands. Some ground vegetation is retained on the western side of the wetland, closest to the Yarran Shrubland and Sandplain Mallee, consisting of sedge and grassy woodland species.

When inundated, these ephemeral wetlands provide potential foraging, breeding, nesting and shelter habitat for several migratory and wetland birds, such as Australian Painted Snipe, Freckled Duck, Rainbow Bee-eater and Little Grebe (*Tachybaptus ruficollis*). A number of amphibians were observed utilising the wetland.



**Plate 5: Black Box Woodland Wetland habitat.**

### *Acacia Woodland/Shrubland*

The 'Acacia Woodland/Shrubland' habitat type is a combination of the two vegetation types Mulga Woodland and Yarran Shrubland identified by AMBX (2012). They have been combined for the purposes of this habitat type as they are structurally very similar and they provide similar habitat resources for local fauna.

Acacia Woodland/Shrubland habitat type occurs mostly as a continuous band of vegetation from south of the central section of the study area and through to the south-eastern stretch of the study area (Figure 14 and Figure 15-18).

Mulga Woodland occurs less commonly within the study area than the Yarran Shrubland. Small stands of Mulga Woodland were located on red crusted loamy clay soils. The Yarran Shrubland occurs on level to undulating plains of brown-red calcareous loams and small depressions (gilgai) are typically found within this community (Plate 6).



**Plate 6: Typical Mulga Woodland**  
(sub-category of Acacia Woodland/ Shrubland).

The Acacia Woodland/Shrubland in the study area is dominated by a canopy of *Acacia aneura* (Mulga) or by *Acacia melvillei* (Yarran), depending on which vegetation type. The understorey in both vegetation types is composed of a combination of chenopod shrubs, herbs and grasses with occasional occurrences of the shrubs *Acacia homalophylla*, *Dodonaea* sp. and *Eremophila* sp. (Plate 7).



**Plate 7: Typical Yarran Shrubland**  
(sub-category of Acacia Woodland/Shrubland).

Remnants of the Yarran Shrubland in the study area are generally in moderate to poor condition, lacking structural integrity and having higher numbers of weed species than most other vegetation communities in the study area. Similarly, the Mulga Woodland is in poor condition given much of the canopy layer has disappeared and heavy grazing has depleted the shrub and ground layers. Weed invasions were also relatively high in this community.

This habitat type provides minimal shelter/breeding habitat given decorticated bark, hollows is either absent or very rare. Some fallen timber and standing dead trees were present within this habitat, with 10-30 m of fallen timber per hectare and 15 standing dead trees per hectare (Figure 22 and Appendix B). Some shelter habitats present were low chenopod shrubs and taller sclerophyllous shrubs, existing as dense patches within the communities. These areas provide some shelter habitat for small mammals, reptiles and small passerine birds.

As a combined habitat type, these vegetation types provide some foraging and shelter resources for native and threatened species. Several threatened species were recorded within this habitat type or nearby during AMBS surveys. The value of this habitat is limited to some extent by the previous clearing of strata. No threatened species are likely to be reliant on this habitat type, but may still utilise it.

### *Disturbed Shrubland*

The Disturbed Shrubland habitat type is found in drainage lines, swales between dunes and on sandplains within the study area. It is located as scattered, isolated patches throughout the central and southern sections of the study area (Figure 14 and 15-18). Typically these shrublands occur on soils which have a hard crust or exposed subsoil surface as a result of erosion (Plate 8).



**Plate 8: Typical Disturbed Shrubland habitat.**

This unit is the result of previous clearing and the continued pressures of grazing from introduced and native herbivores such as feral goats, European rabbits, macropods and stock. Such species prevent many palatable shrub and tree species from re-establishing and enabling unpalatable species to become dominant over time (Beadle 1948; Benson *et al.* 2006). This unit is typically dominated by the shrub species *Eremophila sturtii* and *Dodonaea viscosa* subsp. *angustissima* with *Nitraria billardierei* (Dillon Bush) and *Senna* sp. occurring less commonly.



Other species associated with this unit in the ground layer includes bluebush shrubs, daisy, herbs and grasses. Weed invasion within this unit is highly variable with some areas containing very few and others in closer contact to farming infrastructure containing greater than 20% in the understorey.

Shrubland Complex of Disturbed Areas is often found in association with disturbed remnants of the vegetation communities Yarran Shrubland, Belah-Rosewood Woodland, Black Box Woodland and Sandplain Mallee, and may represent vegetation of this type which is severely disturbed. These areas no longer have characteristics which allow for the determination of past vegetation types.

This habitat type provides minimal shelter/breeding habitat given decortivating bark, hollows, fallen timber is rare or absent. Some shelter habitat is present within the community where low chenopod shrubs and taller sclerophyllous shrubs are present as dense patches within the communities. These areas may provide some shelter habitat for small mammals, reptiles and perhaps small passerine birds.

Despite the disturbed nature of this unit, some portions were regenerating and had limited signs of disturbances such as weeds. Sections of this unit would provide food sources for mobile nectivorous species such as Pied Honeyeater and Purple-gaped Honeyeater where *Eremophila* and *Dodonaea* species are dominant. Dense shrubby areas would also provide potential shelter for many species.

No threatened species were recorded within this habitat or nearby to this unit during AMBS surveys. However, some threatened species may use this unit to supplement their key habitat areas, in particular generalist hunters such as raptors or species that forage on the edge of cleared areas (e.g. Hooded Robin). No threatened species are likely to be reliant on this community.

### *Grass and Shrub Depressions*

Grass and Shrub Depressions are located as very small scattered, isolated patches throughout the central sections of the study area (Figure 15-18). Grass and Shrub Depressions are scattered throughout the study area and most are small and consequently many have not been mapped.

Areas of the unit Grass and Shrub Depressions are found in drainage depressions or gilgai and are often associated with Black Box Woodland, Yarran Shrubland and Belah-Rosewood Woodland communities. In some locations of the study area, the assemblage occurs in relatively large drainage depressions that often support Black Box Woodland. In other locations it occurs in hollows known as gilgai, which form in clay-rich soils exposed to periodic wetting and drying (Plate 9).

Habitat resources such as hollows and decortivating bark were generally absent in this habitat type (Figure 19, 20, 21, 22 and 24 and Appendix B). Small amounts of fallen timber were present with 10 to 20 m of wood per hectare. The presence of water in this habitat would provide a source for common mobile species after heavy rain events.

No threatened species were recorded within this habitat or nearby during AMBS surveys (Figures 8-12). However, threatened species that are dependent on ephemeral wetlands may use this habitat after heavy rain events when they fill up with water (e.g. White-fronted Chat). No threatened species are likely to be reliant on this habitat type.





**Plate 9: Typical Grass and Shrub Depression.**

These depressions have a unique association of herb and grass species including *Marsilea drummondii*, *Centipeda cunninghamii* (Common Sneezeweed), *Centipeda thespidioides*, *Goodenia fascicularis*, *Stemodia florulenta*, *Teucrium racemosum*, *Teucrium albicaule*, *Eragrostis falcata* (Sickle Lovegrass), *Wahlenbergia gracilentia* (Annual Bluebell), *Isolepis australiensis* and *Schenkia spicata* (Spike Cenatury).

Grass and Shrub Depressions in the study area are in moderate to poor condition, being severely disturbed in some circumstances. Damage to this assemblage is high as they retain water for longer periods than surrounding areas and consequently are heavily visited by stock and goats. Weeds occur in moderate density within this unit. These depressions are likely to have very little vegetation present during drought periods.

Habitat resources such as fallen timber, hollows and decorticated bark are rare in this habitat type. However the presence of water in this habitat would provide a valuable source for common mobile species after heavy rain events.

No threatened species were recorded within this habitat or nearby to this unit during AMBS surveys. However, threatened species that are dependent on ephemeral wetlands may use this unit after heavy rain events when they fill up with water (e.g. White-fronted Chat or Australian Bittern). No threatened species are likely to be reliant on this habitat type.

### *Cleared Land*

A portion of the study area has been cleared and used as agricultural cropping land. There are occasional occurrences of remnant native species within this area, sometimes occurring as small isolated clumps of trees (Plate 10). This broad stratification unit represents land that is considered too disturbed to be able to make reliable conclusions about the vegetation that occurred here in the past and has little to no habitat resources available, except when grasses are seeding or when crops are grown. It is most likely that this area was covered by stands of Yarran Shrubland, Black Box Woodland and Mixed Belah-Rosewood Woodland. Regenerating *Acacia melvillei* suggests that a significant portion may have once included Yarran Shrubland. Cleared land is in poor condition.

This unit may provide some seasonal foraging habitat for some local populations of parrots such as Major Mitchell's Cockatoo, Galah (*Eolophus roseicapilla*) and Mulga Parrots (*Psephotus varius*). Malleefowl have also been reported to forage in cleared lands after harvesting.



**Plate 10: Typical Cleared Land habitat.**

### *Resources for threatened species*

#### **Hollows**

While hollow bearing trees are present across the landscape, during the survey they were found to be variable in numbers and size and unevenly distributed across habitat types, dependent on the age of the vegetation, disturbance history and vegetation type. In general the remnant Black Box Woodland retained the highest number of hollows per hectare (270) (Figure 20). The Belah-Rosewood Woodland, Sandplain Mallee and Dune Mallee habitats also contained a number of hollows and dead trees.

The presence of hollows within these habitat types was highly dependent on the fire, grazing and disturbance history of each portion of the habitat. As a general observation, the Linear Dune Mallee particular in the central and northern sections of the study area (outside of the fire scar close the Boree Plains Homestead) contained a high number of hollows per hectare (42.5), as did Sandplain Mallee (86.3) and Belah-Rosewood (34) (Figure 20).

Hollows within the Spinifex Mallee Woodland and Belah-Rosewood habitats were generally (but not always) smaller than those observed in mature sections of Black Box Woodland. Large hollows are a limited resource and species dependent on large hollows are likely to be restricted within the locality, unless they are highly mobile. For instance large hollow-dependent mobile species such as Major Mitchell's Cockatoo are likely to be present in the locality. Smaller hollow-dependent species such as microbats are likely to be present in high numbers given the large availability of small, suitable hollows, fissures and decorticated bark in the Belah-Rosewood Woodland and Mallee Woodland (Figure 19 and 24).

Abbreviations for habitat types are as follows in the figures below: Belah-Rosewood Woodland (BR), Linear Dune Mallee (DM), Sandplain Mallee (SM), Black Box Woodland (BB), Grass/Herbland Depressions (Grass Herb Dep) and Acacia Woodland/Shrubland (AWS).

## Spinifex

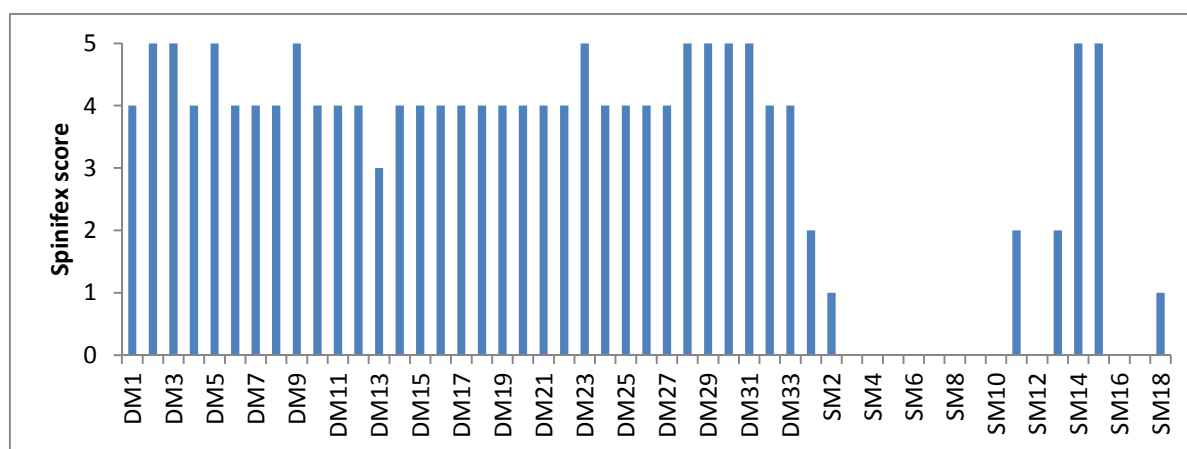
Another key habitat resource available in high abundance within the study area is well developed Spinifex (*Triodia* spp.) hummocks. A number of threatened species known or predicted to occur within the study area are Spinifex specialists, including (but are not restricted to):

- Southern Ningui;
- Jewelled Gecko;
- Spinifex Slender Blue tongue;
- Western Blue tongue; and
- Marble-faced Delma.

These species and others are dependent upon well developed Spinifex hummocks as a shelter and/or foraging resource. In general, Linear Dune Mallee areas that were surveyed during habitat assessments had retained well developed (good) spinifex hummocks in high abundance (Figure 21).

The condition and abundance of Spinifex hummocks in 50 m x 20 m plots was recorded during habitat assessments given the importance of this resource within semi-arid regions. The condition and abundance categories were determined based on the 'frequency of occurrence' of hummocks within plots, size of hummocks and whether there were signs of disturbance in and around the hummocks (grazing, trampling, clearing etc). The basis for each Spinifex score is displayed below.

Spinifex is present in highest abundance in the Linear Dune Mallee (DM) habitat type with an average score of 4.24 and to a lesser but varying degree within Sandplain Mallee (SM), with an average score of 1 (Appendix B ). Spinifex condition and abundance is highly variable in transitional zones between these two habitat types.



**Figure 21: Spinifex score (condition/abundance) by habitat assessment site.**

**Spinifex Score codes:** 0 = Absent, 1 = Disturbed/low abundance, 2 = Fair condition/occasional, 3 = Moderate condition/common, 4 = Good/high abundance, 5 = Dominant/highly abundant.

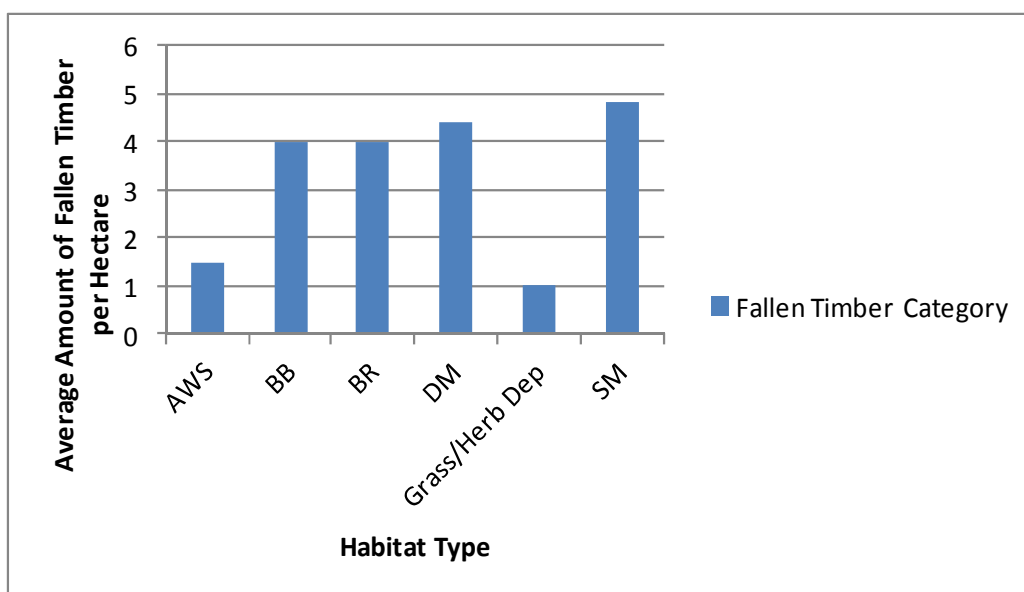


## Water Resources

Water is a limited resource within the semi-arid zones and thus what standing water is present is an important habitat resource for species within the area, including some threatened microbats. Standing water occurs in two ways within the study area, as man-made tanks (dams) (Figure 25), and as ephemeral or semi-permanent floodplain wetlands within Black Box Woodland and to a lesser degree the Grass and Shrub Depressions. The greatest sources of natural water within the area are the Black Box Woodland Wetlands (Figure 25). These wetlands appear to hold water for long periods after rain and may provide wetland ‘stepping stones’ within the landscape for nomadic, semi-nomadic and migratory wetland birds and seasonal habitat for resident or semi-nomadic species that breed in response to ideal conditions such as rain events.

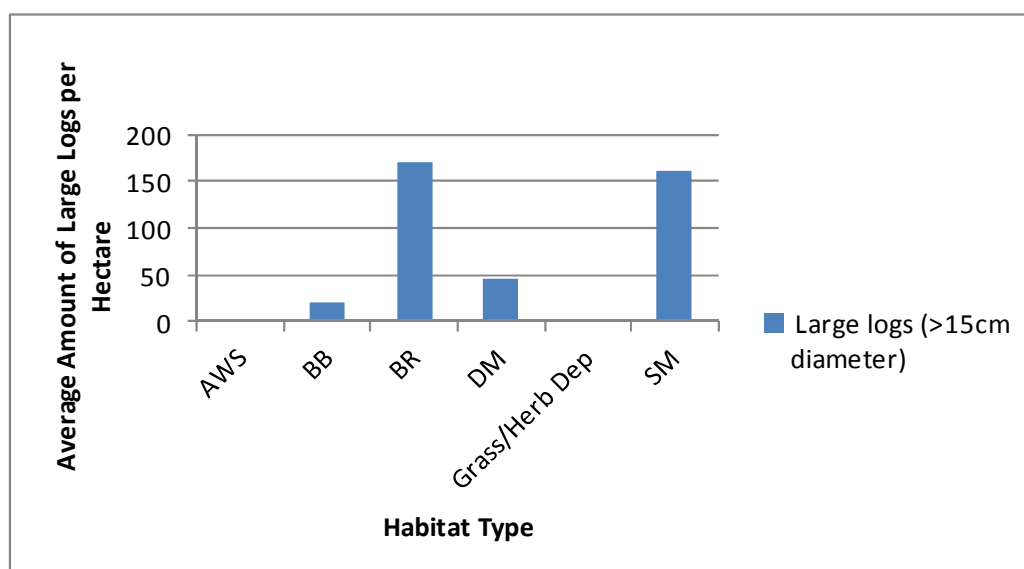
## Fallen Timber

Fallen timber was present in varying densities and size throughout the study area. Some of the Sandplain Mallee, Black Box Woodland and Belah- Rosewood Woodland areas contain large loads of fallen timber (Figure 22), providing excellent habitat for species that shelter in or under logs. Of some note, is the amount of large logs (with a diameter greater than 15cm) present in the Belah-Rosewood Woodland (Figure 23). In this habitat type, whole trees were often observed on the ground. Large logs suitable for larger species are limited in the study area, except for some over mature areas within the Black Box Woodland, where large hollow branches were present at the base of trees (Appendix B). Mallee Woodlands also contained fallen timber in areas that haven’t been recently burnt; the fallen timber in these habitat types is typically smaller in size but is still an important potential habitat resource for small mammals such as the Southern Ningai and Western Pygmy Possum.



**Figure 22: Average fallen branches (score) per hectare for each habitat type.**

**Fallen timber codes:** 1= No fallen branches, 2= 10 to 20 m of fallen timber per hectare, 3= 30 to 50 m of fallen timber per hectare, 4= 60 to 90m of fallen timber per hectare, 5= 100 to 190m of fallen timber per hectare, 6= > 200 m of fallen timber per hectare.

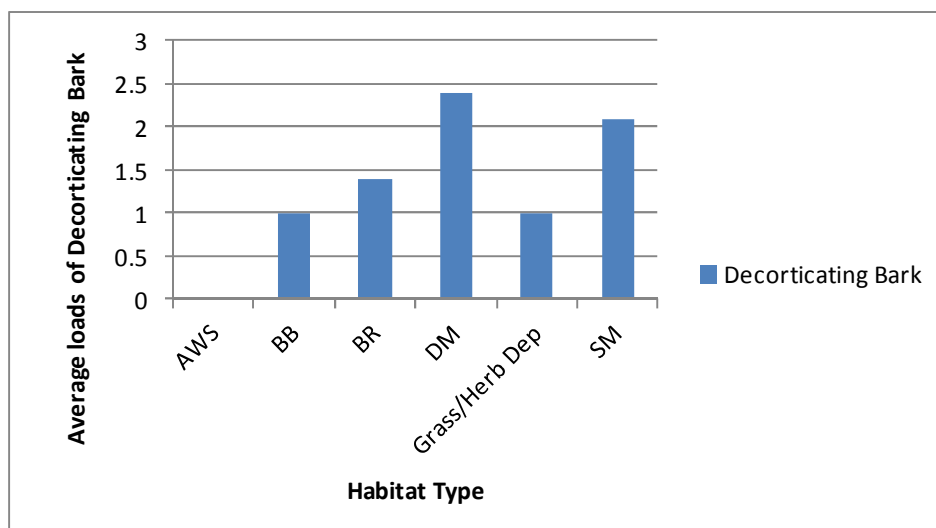


**Figure 23: Average number of large logs per hectare for each habitat type.**

### Other Habitat Resources

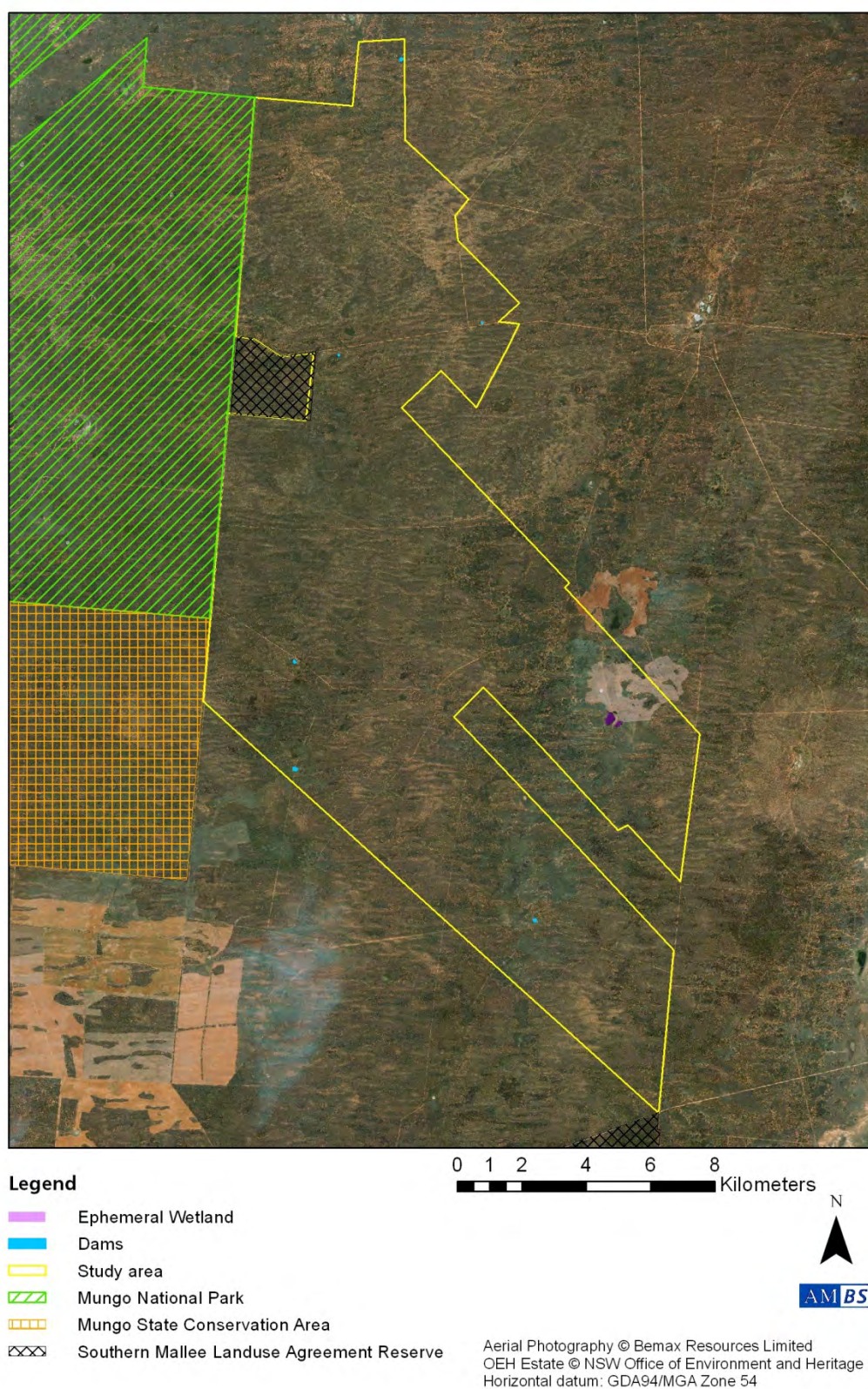
Shedding or decortivating bark also provides temporary shelter or roosting resources for fauna such as microbats, Western Pygmy Possum's and geckos. Based on the results from habitat assessments, it appears as though Linear Dune Mallee retains the highest loads of decortivating bark, followed by Sandplain Mallee (Figure 24). This is likely to be the case as both woodland types' posses Eucalyptus species that shed bark as long ribbons and the lack of fires in the past few decades.

The study area did not contain rocky outcrops, cliffs or caves.



**Figure 24: Average loads of decortivating bark for each habitat type.**

**Decortivating bark codes:** 0 = Absent, 1 = Rare, 2 = Common, 3 = Abundant.



**Figure 25: Black Box Wetland and farm dams.**



## Food Resources

A number of plant species that occur throughout the study area provide particular potential habitat resources for threatened fauna were recorded (Table 6).

**Table 6: Plant species that provide particular habitat for threatened species.**

| Plant Species  | Habitat Component           | Fauna Species  |
|--|-----------------------------|--|
| Flowering Eucalypts including <i>Eucalyptus dumosa</i> , <i>E. costata</i> , <i>E. socialis</i> , <i>E. gracilis</i> , etc.                            | Food source                 | Major Mitchell's Cockatoo; Purple-crowned Lorikeet, Regent Parrot, Purple-gaped Honeyeater, Pied Honeyeater.                                       |
| <i>E. largiflorens</i>   | Shelter/roosting            | Major Mitchell's Cockatoo, Little Pied Bat, South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form).               |
| <i>Casuarina pauper</i>  | Shelter/roosting            | South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form), Western Pygmy Possum, Little Pied Bat.                    |
| Flowering or seeding Acacias including <i>Acacia aneura</i> , <i>A. homalophylla</i> etc.  | Food source                 | Malleefowl, Major Mitchell's Cockatoo, Pied Honeyeater, Purple-gaped Honeyeater.   |
| Flowering shrubs such as <i>Dodonaea viscosa</i> subsp. <i>angustissima</i> , <i>Eremophila mitchelli</i> , <i>E. Sturtii</i> , <i>E. gabra</i> , etc. | Food source, shelter        | Pied Honeyeater, Bolam's Mouse.  |
| <i>Triodia</i> sp.   | Foraging and shelter Source | Southern Ningau, Jewelled Gecko, Spinifex Slender Blue-tongue, Western Blue-tongue, Marble-faced Delmar, Mallee Worm-lizard, Western Pygmy Possum. |

## Threatened Species Habitat

A description of known or potential habitat for threatened species recorded during database searches is provided in Table 7. A description of the habitat resources available to threatened species within the habitat types is provided below.

**Table 7: Threatened fauna and potential habitat.**

| Group           | Scientific Name                          | Common Name                  | Previously Recorded in Locality? | Potential Habitat in the Study Area   |
|-----------------|--|------------------------------|----------------------------------|---|
| <b>Frogs</b>    | <i>Neobatrachus pictus</i>               | Painted Frog                 | Not recorded                     | Potential breeding and foraging habitat after heavy rain.   |
|                 | <i>Litoria raniformis</i>                | Southern Bell Frog           | Not recorded                     | Potential breeding and foraging habitat in Black Box Wetlands and farm dams.  |
| <b>Reptiles</b> | <i>Strophurus elderi</i>                 | Jewelled Gecko               | Recorded in the study area       | Breeding and foraging habitat Linear Dune Mallee with mature spinifex.  |
|                 | <i>Delma australis</i>                   | Marble-faced Delma           | Not recorded                     | Potential breeding and foraging habitat in Linear Dune Mallee.  |
|                 | <i>Aprasia inaurita</i>                  | Mallee Worm-lizard           | Recorded in the study area       | Breeding and foraging habitat in Sandplain Mallee and Linear Dune Mallee.   |
|                 | <i>Cyclodomorphus melanops elongates</i> | Spinifex Slender Blue-tongue | Recorded in the study area       | Breeding and foraging habitat in Linear Dune Mallee.  |
|                 | <i>Tiliqua occipitalis</i>               | Western Blue-tongue          | Not recorded                     | Potential breeding and foraging habitat in Linear Dune Mallee and Sandplain Mallee.   |
|                 | <i>Echiopsis curta</i>                   | Bardick                      | Recorded in the study area       | Breeding and foraging habitat in Linear Dune Mallee.  |
|                 |  |                              |                                  | Breeding and foraging habitat in Linear Dune Mallee and Sandplain Mallee.   |
| <b>Birds</b>    | <i>Leipoa ocellata</i>                   | Malleefowl                   | Recorded in the study area       | Seasonal foraging habitat in Cleared land, Shrubland, Acacia Woodland/Shrubland, and Belah-Rosewood Woodland.   |
|                 | <i>Anseranas semipalmata</i>             | Magpie Goose                 | Not recorded                     | Potential habitat limited to Black Box Wetland.   |
|                 | <i>Stictonetta naevosa</i>               | Freckled Duck                | Recorded nearby the study area   | Potential breeding and foraging habitat in Black Box Wetlands.  |
|                 | <i>Oxyura australis</i>                  | Blue Billed Duck             | Not recorded                     | Potential habitat limited to Black Box Wetland.   |
|                 | <i>Botaurus poiciloptilus</i>            | Australasian Bittern         | Not recorded                     | Potential habitat limited to Black Box Wetland.   |
|                 | <i>Falco hypoleucos</i>                  | Grey Falcon                  | Not recorded                     | Potential breeding and foraging habitat in Black Box Floodplain Woodland. Potential foraging habitat in Acacia Woodland/Shrubland and Shrubland.  |
|                 | <i>Lophoictinia isura</i>                | Square-tailed Kite           | Not recorded                     | Potential foraging habitat only in Black Box Floodplain Woodland, Acacia Woodland/Shrubland, Linear Dune Mallee and Sandplain Mallee.   |
|                 | <i>Hamirostra melanosternon</i>          | Black-breasted Buzzard       | Not recorded                     | Potential foraging and breeding habitat in Black Box Floodplain Woodland, Linear Dune Mallee, Sandplain Mallee, Acacia Woodland/Shrubland, Shrubland and Cleared Land.  |
|                 | <i>Circus assimilis</i>                  | Spotted Harrier              | Recorded in the study area       | Potential breeding habitat in Black Box Floodplain Woodland, Sandplain Mallee and Linear Dune Mallee. Foraging habitat in Cleared Land, Shrubland, Acacia Woodland/Shrubland.   |
|                 | <i>Hieraaetus morphnoides</i>            | Little Eagle                 | Recorded in the study area       | Potential breeding and foraging habitat in Black Box Floodplain Woodland, Sandplain Mallee, Linear Dune Mallee and Belah-Rosewood Woodland. Foraging habitat only in Cleared Land, Shrubland and Acacia Woodland/Shrubland. |
|                 | <i>Ardeotis australis</i>                | Australian Bustard           | Recorded nearby the study area   | Potential breeding and foraging habitat in open Sandplain Mallee, Linear Dune Mallee and Black Box Floodplain Woodland. Seasonal foraging habitat in Cleared Land.  |
|                 | <i>Grus rubicund</i>                     | Brolga                       | Not recorded                     | Marginal foraging habitat around Black Box wetlands and surrounding Cleared Land and Shrubland.   |
|                 | <i>Burhinus grallarius</i>               | Bush Stone-curlew            | Recorded nearby the study area   | Breeding and foraging habitat present.  |

| Group | Scientific Name  | Common Name                                | Previously Recorded in Locality? | Potential Habitat in the Study Area  |
|-------|--|--|----------------------------------|--|
|       | <i>Rostratula australis</i>  | Australian Painted Snipe                   | Recorded nearby the study area   | Potential breeding and foraging habitat in Black Box Wetlands. Foraging habitat in Black Box Floodplain Woodland and Grass and Shrub Depressions.  |
|       | <i>Limosa limosa</i>   | Black-tailed Godwit                        | Not recorded                     | Marginal foraging habitat around Black Box Wetlands.   |
|       | <i>Calyptorhynchus banksii samueli</i>                                       | Red-tailed Black-Cockatoo (inland species) | Not recorded                     | Not recorded during survey, is a very obvious species when present, no nearby records and is generally associated with habitat around waterways.   |
|       | <i>Lophochroa leadbeateri</i>  | Major Mitchell's Cockatoo                  | Recorded in the study area       | Breeding and foraging habitat in Black Box Floodplain Woodland. Potential breeding habitat in Linear Dune Mallee and Sandplain Mallee. Foraging habitat in Acacia Woodland/Shrubland, Sandplain Mallee, Linear Dune Mallee, Belah-Rosewood Woodland and Shrubland.                       |
|       | <i>Glossopsitta porphyrocephala</i>  | Purple-crowned Lorikeet                    | Recorded nearby the study area   | Potential breeding and foraging habitat in Black Box Floodplain Woodland, Linear Dune Mallee and Sandplain Mallee.   |
|       | <i>Polytelis anthopeplus monarchoides</i>                                    | Regent Parrot (eastern subspecies)         | Recorded in the study area       | Marginal foraging habitat in Sandplain Mallee, Linear Dune Mallee and perhaps Cleared Land. No breeding habitat. Distribution is generally restricted to within 30 km of the Murray River. Only rare vagrants are found beyond this area.  |
|       | <i>Ninox connivens</i>   | Barking Owl                                | Recorded nearby the study area   | Marginal breeding habitat in Black Box Floodplain Woodland and potential foraging habitat elsewhere. Species distribution is generally limited to the major rivers such as the Darling and Murray River in the semi-arid zones and they are only sparsely recorded in areas beyond them. |
|       | <i>Calamanthus cautus</i> (Also known as <i>Hylacola cautus</i> (OEH 2012a)) | Shy Heathwren                              | Not recorded                     | Potential breeding and foraging habitat Linear Dune Mallee and Sandplain Mallee.   |
|       | <i>Calamanthus campestris</i>  | Rufous Fieldwren                           | Recorded nearby the study area   | No potential habitat within the study area.  |
|       | <i>Pyrrholaemus brunneus</i>   | Redthroat                                  | Recorded nearby the study area   | Limited breeding and foraging habitat in Acacia Woodland/Shrubland.  |
|       | <i>Lichenostomus cratitius</i>   | Purple-gaped Honeyeater                    | Recorded nearby the study area   | Potential/seasonal foraging habitat in Sandplain Mallee and Linear Dune Mallee.  |
|       | <i>Manorina melanotis</i>  | Black-eared Miner                          | Not recorded                     | Potential foraging habitat in Linear Dune Mallee and Sandplain Mallee.   |
|       | <i>Certhionyx variegates</i>   | Pied Honeyeater                            | Recorded in the study area       | Breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee and Acacia Woodland/Shrubland. Potential breeding and foraging habitat in Black Box Floodplain Woodland.   |
|       | <i>Epthianura albifrons</i>  | White-fronted Chat                         | Recorded in the study area       | Breeding and foraging habitat in Ephemeral Wetland and Black Box Floodplain Woodland.  |
|       | <i>Melanodryas cucullata cucullata</i>                                       | Hooded Robin (south-eastern form)          | Recorded in the study area       | Breeding and foraging habitat in Black Box Floodplain Woodland, Acacia Woodland/Shrubland, Linear Dune Mallee and Sandplain Mallee. Potential foraging habitat in Shrubland and Cleared Land close to more structured vegetation.  |
|       | <i>Petroica phoenicea</i>  | Flame Robin                                | Recorded nearby the study area   | No habitat in the study area. A number of records from Mungo National Park.  |
|       | <i>Drymodes brunneopygia</i>   | Southern Scrub-robin                       | Not recorded                     | Potential breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee and Acacia Woodland/Shrubland.   |
|       | <i>Cinclosoma castanotum</i>   | Chestnut-backed Quail-thrush               | Recorded in study area           | Breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee and Acacia Woodland/Shrubland.   |
|       | <i>Daphoenositta chrysoptera</i>   | Varied Sittella                            | Recorded in the study area       | Breeding and foraging habitat in Black Box Floodplain Woodland, Linear Dune Mallee and Sandplain Mallee. Potential foraging habitat in Acacia  |



| Group   | Scientific Name   | Common Name   | Previously Recorded in Locality?   | Potential Habitat in the Study Area  |
|---------|---|---|--|--|
|         |   |   |  | Woodland/Shrubland.  |
|         | <i>Pachycephala inornata</i>                                      | Gilbert's Whistler  | Recorded in the study area   | Breeding and foraging habitat in Linear Dune Mallee, Belah-Rosewood Woodland and Sandplain Mallee.   |
|         | <i>Stagonopleura guttata</i>                                      | Diamond Firetail  | Recorded nearby the study area   | Potential breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee and Black Box Floodplain Woodland.   |
| Mammals | <i>Ningau yvonneae</i>  | Southern Ningau   | Recorded in the study area   | Breeding and foraging habitat in Linear Dune Mallee. Potential breeding and foraging habitat in Sandplain Mallee.  |
|         | <i>Cercartetus concinnus</i>                                      | Western Pygmy Possum  | Not recorded during current surveys but has been previously recorded in the study area | Breeding and foraging habitat in Linear Dune Mallee and Belah-Rosewood Woodland with well developed understorey. Not recorded by the surveys but has been previously recorded in the study area.         |
|         | <i>Saccolaimus flaviventris</i>                                   | Yellow-bellied Sheathtailed-bat   | Recorded in the study area   | Breeding and foraging habitat in all communities.  |
|         | <i>Nyctophilus corbeni</i> (also known as <i>N. Timoriensis</i> ) | South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form) | Recorded in the study area   | Breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee, Black Box Floodplain Woodland, and Belah-Rosewood Woodland.   |
|         | <i>Chalinolobus picatus</i>                                       | Little Pied Bat   | Recorded in the study area   | Breeding and foraging habitat in Black Box Floodplain Woodland, Acacia Woodland/Shrubland, Belah-Rosewood Woodland, Linear Dune Mallee, Sandplain Mallee.  |
|         | <i>Vespadelus baverstocki</i>                                     | Inland Forest Bat   | Recorded in the study area   | Breeding and foraging habitat in Linear Dune Mallee, Sandplain Mallee, Acacia Woodland/Shrubland, Black Box Floodplain Woodland, and Belah-Rosewood Woodland.  |
|         | <i>Pseudomys bolami</i>   | Bolam's Mouse   | Recorded nearby the study area   | Breeding and foraging habitat in Belah-Rosewood Woodland, Sandplain Mallee, Linear Dune Mallee, Acacia Woodland/Shrubland, and Shrubland. Potential breeding and foraging habitat in Linear Dune Mallee. |
|         | <i>Rattus villosissimus</i>                                       | Long-haired Rat   | Not recorded   | Potential breeding and foraging habitat in all communities during extended wet periods.  |

Note: Locality refers to any species recorded within 20km of the study area.

## 4 Conclusion

A fauna study was undertaken throughout the study area between February and May 2012. The study included a desktop review, targeted surveys and habitat assessments.

The desktop review found that a total of 54 threatened fauna species listed under the TSC Act and/or EPBC Act are known or predicted to occur in the Lower Murray/Darling Basin CMA sub-region, South Olary Plain, Murray Basin Sands (Part B). These 54 species are comprised of two frogs, six reptiles, 36 birds and 10 mammals. A total of 25 threatened species have been recorded within a 20 km radius of the study area, comprised of seven mammals, two reptiles and 16 birds.

A total of 179 vertebrate fauna species were recorded during the surveys comprising two frogs, 39 reptiles, 115 birds and 23 mammals. Six of the species recorded are introduced species. All six were mammals and all were classified as being common or abundant in the study area, other than dogs, which were only recorded infrequently.

A total of 20 species recorded in the study area during the surveys are listed as threatened under the TSC Act and/or EPBC Act. Threatened species that were positively recorded in the study area include the Bardick, Jewelled Gecko, Mallee Worm-lizard, Spinifex Slender Blue-tongue, Chestnut-backed Quail-thrush, Gilbert's Whistler, Hooded Robin (south-eastern form), Little Eagle, Major Mitchells Cockatoo, Malleefowl, Pied Honeyeater, Regent Parrot (eastern subspecies), Spotted Harrier, Varied Sitella, White-fronted Chat, Greater/Southern Long-eared Bat, Inland Forest Bat, Little Pied Bat, Yellow-bellied Sheath-tail-bat and Southern Ningui. The Rainbow Bee-eater, which is listed as migratory on the EPBC Act, was also recorded within the study area.

The study area contains known and potential habitat for a range of threatened fauna. Broad habitat types include Linear Dune Mallee, Sandplain Mallee, Belah-Rosewood, Black Box Floodplain Woodland, Black Box Wetland, Grass and Herbland Depressions, Acacia Woodland/Shrubland, Disturbed Shrubland and Cleared Land.

A number of threatened species not recorded by this study have been recorded in other studies nearby the study area. Potential habitat for these species exists within the study area and they are considered likely to occur.

The condition of fauna habitat varied. Habitats such as the Cleared Land were highly disturbed; habitats located close to depressions that fill with water after rain (such as Black Box) had the ground layers disturbed; and Belah-Rosewood and Sandplain Mallee were affected by grazing. The Linear Dune Mallee habitat within the study area was in relatively good condition.

The Linear Dune Mallee and Sandplain Mallee habitats provide potential habitat for a range of threatened fauna associated with spinifex and hollows, fissures and decorticated bark and the mature parts of the Black Box Woodland contain large hollows. Features such as fallen logs were distributed throughout most of the study area.

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## Appendix A: Co-ordinates of Survey Locations

| Survey Technique     | Easting | Northing |
|----------------------|---------|----------|
| Elliott A Traps      | 714950  | 6256116  |
|                      | 713256  | 6259821  |
|                      | 706600  | 6266670  |
|                      | 710152  | 6259956  |
|                      | 711521  | 6272052  |
|                      | 712083  | 6256988  |
|                      | 705710  | 6263289  |
|                      | 705152  | 6259294  |
|                      | 707228  | 6272662  |
|                      | 713312  | 6266782  |
|                      | 716940  | 6255652  |
|                      | 713030  | 6268596  |
|                      | 710137  | 6266827  |
|                      | 717238  | 6253472  |
|                      | 712074  | 6250103  |
|                      | 715714  | 6246889  |
| Pitfall/Funnel Traps | 714928  | 6256162  |
|                      | 713266  | 6259829  |
|                      | 706596  | 6266679  |
|                      | 710239  | 6259948  |
|                      | 711528  | 6272087  |
|                      | 712031  | 6256982  |
|                      | 705743  | 6263349  |
|                      | 710134  | 6266839  |
|                      | 713145  | 6268570  |
|                      | 705184  | 6259296  |
|                      | 707237  | 6272625  |
|                      | 713317  | 6266768  |
|                      | 716945  | 6255673  |
|                      | 713223  | 6268474  |
|                      | 717238  | 6253472  |
|                      | 712044  | 6250158  |
|                      | 715691  | 6246860  |
| Remote Cameras       | 714966  | 6256117  |
|                      | 713258  | 6259855  |
|                      | 710140  | 6259920  |
|                      | 711546  | 6272122  |
|                      | 712149  | 6256990  |
|                      | 705758  | 6263272  |
|                      | 705161  | 6259298  |
|                      | 707221  | 6272611  |

| Survey Technique                     | Easting | Northing |
|--------------------------------------|---------|----------|
|                                      | 713319  | 6266832  |
|                                      | 716957  | 6255623  |
|                                      | 706651  | 6266705  |
|                                      | 710137  | 6266827  |
|                                      | 713056  | 6268452  |
|                                      | 716940  | 6253895  |
|                                      | 712118  | 6250111  |
|                                      | 715712  | 6246916  |
|                                      |         |          |
| Nocturnal Frog Searches              | 716940  | 6253895  |
|                                      |         |          |
| Diurnal Birds Census (3 repetitions) | 713266  | 6259829  |
|                                      | 710141  | 6259871  |
|                                      | 705143  | 6259304  |
|                                      |         |          |
| Diurnal Birds Census (2 repetitions) | 714928  | 6256162  |
|                                      | 706651  | 6266705  |
|                                      | 711517  | 6272074  |
|                                      | 712031  | 6256982  |
|                                      | 705743  | 6263349  |
|                                      | 710137  | 6266827  |
|                                      | 713056  | 6268452  |
|                                      | 707228  | 6272662  |
|                                      | 713319  | 6266832  |
|                                      | 716886  | 6255685  |
|                                      | 713223  | 6268474  |
|                                      | 717238  | 6253472  |
|                                      | 712044  | 6250158  |
|                                      | 715691  | 6246860  |
|                                      |         |          |
| Diurnal Birds Census (1 repetition)  | 717004  | 6255766  |
|                                      | 706998  | 6267334  |
|                                      | 707550  | 6268617  |
|                                      | 712699  | 6255603  |
|                                      | 714392  | 6249086  |
|                                      | 713796  | 6251410  |
|                                      | 712583  | 6251437  |
|                                      |         |          |
| Waterbird Survey                     | 716940  | 6253895  |
|                                      |         |          |
| Spotlighting (2 repetitions)         | 716940  | 6253895  |
|                                      | 714928  | 6256162  |
|                                      | 713266  | 6259829  |
|                                      | 706651  | 6266705  |
|                                      | 710239  | 6259948  |
|                                      | 711517  | 6272074  |

| Survey Technique                       | Easting | Northing |
|--|---------|----------|
|  | 712031  | 6256982  |
|  | 705743  | 6263349  |
|  | 710137  | 6266827  |
|  | 713056  | 6268452  |
|  | 705210  | 6259297  |
|  | 707228  | 6272662  |
|  | 713319  | 6266832  |
|  | 716886  | 6255685  |
|  | 712044  | 6250158  |
|  | 715691  | 6246860  |
|  |         |          |
| Spotlighting (1 repetition)            | 713700  | 6259900  |
|  | 717004  | 6255766  |
|  | 713223  | 6268474  |
|  |         |          |
| Diurnal Reptile Search (3 repetitions) | 717113  | 6253797  |
|  |         |          |
| Diurnal Reptile Search (2 repetitions) | 713223  | 6268474  |
|  | 716886  | 6255685  |
|  | 713319  | 6266832  |
|  | 707228  | 6272662  |
|  | 705210  | 6259297  |
|  | 713056  | 6268452  |
|  | 710137  | 6266827  |
|  | 715691  | 6246860  |
|  | 705743  | 6263349  |
|  | 712031  | 6256982  |
|  | 711517  | 6272074  |
|  | 710239  | 6259948  |
|  | 706651  | 6266705  |
|  | 713266  | 6259829  |
|  | 712044  | 6250158  |
|  | 714928  | 6256162  |
|  |         |          |
| Diurnal Reptile Search (1 repetition)  | 713700  | 6259900  |
|  | 713175  | 6255839  |
|  | 710906  | 6267993  |
|  | 707019  | 6265903  |
|  | 706998  | 6267334  |
|  | 705225  | 6259788  |
|  | 705507  | 6261634  |
|  | 706927  | 6260143  |
|  | 719093  | 6249701  |
|  | 718118  | 6245815  |
|  | 717101  | 6246209  |
|  | 709132  | 6254198  |



| Survey Technique              | Easting | Northing |
|-------------------------------|---------|----------|
|                               | 708324  | 6255267  |
|                               | 706958  | 6256399  |
|                               | 706026  | 6257122  |
|                               | 712699  | 6255603  |
|                               | 710898  | 6252909  |
|                               | 712197  | 6258163  |
|                               | 712606  | 6261037  |
|                               | 708891  | 6260014  |
|                               | 705997  | 6260271  |
|                               | 711889  | 6256013  |
|                               | 711162  | 6251509  |
|                               | 712085  | 6250474  |
|                               | 706233  | 6266731  |
|                               | 709114  | 6260006  |
|                               | 717004  | 6255766  |
|                               |         |          |
| Hair Tubes                    | 713254  | 6259822  |
|                               | 715053  | 6256083  |
|                               | 711558  | 6272113  |
|                               | 707227  | 6272618  |
|                               | 710159  | 6259836  |
|                               | 705702  | 6263282  |
|                               | 712082  | 6256992  |
|                               | 713030  | 6268596  |
|                               | 713422  | 6266719  |
|                               | 710133  | 6266823  |
|                               | 706680  | 6266701  |
|                               | 717238  | 6253472  |
|                               | 712096  | 6250110  |
|                               | 715745  | 6246979  |
|                               |         |          |
| Call-playback (5 repetitions) | 710410  | 6273192  |
|                               | 705382  | 6261060  |
|                               | 711680  | 6259889  |
|                               | 713249  | 6255769  |
|                               | 717346  | 6253653  |
|                               | 710386  | 6267122  |
|                               | 707020  | 6267854  |
|                               | 714468  | 6249095  |
|                               |         |          |
| Call-playback (1 repetition)  | 717004  | 6255766  |
|                               |         |          |
| ANABATS                       | 714928  | 6256162  |
|                               | 713266  | 6259829  |
|                               | 706651  | 6266705  |
|                               | 710239  | 6259948  |

| Survey Technique | Easting | Northing |
|------------------|---------|----------|
|                  | 711517  | 6272074  |
|                  | 712031  | 6256982  |
|                  | 705743  | 6263349  |
|                  | 713056  | 6268452  |
|                  | 705210  | 6259297  |
|                  | 707228  | 6272662  |
|                  | 713319  | 6266832  |
|                  | 716886  | 6255685  |
|                  | 710137  | 6266827  |
|                  | 717238  | 6253472  |
|                  | 712044  | 6250158  |
|                  | 715691  | 6246860  |
|                  |         |          |
| Harp Traps       | 714928  | 6256162  |
|                  | 713266  | 6259829  |
|                  | 706651  | 6266705  |
|                  | 710239  | 6259948  |
|                  | 711517  | 6272074  |
|                  | 712031  | 6256982  |
|                  | 705743  | 6263349  |
|                  | 713056  | 6268452  |
|                  | 705210  | 6259297  |
|                  | 707228  | 6272662  |
|                  | 713319  | 6266832  |
|                  | 716886  | 6255685  |
|                  | 710137  | 6266827  |
|                  | 717238  | 6253472  |
|                  | 712044  | 6250158  |
|                  | 715691  | 6246860  |

| Malleefowl<br>( <i>Leipoa ocellata</i> )/Scat<br>Transects | Easting<br>Start | Northing<br>Finish | Easting<br>Midpoint | Northing<br>Midpoint | Easting<br>Start | Northing<br>Finish |
|--|------------------|--------------------|---------------------|----------------------|------------------|--------------------|
|  | 715503           | 6256294            | 714994              | 6256191              | 714485           | 6256088            |
|  | 715692           | 6246806            | 715304              | 6246995              | 714917           | 6247185            |
|  | 717078           | 6253117            | 716855              | 6253588              | 717306           | 6253793            |
|  | 711892           | 6256012            | 712376              | 6255829              | 712861           | 6255645            |
|  | 710575           | 6259903            | 710030              | 6259910              | 709485           | 6259917            |
|  | 705910           | 6263126            | 705829              | 6262625              | 705748           | 6262124            |
|  | 707040           | 6272732            | 707349              | 6273121              | 707659           | 6273510            |
|  | 711558           | 6259891            | 711961              | 6259581              | 712364           | 6259272            |
|  | 712043           | 6250158            | 712602              | 6250411              | 712224           | 6250808            |
|  | 704809           | 6257041            | 705311              | 6257142              | 705813           | 6257242            |
|  | 706768           | 6270402            | 706470              | 6268302              | 706172           | 6266203            |
|  | 711527           | 6272074            | 711335              | 6271827              | 711518           | 6272074            |
|  | 713371           | 6266006            | 712979              | 6265967              | 712588           | 6265928            |
|  | 711154           | 6265037            | 711560              | 6264740              | 711966           | 6264443            |
|  | 709462           | 6265619            | 709826              | 6265655              | 710191           | 6265691            |
|  | 712031           | 6256983            | 711169              | 6257658              | 712197           | 6258163            |
|  | 713288           | 6267334            | 713321              | 6266805              | 713354           | 6266276            |
|  | 713180           | 6269077            | 713213              | 6268542              | 713246           | 6268007            |
|  | 710531           | 6267387            | 710222              | 6266950              | 709912           | 6266514            |

Appendix B: Habitat Assessment Data

| Site                            | Area   | Photo no.  | East   | North   | veg category        | veg community description  | Topo desc                  | S   | Asp | Alt | General Condition   | F | C   | L | G     | W | T   | Other                 | SD | ST | DGL  | TL %  | ATH  | AS         | SL %  | AS H | GL % | CC % | V% | L >15 cm | BS %  | L%      | LD (cm) | LDT | HT | B  | SH | MH | LH | BH | Fs | Stu | FT (m) | Sp | LG (m) |
|---------------------------------|--------|------------|--------|---------|---------------------|--|----------------------------|-----|-----|-----|---|---|-----|---|-------|---|-----|-----------------------|----|----|--|-------|------|------------|-------|------|------|------|----|----------|-------|---------|---------|-----|----|----|----|----|----|----|----|-----|--------|----|--------|
| BRH1                            | Offset | 5100-5103  | 717101 | 6246209 | Belah/ Rosewood     | Open woodland, patchy shrub layer little canopy  | Sandplain                  | 0   |     | 88  | Good little evidence of weeds or feral animal disturbance   | 0 | 1   | 0 | 1     | 0 | 0   | Goat scats            | 2  | 3  | Other (Shrubs) subdominant Lichen            | < 5   | 15   | L          |       | 1    | 20   |      | 70 | 2        | 25    | 5       | 1       | 0   | 3  | 0  | 7  | 1  | 0  | 0  | 0  | 0   | 5      | 0  | 40     |
| OWL 4                           | Offset | 5067-68    | 713175 | 6255839 | Belah/ Rosewood     | Small stand Belah open woodland understory dominated by chenopods  | Sandplain                  | 1   | 150 | 109 | small battered Belah stand with mature trees  | 0 | 0   | 0 | 1     | 1 | 0   | 1 (Goat scats)        | 1  | 2  | Herb/Grass                                   | 30    | 15   | M          | 2     | 4    | 30   |      | 45 | 3        | 15    | 33      | < 0.50  | 1   | 3  | 1  | 5  | 0  | 0  | 0  | 1  | 0   | 3      | 0  | 5      |
| BR1 southern offset             | Offset | 5063-64    | 714944 | 6256141 | Belah/ Rosewood     | Bellah woodland with some hollows development, no weeds, signs of cattle, goats and rabbits. Some mallee in flower and mistletoe in berry.   | Sandplain                  | 1   | 180 | 89  | Good little evidence of clearing away from road, minimal cattle but evidence of goats                 | 0 | 0   | 0 | 1     | 0 | 0   | 1 (rabbit)            | 1  | 2  | Herb/Grass                                   | 15    | 11   | L          | 5     | 5    | 22   |      | 50 | 2        | 23    | 25      | 0.5     | 0   | 3  | 0  | 3  | 0  | 0  | 0  | 1  | 0   | 5      | 0  | 3      |
| Gilbert                         | Offset | 5405-10    | 712583 | 6251437 | Belah/ Rosewood     | Casuarina, rosewood and groundlayer of goosefoot and ruby saltbush   | ?                          | 0   |     |     |   | 0 | 0   | 0 | 1     | 0 | 1   |                       | 2  | 3  | Saltbush                                     | 20    | 18   | M          | 5     | 2    | 40   |      | 60 | 10       | 10    | 20      | 1       | 2   | 2  | 1  | 2  | 0  | 0  | 0  | 1  | 0   | 5      | 0  | 50     |
| BB1                             | Offset | 5069-71    | 717238 | 6253472 | Black Box           | Black Box woodland about to flower, bordered by cleared land. Water recently present   | Depression                 | 0   | 0   | 81  | Moderate and regenerating. Bordered by cleared land. Mostly young trees with little hollow formation. | 0 | 3   | 0 | 2     | 1 | 0   | 2 (rabbits, shooting) | 1  | 2  | Herb/grass                                   | 6     | 10.5 | E          | 2     | 1    | 20   |      | 25 | 1        | 10    | 65      | < 0.5   | 0   | 7  | 1  | 36 | 0  | 0  | 1  | 1  | 0   | 5      | 0  | 4      |
| BB1-Flood                       | Offset | 912-913    | ?      | ?       | Black Box           | Black Box community, open grassy woodland with minimal shrub layer and large infestation of weeds including fleabane. Waterbody/wetland present                                      | Depression                 | 2   | 135 | 77  | Immature and regenerating understory. Disturbed with weed invasion                                    | 0 | 3   | 0 | 3     | 3 | 2.3 |                       |    |    | Herb/grass                                   | 15-20 |      | Y-E some L | 2-5   | 10   |      | 20   | 0  | 60       | 2-5   | > 0.1   | 3       | 3   | 1  | 15 | 1  | 0  | 1  | 1  | 0  | 3   | 0      | 0  |        |
| BR3                             | Offset | 889-891    | 713266 | 6259829 | Casuarina/ Rosewood | Flowering Casuarina and Mallee   | -                          | 0   | 0   | 114 | Heavy grazing understory, shrub overlay healthy   | 1 | 2   | 2 | 2 - 3 | 1 |     |                       | 3  |    | Other (Bluebush & needles)                   | 15-20 | 7    | M-L        | 10-15 | 0.75 | 10   |      | 20 | 3        | 30    | 10      | 0.1     | 0   | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 4   | 2      | 0  | 1-2    |
| BR2                             | Offset | 926-927    | 712043 | 6250158 | Casuarina/ Rosewood | Flowering Senna, Bellah.   | Sandplain                  | 0   |     | 97  | Moderate, heavily grazed understory   | 0 | 2-3 | 0 | 2 - 3 | 1 | 1   |                       |    |    |  |       |      | E-M some L |       |      |      | 20   | 0  | 40       | 10    | 0.1     | 1       | 2   | 1  | 2  | 0  | 0  | 1  | 1  | 0  | 2   | 0      | 0  |        |
| BR1                             | Offset | 916-917    | 714928 | 6256162 | Casuarina/ Rosewood | Flowering spear grass, rosewoods, casuarina, some signs of clearing and disturbance from grazing. Lots of small hollows and standing dead trees.                                     | Sandplain                  | 2   | 270 | 101 | Moderate, regeneration, disturbances  | 0 | 1-2 | 0 | 1 - 2 | 1 | 1   |                       | 2  | 1  | Hummock/ Grass & Herb/Grass                  | 35    |      | M-L        |       |      |      | 65   | 0  | 15       | 15-20 | 0.1-0.2 | 3       | 6   | 0  | 6  | 0  | 0  | 0  | 1  | 0  | 4   | 0      | 0  |        |
| Offset BR2                      | Offset | 5378-5381  | 712020 | 6250160 | Casuarina/ Rosewood | Casuarina, Acacia 3 sp., saltbush, goosefoot,  |                            | 0   |     | 107 | Good, Moderate  | 1 | 0   | 0 | 1     | 0 | 2   |                       | 2  | 3  | Tussock/Grass s & Lther (Chenopod/ saltbush) | 10    | 10   | M          |       | 1.5  |      | 50   | 5  | 30       | 15    | < 1     | 1       | 2   | 1  | 2  | 1  | 0  | 2  | 2  | 0  | 5   | 0      | 15 |        |
| DMH7                            | Offset | 5097-99    | 718118 | 6245815 | Mallee/ Spinifex    | Dune Mallee with Triodia   | Mid dune                   | < 5 | 280 | 95  | Good condition immature Mallee  | 0 | 0   | 0 | 0     | 0 | 0   |                       | 1  | 1  | Hummock/ Grass                               | 15    | 5    | Y          | < 2   | 1    | 15   |      | 15 | < 1      | 50    | 35      | 0-2     | 0   | 0  | 3  | 0  | 0  | 0  | 0  | 0  | 0   | 3      | 4  | 3      |
| SM HAB3                         | Offset | 4378       | 711141 | 6264986 | Mallee/ saltbush    | Young mallee, slendy tall and small many hollows in centre. Occasional older trees. Shrub layer sparse. Groundcover herbs some speargrass and occasional spinifex.                   | Top of dune                | 1   | S   | 87  | Moderate, immature, 3 structural layers with grazing disturbance nearby track                         | 0 | 1   | 0 | 1     | 2 | 1   |                       | 1  | 1  | Tussock/ Grass                               | 40    | 4    | E          | 10    |      | 30   | 5    | 30 | 0        | 40    | 20      | 1-2     | 0   | 9  | 2  | 0  | 0  | 0  | 11 | 1  | 0   | 5      | 2  | 0      |
| SMHAB1 Northern Offset Addition | Offset | 1933, 4370 | 706998 | 6267334 | Mallee/ saltbush    | Sandplain mallee, scattered eucs, some mature with well developed hollows, mostly small. Shrub layer present. Ground cover mainly speargrass and herbs. Lichen present but broken up | Sandplain or Aeolian Plain | 0   |     | 100 | Moderate, mature 3 structural layers with grazing disturbance   | 0 | 0   | 0 | 2     | 2 | 1   |                       | 1  | 1  | Tussock/ Grass                               | 15    | 7    | Y-M        | 10    |      | 40   | 20   | 40 | < 5      | 30    | 30      | 3       | 0   | 7  | 2  | 7  | 1  | 0  | 6  | 2  | 0   | 5      | 1  | 10     |
| SMBB                            | Offset | N/A        | 714401 | 6248062 | Mallee/ Saltbush    | -  | -                          | 0   | 0   | 70  | good some evidence of grazing   | 0 | 0   | 0 | 1     | 0 | 1   |                       | 1  | 1  | Tussock/ Grass & Saltbush                    | 10    | 8    | M          | 5     | 2    | 40   |      | 55 | 2        | 15    | 28      | 1.3     | 15  | 4  | 3  | 10 | 2  | 0  | 0  | 1  | 0   | 5      | 0  | 15     |
| OWL 6                           | Offset | 5429-31    | 714392 | 6249086 | Mallee/ Saltbush    | Saltbush mix of young and mature mallee 1 Yarran   | -                          | 0   | 0   | 74  |   | 0 | 0   | 0 | 1     | 0 | 1   |                       | 1  | 1  | Saltbush                                     | 10    | 4    | M          | 1     | 3    | 50   |      | 55 | 2        | 30    | 13      | 0.1     | 2   | 3  | 0  | 6  | 0  | 0  | 0  | 0  | 0   | 5      | 0  | 6      |
| SPH2                            | Offset | 5083-5086  | 705225 | 6259788 | Mallee/ Saltbush    | Sandplain Mallee highly variable shrub/ground cover layer  | Sandplain                  | 0   | 180 | 77  | Good late mature mallee with some hollows. Sparse and patchy shrub layer                              | 0 | 0   | 0 | 0     | 0 | 0   |                       | 1  | 3  | Tussock/ Grass                               | 10    | 7    | L          | < 5   | 0.5  | 20   |      | 35 | 3        | 60    | 5       | 0-2     | 8   | 5  | 3  | 9  | 0  | 0  | 0  | 0  | 0   | 5      | 0  | 60     |



| Site                               | Area   | Photo no.             | East   | North   | veg category     | veg community description   | Topo desc   | S   | Asp | Alt | General Condition   | F | C | L | G     | W | T | Other              | SD | ST    | DGL                     | TL %  | ATH | AS         | SL % | AS H | GL %  | CC % | V%    | L >15 cm | BS %  | L%      | LD (cm) | LDT | HT | B | SH | MH | LH | BH | Fs | Stu | FT (m) | Sp | LG (m) |
|------------------------------------|--------|-----------------------|--------|---------|------------------|---|-------------|-----|-----|-----|---|---|---|---|-------|---|---|--------------------|----|-------|-------------------------|-------|-----|------------|------|------|-------|------|-------|----------|-------|---------|---------|-----|----|---|----|----|----|----|----|-----|--------|----|--------|
| SPH3                               | Offset | 5089-5094             | 706927 | 6260143 | Mallee Saltbush  | Sandplain Mallee  | Sandplain   | 0   |     | 79  | Good, some dead centres, possibly regenerating from clearing or fire, nearby areas disturbed from clearing pics 5091-93   | 0 | 2 | 0 | 1     | 0 | 2 |                    | 1  | 3     | Tussock/ Grass & Lichen | 20    | 8   | E-M        | < 5  | 0.5  | < 5   |      | 35    | < 5      | 35    | 30      | 0-3     | 4   | 3  | 3 | 1  | 3  | 0  | 0  | 1  | 0   | 5      | 0  | 69     |
| SPH1                               | Offset | 5078-79               | 706026 | 6257122 | Mallee/ Saltbush | Sandplain Mallee little hollow development. Groundlayer dominated by Chenopods. Soil mostly with crust of lichen.   | Sandplain   | 0   | 0   | 84  | Good condition with some disturbance by goats numerous trails.  | 0 | 0 | 0 | 0     | 0 | 0 | 1 (Goats)          | 1  | 2-Mar | Chenopods               | 15    | 8   | M          | 2    | 1.5  | 47    |      | 65    | 2        | 8     | 25      | < 0.5   | 10  | 0  | 3 | 10 | 0  | 0  | 0  | 0  | 0   | 5      | 0  | 5      |
| DM6 Northern Additional offset     | Offset | 1955, 1954; 4354-4355 | 710130 | 6266848 | Mallee/ spinifex | Dune Mallee with tea tree shrub layer & spinifex ground layer. Some big spinifex clumps many small with green shoots.   | -           | < 5 | 150 | 102 | Good condition, 3 layers, may have been cleared in past. Mallee is small and appears mostly young but has hollows at base | 0 | ? | 0 | 0     | 0 | 0 |                    | 1  | 1     | Hummock/ Grass          | 30    | 4   | Y-L        | 30   | 1.5  | 20    | 10   | 30    | 0        | 40    | 30      | 0.5     | 0   | 5  | 3 | 0  | 0  | 0  | 7  | 0  | 0   | 5      | 5  | 0      |
| DM7 Northern additional offset     | Offset | 1945, 1944; 4358-4359 | 716141 | 6268594 | Mallee/ spinifex | Groundlayer mainly small triodia clumps, tea tree shrubland with scattered mallee. Tree layer low, sparse with young mallee.  | Top of Dune | 0-5 | NNW | 93  | Good condition, regeneration, mainly Tea tree with Mallee saplings emergent and triodia                                   | 3 | 0 | 0 | 0     | 0 | 0 |                    | 1  | 1     | Hummock/ Grass          | < 5   | 2   | Y-L        | 40   | 2    | 5     | 10   | 40    | 0        | 50    | < 5     | < 1     | 0   | 0  | 1 | 0  | 0  | 0  | 0  | 1  | 0   | 5      | 5  | 0      |
| DM7 OPP Northern additional offset | Offset | 1943-4360             | 713225 | 6268441 | Mallee/ spinifex | Eucalyptus mallee regeneration after fire. Tree layer sparse, young slender mallee eucs. Shrubs layer present. Groundcover spinifex small clumps and herbs. A lot of bare ground. Some lichen patches | Inter-dune  | 0   |     | 108 | Good, regenerating after fire, 3 layers present, minor evidence of grazing  | 3 | 0 | 0 | 1     | 0 | 0 |                    | 1  | 1     | Hummock/ Grass          | 10    | 3   | Y          | 5    | 1.5  | 20    | 20   | 40    | 0        | 40    | < 5     | < 1     | 0   | 0  | 2 | 0  | 0  | 0  | 0  | 1  | 0   | 5      | 4  | 0      |
| DMHAB1 Northern additional offset  | Offset | 1935-4368             | 712783 | 6266056 | Mallee/ spinifex | Young Mallee trees with central hollows many. Trees sparse interspersed with tall shrubs. Triodia understory. Much ground is bare.  | Top of dune | 5   | N   | 105 | Good Condition 2-3 layers, mostly immature/reg enerating, some grazing (cattle, rabbits, goats)                           | 0 | ? | 0 | 1     | 0 | 1 |                    | 1  | 1     | Hummock/ Grass          | 10    | 4   | Y-L        | 10   | 3    | 20    | 10   | 30    | 0        | 60    | 10      | < 1     | 1   | 7  | 1 | 0  | 0  | 0  | 13 | 1  | 0   | 5      | 5  | 0      |
| DMHAB3 North offset addition       | Offset | 1932-4371             | 707550 | 6268617 | Mallee/ spinifex | Dune mallee. Mainly young trees most with central hollows. Good shrub layer over triodia some speargrass and herbs. Lichen crust present but broken up. Spinifex mostly small clumps.                 | Top of dune | 2   | W   | 76  | Good, immature 3 layers with some grazing disturbance, regeneration observed  | 0 | 0 | 0 | 1     | 1 | 1 |                    | 1  | 1     | Hummock/ Grass          | 30    | 7   | E-M        | 15   | 2    | 20    | 10   | 20    | 0        | 60    | 20      | 1-2     | 1   | 4  | 2 | 0  | 0  | 0  | 6  | 1  | 0   | 5      | 4  | 10     |
| DMHAB4 Northern Additional Offset  | Offset | 1930-4373             | 710906 | 6267993 | Mallee/ spinifex | Young mallee, scattered eucs, low with some central hollows. Sparse shrub layer. Ground mix of triodia, speargrass and herbs. Spinifex small to medium.   | Top of dune | 1   | SSE | 97  | Good immature with 3 structural layers and grazing disturbance  | 0 | 0 | 0 | 1     | 1 | 0 |                    | 1  | 1     | Hummock/ Grass          | 30    | 5   | E          | < 5  | 1.5  | 30    | 10   | 40    | 0        | 50    | 10      | 0-4     | 0   | 7  | 2 | 0  | 0  | 0  | 8  | 1  | 0   | 5      | 4  | 0      |
| DM1                                | Offset | 887-888; 884-886      | 710239 | 6259948 | Mallee/ spinifex | Flowering Spinifex and Mallee.  | Mid dune    | 8   | 225 | 87  | Good  | 0 | 1 | 0 | 1     | 0 | 1 |                    | 1  | 1     | Hummock/ Grass          | 30    | 4   | E-M        | 5-10 | 1    | 40    |      | 30    | 8        | 5-10  | 20      | 0.2-0.3 | 0   | 0  | 3 | 0  | 0  | 0  | 0  | 1  | 0   | 3      | 4  | 0      |
| DM2                                | Offset |                       | 711518 | 6272074 | Mallee/ spinifex | Flowering spinifex and ground layer herbs.  | Top of dune | 5   | 200 |     |   | 0 | 0 | 0 | 1 - 2 | 0 | 1 |                    |    | 1     | Hummock/ Grass          | 25-30 | 4   |            | 20   | 1.25 | 20    |      |       |          |       | 0       | 0       | 2   | 0  | 0 | 0  | 0  | 0  | 0  | 0  | 5   | 3      | 0  |        |
| DM3                                | Offset | 896-897               | 712031 | 6256983 | Mallee/ spinifex | Flowering spinifex and mallee.  | Top of dune | -   |     |     | Good, some regeneration, no weeds   | 0 | 1 | 0 | 1     | 1 | 1 |                    | 1  | 1     | Hummock/ Grass          | 25    |     | E-M        | 5    |      | 30    |      | 75    | 0        | 25    | 25      | 0.2     | 0   | 0  | 3 | 0  | 0  | 0  | 0  | 0  | 0   | 4      | 4  | 0      |
| DM4                                | Offset | 882-883               | 705742 | 6263349 | Mallee/ spinifex | -   | -           | 3   | 45  | 85  |   | 0 | 0 | 0 | 1     | 0 | 0 |                    | 1  |       | Hummock/ Grass          | 30    |     |            | 20   |      | 35-40 |      | 0     | 20       |       | 0.1-0.2 | 0       | 1   | 2  | 0 | 0  | 0  | 0  | 0  | 1  | 4   | 4      | 0  |        |
| DM5                                | Offset | 908-909               | 715688 | 6246786 | Mallee/ spinifex | Flowering spinifex and mallee, grassy woodland with minimal weeds   | Top of dune |     |     | 85  | Moderate, regeneration, disturbance   | 0 | 1 | 0 | 1     | 1 | 1 |                    | 1  | 1     | Hummock/ Grass          | 35    | 4   | E-M some L | 5    | 0.5  | 40    |      | 50-55 | 0        | 15-20 | 20      | 0.1-0.2 | 0   | 2  | 3 | 0  | 0  | 0  | 0  | 1  | 0   | 3      | 4  | 0      |
| DMH4                               | Offset | 5080-5082             | 712699 | 6255603 | Mallee/ Spinifex | Blue flowering shrubs common. Mostly young Mallee, Acacia, Triodia, Dodonea   | Top of dune | 0   |     | 112 | Good, mostly young mallee, few older trees with hollows   | 0 | 0 | 0 | 0     | 0 | 0 | Few Goat cow scats | 1  | 1     | Hummock/ Grass          | 15    | 5   | Y-E-M-L    | 2    | 1    | 45    |      | 45    | < 1      | 30    | 15      | 0-5     | 6   | 6  | 3 | 7  | 0  | 0  | 0  | 1  | 0   | 3      | 4  | 27     |
| DMH3                               | Offset | 5076-5077             | 706958 | 6256399 | Mallee/ Spinifex | Dune Mallee with patchy triodia. Dodonea, Acacia, Lichen  |             | 5   | 120 | 76  | Good young Mallee, little current disturbance   | 0 | 0 | 0 | 0     | 0 | 0 | 1 (Cattle Goats)   | 1  | 1     | Tussock/ Grass          | 15    | 5   | E          | 1    | 1    | 35    |      | 30    | 1        | 50    | 20      | 0-2     | 3   | 0  | 3 | 0  | 0  | 0  | 0  | 0  | 0   | 4      | 4  | 28     |
| DMH2                               | Offset | 5074-75               | 708324 | 6255267 | Mallee/ Spinifex | Dune Mallee with patchy triodia. Dodonea, Acacia, Lichen  | Top of dune | 1   | 330 | 81  | Good condition  | 0 | 0 | 0 | 0     | 0 | 0 | 1 (Goats)          | 1  | 1     | Tussock/ Grass          | 10    | 6   | E          | 1    | 1    | 45    |      | 55    | 0        | 5     | 40      | < 0.5   | 3   | 3  | 3 | 3  | 0  | 0  | 0  | 0  | 0   | 5      | 4  | 0      |

| Site                              | Area   | Photo no. | East   | North   | veg category               | veg community description  | Topo desc                  | S  | Asp | Alt | General Condition  | F | C   | L | G | W | T   | Other                          | SD | ST | DGL                                    | TL %           | ATH | AS  | SL %  | AS H | GL %  | CC % | V% | L >15 cm | BS % | L% | LD (cm) | LDT   | HT  | B  | SH | MH | LH | BH | Fs | Stu | FT (m) | Sp | LG (m) |   |
|-----------------------------------|--------|-----------|--------|---------|----------------------------|--|----------------------------|----|-----|-----|--|---|-----|---|---|---|-----|--------------------------------|----|----|--|----------------|-----|-----|-------|------|-------|------|----|----------|------|----|---------|-------|-----|----|----|----|----|----|----|-----|--------|----|--------|---|
| DMH1                              | Offset | 5072-5073 | 709132 | 6254198 | Mallee/ Spinifex           | Dune Mallee with Triodia groundcover few fissures and hollows.   | Mid dune                   | 10 | 180 | 83  | Good condition mallee. Little evidence of disturbance  | 0 | 0   | 0 | 0 | 0 | 0   |                                | 1  | 1  | Hummock/ Grass                         | 10             | 5   | M-L | 5     | 1    | 20    |      | 40 | 1        | 80   | 30 | 0.5     | 0     | 0   | 3  | 0  | 0  | 0  | 0  | 1  | 0   | 5      | 4  | 11     |   |
| DM3 southern offset               | Offset | 5065-66   | 712077 | 6256992 | Mallee/ Spinifex           | Dune Mallee open low woodland with Triodia dominant presence of Dodonea, Acacia, Lichen  | Top of dune                | 0  | 0   | 110 | Good condition goat tracks and scats common  | 0 | 0   | 0 | 1 | 0 | 0   | 2 (Goat 1)                     | 1  | 1  | Hummock/ Grass & Lichen                | 5              | 5   | L   | 1     | 1.5  | 45    |      | 45 | 0        | 10   | 45 | < 0.5   | 8     | 8   | 3  | 12 | 0  | 0  | 0  | 1  | 0   | 1      | 4  | 0      |   |
| DMH6                              | Offset | 5095-5096 | 719093 | 6249701 | Mallee/ Spinifex           | Dune Mallee with Triodia   | Top of dune                | 0  |     | 102 | Good condition young Mallee little understory  | 0 | 0   | 0 | 1 | 0 | 0   | Goat scats present             | 1  | 1  | Hummock/ Grass & Lichen                | 10             | 5   | Y   | 1     | 1    | 15    |      | 40 | < 5      | 40   | 20 | 0-2     | 5     | 2   | 3  | 3  | 0  | 0  | 0  | 1  | 0   | 4      | 4  | 41     |   |
| DMH5                              | Offset | 5087-88   | 705507 | 6261634 | Mallee/ Spinifex           | Dune Mallee with patchy shrubs and presence of Triodia   | Mid dune                   | 1  | 5   | 73  | Good condition with scattered shrubs   | 0 | 1   | 0 | 0 | 0 | 0   | 0                              |    | 1  | 1                                      | Tussock/ Grass | 10  | 7   | E     | 5    | 2     | 20   |    | 35       | 0    | 50 | 15      | < 0.5 | 21  | 21 | 3  | 36 | 13 | 4  | 0  | 0   | 0      | 5  | 5      | 0 |
| DMBB                              | Offset | 5432-34   | 712197 | 6258163 | Mallee/ Spinifex           | Dune Mallee young some spinifex, few large trees no hollows or logs  | Top of dune                | 0  | 0   | 120 | Good moderate condition  | 0 | 0   | 0 | 1 | 0 | 1   |                                | 1  | 1  | Spinifex                               | 30             | 4   | E-M | 5     | 1    | 40    |      | 55 | 1        | 20   | 24 | 1       | 0     | 0   | 2  | 0  | 0  | 0  | 0  | 0  | 0   | 5      | 4  | 0      |   |
| DMCC                              | Offset | 5411-43   | 712606 | 6261037 | Mallee/ Spinifex           | wide flat plateau mix of young and old mallee, small spinifex.   | Top of dune                | 0  | 0   | 109 | Good moderate  | 0 | 0   | 0 | 1 | 0 | 1   |                                | 1  | 1  | Spinifex                               |                | 4   | E-M |       | 1    |       |      | 40 | 0        | 25   | 35 | 1       | 0     | 0   | 3  | 0  | 0  | 0  | 0  | 0  | 0   | 5      | 4  | 0      |   |
| DMDD                              | Offset | 5444-46   | 708891 | 6260014 | Mallee/ Spinifex           | small spindly mallee, few mature Spinifex  | Top of dune                | 0  | 0   | 78  | Good moderate possible previous disturbance  | 0 | 0   | 0 | 1 | 0 | 1   |                                | 1  | 1  | Spinifex                               |                | 4   | E-M |       |      |       |      | 55 | 0        | 30   | 15 | 1       | 0     | 0   | 2  | 0  | 0  | 0  | 0  | 0  | 0   | 5      | 4  | 0      |   |
| Jewelled Gecko                    | Offset | 5447-49   | 705997 | 6260271 | Mallee/ Spinifex           | broad plateau on dune mostly small spindly mallee  | Top of dune                | 0  | 2   | 84  | Good moderate a few goat tracks  | 0 | 0   | 1 | 0 | 0 | 1   |                                | 1  | 1  | Spinifex                               | 30             | 5   | E-M | 5     | 1    | 40    |      | 60 | 0        | 25   | 15 |         | 0     | 0   | 2  | 0  | 0  | 0  | 0  | 0  | 0   | 5      | 5  | 0      |   |
| T12DM                             | Offset | 5450-51   | 711889 | 6256013 | Mallee/ Spinifex           | mature mallee sparse. Abundant large spinifex  | Top of dune                | 0  | 0   | 110 | signs of goat tracks   | 0 | 0   | 0 | 1 | 0 | 1   |                                | 1  | 1  | Spinifex                               | 20             | 5   | M   | 10    | 2    |       |      | 60 | 2        | 20   | 18 | 1       | 2     | 1   | 3  | 1  | 0  | 0  | 0  | 0  | 0   | 5      | 5  | 3      |   |
| DMAA                              | Offset | 5402-04   | 711163 | 6251509 | Mallee/ Spinifex           | -  | Top of dune                | 0  |     | 102 | Good moderate disturbed possibly in past due to size of spinifex and mallee                      | 0 | 0   | 0 | 1 | 0 | 1   |                                | 1  | 1  | Spinifex                               | 10             | 4   | E-M | 5     | 2    |       |      | 55 | 0        | 25   | 20 | 1       | 0     | 0   | 2  | 0  | 0  | 0  | 0  | 1  | 0   | 5      | 5  | 0      |   |
| DM5 offset area                   | Offset | 5348-5350 | 715700 | 6246869 | Mallee/ Spinifex           | -  | Top of dune                | 0  |     | 86  | Moderate, hollows present regenerating, disturbance in past due to spinifex clump size           | 0 | 0   | 0 | 1 | 0 | -   | pitfall trap line, goat tracks | 1  | 1  | Hummock/ Grass & Spinifex              | 20             | 6   | E-M | 1     | 1    | 25    |      | 25 | 2        | 20   | 53 | 2-4     | 1     | 1   | 2  | 1  | 1  | 0  | 0  | 1  | 0   | 5      | 5  | 4      |   |
| Malleefowl Mound at campaspe      | Offset | N/A       | 712993 | 6262598 | Mallee/ Spinifex           | spinifex has finished seeding, no fire, no logging, Acacia present, some Mallee in bud/flower/pod but patchy. Typical Dune Mallee  | Top of dune                |    | E-W | 4   | Good no weeds but presence of grazing by feral goats, no fire no logging                         | 0 | 0   | 0 | 1 | 0 | 2   |                                | 1  | 1  | Hummock/ Grass & Spinifex              | 50             | 4   | E-M | 0     |      | 30    |      | 60 | 0        | 30   | 20 | 1       | 0     | 0   | 3  | 0  | 0  | 0  | 0  | 0  | 0   | 5      | 4  | 0      |   |
| SM3 North Additional Offset       | Offset | 1946-4357 | 713314 | 6266830 | Mallee/ Spinifex/ saltbush |  | Sandplain or Aeolian Plain | 0  |     | 101 | Moderate-Good; young mallee with triodia and herabaceous understory, impacted by grazing         | 0 | 0   | 0 | 2 | 1 | 0   |                                | 1  | 1  | Tussock/ Grass                         | 30             | 5   | Y-L | < 5   | 1.5  | 20    | 5    | 30 | 0        | 50   | 20 | 0.2     | 0     | 111 | 1  | 0  | 0  | 0  | 10 | 1  | 0   | 5      | 5  | 6      |   |
| DMHAB2 Northern additional offset | Offset | 1934-4369 | 706575 | 6268398 | Mallee/ Spinifex/ saltbush | tall Mallee over shrub layer of acacia. Trees sparse. Shrubs dense but sparse. Ground cover of Triodia, speargrass and herbs. Lichen crust.  | Base of dune               | 0  |     | 89  | Good, 3 layers, immature, some grazing (rabbits)   | 0 | ?   | 0 | 1 | 1 | 0   |                                | 1  | 1  | Tussock/ Grass & Hummock/ Grass        | 30             | 8   | M   | 10    | 3    | 30    | 20   | 40 | 0        | 20   | 20 | < 1     | 0     | 5   | 1  | 0  | 0  | 0  | 9  | 1  | 0   | 5      | 5  | 0      |   |
| SM1                               | Offset | 918-919   | 705210 | 6259297 | Mallee/ stipa              | flowering Acacia, mallee, stipa. Some mature trees some weeds, evidence of grazing   | Sandplain                  | 0  |     | 82  | Moderate, regeneration, some disturbance scats of goat and wallabys                              | 0 | 1-2 | 0 |   | 1 | 1   |                                | 1  | 1  | Tussock/ Grass & Herb & Other Chenopod | 30             | 4   | M-L | 25    |      | 40    |      | 70 | 6        | 30   | 20 | 0.1-0.2 | 4     | 6   | 3  | 4  | 2  | 0  | 0  | 2  | 0   | 4      | 0  | 6      |   |
| SM2                               | Offset | 881-880   | 707226 | 6272662 | Mallee/ stipa -Chenopod    | seeding grasses, regenerating sandplain surrounded by disturbed cleared Belah woodland   | Sandplain                  | 0  | 270 | 80  | Regenerating, disturbed and cleared Belah woodland, evidence of grazing                          | 0 | 2   | 2 | 2 | 0 | 1-2 |                                | 2  |    | Tussock/ Grass & Other (saltbush)      | 20             | 4   | E-Y | 15-20 | 0.77 | 30-40 |      |    |          |      |    | 3       | 3     | 3   | 0  | 4  | 0  | 0  | -  | 0  | 4   | 0      | 0  |        |   |
| CYPHAB1                           | Offset | 1931-4372 | 707019 | 6265903 | Other                      | Cyprus pine with elements of Belah /rosewood over speargrass. Shrub layer very sparse apart from rosewood mainly chenopods. Groundcover speargrass and some herbs. Lichen crust present but broken up by animal tracks | Top of dune                | 2  | SW  | 105 | moderate/mature 3 layered structure with heavy grazing disturbance. No tree regenerating evident | 0 | 0   | 0 | 2 | 2 | 0   |                                | 1  | 1  | Tussock/ Grass                         | 30             | 14  | M   | 5     |      | 20    | 20   | 20 | < 5      | 70   | 10 | 1       | 7     | 0   | 3  | 0  | 0  | 0  | 0  | 3  | 0   | 4      | 0  | 25     |   |

| Site                     | Area   | Photo no. | East   | North   | veg category        | veg community description                            | Topo desc                            | S     | Asp | Alt | General Condition   | F | C   | L | G   | W | T   | Other             | SD | ST | DGL   | TL % | ATH | AS  | SL % | AS H | GL % | CC % | V% | L >15 cm | BS %  | L%   | LD (cm) | LDT | HT | B | SH | MH | LH | BH | Fs | Stu | FT (m) | Sp | LG (m) |
|--------------------------|--------|-----------|--------|---------|---------------------|--|--------------------------------------|-------|-----|-----|---|---|-----|---|-----|---|-----|-------------------|----|----|---|------|-----|-----|------|------|------|------|----|----------|-------|------|---------|-----|----|---|----|----|----|----|----|-----|--------|----|--------|
| CYP Northern add. Offset | Offset | 1956-4353 | 706586 | 6266666 | Other               | Cyprus Pine woodland with grassy understorey on dune | Mid dune                             | 5-Oct | 150 | 52  | Moderate/Mature mostly native impacted by goats. Shrubs mostly absent, bare patches present                 | 0 | ?   | 0 | 3   | 1 | 1   |                   | 1  | 1  | Tussock/Grass                                 | 15   | 20  | L   | < 5  | 0.5  | 30   | 30   | 60 |          | 40    | 10   | < 1     | 8   | 0  | 3 | 2  | 0  | 0  | 0  | 3  | 0   | 5      | 0  | 15     |
| YSREG2                   | Offset | 5061-21   | 716943 | 6255666 | Shrubland           | Yarran Shrubland                                     | Sandplain                            | 1     | 200 | 87  | Regenerating, patchy with extensive cleared areas, Disturbed - heavily used by cattle, borders cleared land | 0 | 3   | 0 | 2   | 1 | 1   | 1 (rabbit, goats) | 1  | 2  | Herb/Grass                                    | 0.1  | 11  | M   | 12   | 4    | 40   |      | 40 | 0        | 5     | 55   | 0.5     | 0   | 0  | 0 | 0  | 0  | 0  | 0  | 0  | 0   | 2      | 0  | 0      |
| YSREG2                   | Offset | 914-915   | 716886 | 6255685 | Shrubland/Grassland | Flowering grasses and Acacia                         | Other (Alluvial floodplain)          | 2     | 210 | 87  | Regeneration of Acacia sp. disturbed shrubland  | 0 | 2-3 | 0 | 2-3 | 2 | 1-2 |                   | 2  | 3  | Tussock/Grass & Herb                          | 0    |     | Y-E | 5-10 |      | 65   |      | 65 | 0        | 5-10  | 2    | 0.1     | 3   | 2  | 0 | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 0  | 0      |
| Y5 - dis 1               | Offset | 910-911   | 717415 | 6252926 | Shrubland/Grassland | Flowering tussock grass and Acacia                   | Other (Flat old Alluvial floodplain) | 0     |     | 77  | Very disturbed, heavily grazed  | 1 | 3   | 0 | 3   | 1 | 1-2 |                   | 2  | 3  | Tussock/Grass & Other (chenopod small shrubs) | 1    |     |     | 5    |      | 55   |      | 55 | 0        | 20-25 | 5-10 | 0       | 0   | 1  | 1 |    |    |    |    | 0  | 1   | 1      | 0  | 0      |

GC= General Condition, F= Fire, C= Clearing, Lo= Logging, G= Grazing, W= Weeds, T= Tracks  
S= Slope, Asp= Aspect, Alt= Altitude, SD= Soil Depth, ST= Soil Type  
DGL= Dominant Ground Layer, TL %= Tree Layer % Cover, ATH= Average Tree Height, AS= Age Structure, SL= Shrub Layer % Cover, ASH= Average Shrub Height, GL%= Ground Layer % Cover  
CC%= Crypto Crust % Cover (Lichen), V%= Vegetation Cover (Total), L>15cm= Logs (>15cm diameter) Cover, BS%= Bare Soil % Cover, L%= Litter % Cover, LD= Litter Depth,  
LDT= Large Dead Trees, HT= No. Of Trees with Hollows, B= Bark Score (0= Absent, 1= Rare, 2= Common, 3= Abundant), SH= No. Of Small Hollows, MH= No. Of Medium Hollows, LH= No. Of Large Hollows, BH= No. Of Basal Hollows  
FS= Fissures (0= Absent, 1= Rare, 2= Common, 3= Abundant), Stu= Stumps, FT= Fallen Timber (m), Sp= Spinifex Score (Condition/ Density), LG= Large Logs (>15cm diameter) Length (m)

## Appendix C: Fauna Species Recorded

| Group    | Common Name                   | Scientific Name                          | Abundance | TSC Act <sup>1</sup> | EPBC Act <sup>2</sup> |
|----------|-------------------------------|--|-----------|----------------------|-----------------------|
| Frogs    | Spotted Grass Frog            | <i>Limnodynastes tasmaniensis</i>        | Common    |                      |                       |
|          | Sudell's Frog                 | <i>Neobatrachus sudelli</i>              | Rare      |                      |                       |
| Reptiles | Wood Gecko                    | <i>Diplodactylus vittatus</i>            | Common    |                      |                       |
|          | Tree Dtella                   | <i>Gehyra variegata</i>                  | Common    |                      |                       |
|          | Bynoe's Gecko                 | <i>Heteronotia binoei</i>                | Common    |                      |                       |
|          | Beaded Gecko                  | <i>Lucasium damaeum</i>                  | Common    |                      |                       |
|          | Box-patterned Gecko^          | <i>Lucasium steindachneri</i>            | Rare      |                      |                       |
|          | Beaked Gecko                  | <i>Rhynchoedura ornata</i>               | Common    |                      |                       |
|          | Spiny-tailed Gecko            | <i>Strophurus ciliaris</i>               | Uncommon  |                      |                       |
|          | Jewelled Gecko                | <i>Strophurus elderi</i>                 | Common    | V                    | -                     |
|          | Southern Spiny-tailed Gecko   | <i>Strophurus intermedius</i>            | Common    |                      |                       |
|          | Thick-tailed Gecko            | <i>Underwoodisaurus milii</i>            | Uncommon  |                      |                       |
|          | Mallee Worm-lizard            | <i>Aprasia inaurita</i>                  | Rare      | E                    | -                     |
|          | Unbanded Delma                | <i>Delma butleri</i>                     | Uncommon  |                      |                       |
|          | Burton's Snake-lizard         | <i>Lialis burtonis</i>                   | Common    |                      |                       |
|          | Spiny-palmed Shinning-skink   | <i>Cryptoblepharus carnabyi</i>          | Common    |                      |                       |
|          | Southern Mallee Ctenotus      | <i>Ctenotus atlas</i>                    | Common    |                      |                       |
|          | Short-clawed Ctenotus         | <i>Ctenotus brachyonyx</i>               | Rare      |                      |                       |
|          |                               | <i>Ctenotus orientalis</i>               | Rare      |                      |                       |
|          | Pale-rumped Ctenotus          | <i>Ctenotus regius</i>                   | Common    |                      |                       |
|          | Barred Wedgesnout Ctenotus    | <i>Ctenotus schomburgkii</i>             | Uncommon  |                      |                       |
|          | Spinifex Slender Blue-tongue  | <i>Cyclodomorphus melanops elongatus</i> | Rare      | E                    | -                     |
|          | Tree Skink                    | <i>Egernia striolata</i>                 | Common    |                      |                       |
|          | Wood Mulch-slider             | <i>Lerista muelleri</i>                  | Abundant  |                      |                       |
|          | Eastern Robust Slider         | <i>Lerista punctatovittata</i>           | Uncommon  |                      |                       |
|          | Pale-striped Mulch Slider     | <i>Lerista speciosa</i>                  | Rare      |                      |                       |
|          | Desert Skink^                 | <i>Liopholis inornata</i>                | Common    |                      |                       |
|          | Common Dwarf Skink            | <i>Menetia greyii</i>                    | Common    |                      |                       |
|          | South-eastern Morethia Skink  | <i>Morethia boulengeri</i>               | Abundant  |                      |                       |
|          | Shrubland Morethia Skink      | <i>Morethia obscura</i>                  | Rare      |                      |                       |
|          | Shingle-back                  | <i>Tiliqua rugosa</i>                    | Rare      |                      |                       |
|          | Nobbi                         | <i>Amphibolurus nobbi</i>                | Common    |                      |                       |
|          | Mallee Military Dragon        | <i>Ctenophorus fordi</i>                 | Common    |                      |                       |
|          | Painted Dragon                | <i>Ctenophorus pictus</i>                | Uncommon  |                      |                       |
|          | Bearded Dragon                | <i>Pogona barbata</i>                    | Rare      |                      |                       |
|          | Central Bearded Dragon        | <i>Pogona vitticeps</i>                  | Common    |                      |                       |
|          | Gould's Goanna                | <i>Varanus gouldii</i>                   | Uncommon  |                      |                       |
|          | Yellow-faced Whipsnake        | <i>Demansia psammophis</i>               | Uncommon  |                      |                       |
|          | Bardick                       | <i>Echiopsis curta</i>                   | Rare      | E                    | -                     |
|          | Dwyer's Snake                 | <i>Parasuta dwyeri</i>                   | Uncommon  |                      |                       |
|          | Mitchell's Short-tailed Snake | <i>Parasuta nigriceps</i>                | Rare      |                      |                       |



| Group | Common Name                        | Scientific Name                           | Abundance | TSC Act <sup>1</sup> | EPBC Act <sup>2</sup> |
|-------|------------------------------------|---|-----------|----------------------|-----------------------|
| Birds | Western Brown Snake                | <i>Pseudonaja nuchalis</i>                | Rare      |                      |                       |
|       | Emu                                | <i>Dromaius novaehollandiae</i>           | Abundant  |                      |                       |
|       | Malleefowl                         | <i>Leipoa ocellata</i>                    | Common    | E                    | V, M                  |
|       | Australian Wood Duck               | <i>Chenonetta jubata</i>                  | Common    |                      |                       |
|       | Grey Teal                          | <i>Anas gracilis</i>                      | Uncommon  |                      |                       |
|       | Australasian Grebe                 | <i>Tachybaptus novaehollandiae</i>        | Uncommon  |                      |                       |
|       | Hoary-headed Grebe                 | <i>Poliocephalus poliocephalus</i>        | Rare      |                      |                       |
|       | Nankeen Night Heron                | <i>Nycticorax caledonicus</i>             | Rare      |                      |                       |
|       | White-necked Heron                 | <i>Ardea pacifica</i>                     | Rare      |                      |                       |
|       | Australian Kestrel                 | <i>Falco cenchroides</i>                  | Rare      |                      |                       |
|       | Brown Falcon                       | <i>Falco berigora</i>                     | Uncommon  |                      |                       |
|       | Black Kite                         | <i>Milvus migrans</i>                     | Rare      |                      |                       |
|       | Whistling Kite                     | <i>Haliastur sphenurus</i>                | Rare      |                      |                       |
|       | Spotted Harrier                    | <i>Circus assimilis</i>                   | Uncommon  | V                    | -                     |
|       | Collared Sparrowhawk               | <i>Accipiter cirrocephalus</i>            | Uncommon  |                      |                       |
|       | Wedge-tailed Eagle                 | <i>Aquila audax</i>                       | Uncommon  |                      |                       |
|       | Little Eagle                       | <i>Hieraaetus morphnoides</i>             | Uncommon  | V                    | -                     |
|       | Black-tailed Native-hen            | <i>Tribonyx ventralis</i>                 | Rare      |                      |                       |
|       | Eurasian Coot                      | <i>Fulica atra</i>                        | Uncommon  |                      |                       |
|       | Little Button-quail                | <i>Turnix velox</i>                       | Rare      |                      |                       |
|       | Black-winged Stilt                 | <i>Himantopus himantopus</i>              | Uncommon  |                      |                       |
|       | Banded Lapwing                     | <i>Vanellus tricolor</i>                  | Rare      |                      |                       |
|       | Masked Lapwing                     | <i>Vanellus miles</i>                     | Uncommon  |                      |                       |
|       | Red-kneed Dotterel                 | <i>Erythrogonyx cinctus</i>               | Rare      |                      |                       |
|       | Black-fronted Dotterel             | <i>Elseymoris melanops</i>                | Common    |                      |                       |
|       | Common Bronzewing                  | <i>Phaps chalcoptera</i>                  | Common    |                      |                       |
|       | Crested Pigeon                     | <i>Ocyphaps lophotes</i>                  | Common    |                      |                       |
|       | Galah                              | <i>Eolophus roseicapillus</i>             | Common    |                      |                       |
|       | Major Mitchell's Cockatoo          | <i>Lophochroa leadbeateri</i>             | Common    | V                    | -                     |
|       | Australian Ringneck                | <i>Barnardius zonarius</i>                | Common    |                      |                       |
|       | Blue Bonnet                        | <i>Northiella haematogaster</i>           | Common    |                      |                       |
|       | Mulga Parrot                       | <i>Psephotus varius</i>                   | Common    |                      |                       |
|       | Blue-winged Parrot                 | <i>Neophema chrysostoma</i>               | Rare      |                      |                       |
|       | Regent Parrot (eastern subspecies) | <i>Polytelis anthopeplus monarchoides</i> | Rare      | E                    | V                     |
|       | Pallid Cuckoo                      | <i>Cacomantis pallidus</i>                | Uncommon  |                      |                       |
|       | Fan-tailed Cuckoo                  | <i>Cacomantis flabelliformis</i>          | Rare      |                      |                       |
|       | Black-eared Cuckoo                 | <i>Chalcites osculans</i>                 | Uncommon  |                      |                       |
|       | Horsfield's Bronze-Cuckoo          | <i>Chalcites basalis</i>                  | Uncommon  |                      |                       |
|       | Barn Owl                           | <i>Tyto alba</i>                          | Uncommon  |                      |                       |
|       | Southern Boobook                   | <i>Ninox boobook</i>                      | Common    |                      |                       |
|       | Tawny Frogmouth                    | <i>Podargus strigoides</i>                | Uncommon  |                      |                       |
|       | Spotted Nightjar                   | <i>Eurostopodus argus</i>                 | Uncommon  |                      |                       |
|       | Australian Owlet-nightjar          | <i>Aegotheles cristatus</i>               | Abundant  |                      |                       |
|       | Rainbow Bee-eater                  | <i>Merops ornatus</i>                     | Rare      | -                    | M                     |

| Group | Common Name                       | Scientific Name                   | Abundance | TSC Act <sup>1</sup> | EPBC Act <sup>2</sup> |
|-------|-----------------------------------|-----------------------------------|-----------|----------------------|-----------------------|
|       | White-throated Treecreeper        | <i>Cormobates leucophaea</i>      | Rare      |                      |                       |
|       | White-browed Treecreeper          | <i>Climacteris affinis</i>        | Common    |                      |                       |
|       | Brown Treecreeper                 | <i>Climacteris picumnus</i>       | Common    |                      |                       |
|       | Variegated Fairy-wren             | <i>Malurus lamberti</i>           | Uncommon  |                      |                       |
|       | White-winged Fairy-wren           | <i>Malurus leucopterus</i>        | Uncommon  |                      |                       |
|       | Spotted Pardalote                 | <i>Pardalotus punctatus</i>       | Common    |                      |                       |
|       | Red-browed Pardalote              | <i>Pardalotus rubricatus</i>      | Rare      |                      |                       |
|       | Striated Pardalote                | <i>Pardalotus striatus</i>        | Abundant  |                      |                       |
|       | Chestnut-rumped Heathwren         | <i>Hylacola pyrrhopygia</i>       | Rare      |                      |                       |
|       | Weebill                           | <i>Smicrornis brevirostris</i>    | Abundant  |                      |                       |
|       | Western Gerygone                  | <i>Gerygone fusca</i>             | Uncommon  |                      |                       |
|       | Inland Thornbill                  | <i>Acanthiza apicalis</i>         | Uncommon  |                      |                       |
|       | Chestnut-rumped Thornbill         | <i>Acanthiza uropygialis</i>      | Common    |                      |                       |
|       | Western Thornbill                 | <i>Acanthiza inornata</i>         | Rare      |                      |                       |
|       | Yellow-rumped Thornbill           | <i>Acanthiza chrysorrhoa</i>      | Common    |                      |                       |
|       | Yellow Thornbill                  | <i>Acanthiza nana</i>             | Common    |                      |                       |
|       | Striated Thornbill                | <i>Acanthiza lineata</i>          | Rare      |                      |                       |
|       | Southern Whiteface                | <i>Aphelocephala leucopsis</i>    | Uncommon  |                      |                       |
|       | Yellow-faced Honeyeater           | <i>Lichenostomus chrysops</i>     | Uncommon  |                      |                       |
|       | Singing Honeyeater                | <i>Lichenostomus virescens</i>    | Common    |                      |                       |
|       | White-eared Honeyeater            | <i>Lichenostomus leucotis</i>     | Abundant  |                      |                       |
|       | Yellow-plumed Honeyeater          | <i>Lichenostomus ornatus</i>      | Common    |                      |                       |
|       | Fuscous Honeyeater                | <i>Lichenostomus fuscus</i>       | Uncommon  |                      |                       |
|       | White-plumed Honeyeater           | <i>Lichenostomus penicillatus</i> | Uncommon  |                      |                       |
|       | Noisy Miner                       | <i>Manorina melanocephala</i>     | Rare      |                      |                       |
|       | Yellow-throated Miner             | <i>Manorina flavigula</i>         | Common    |                      |                       |
|       | Brown-headed Honeyeater           | <i>Melithreptus brevirostris</i>  | Common    |                      |                       |
|       | Little Friarbird                  | <i>Philemon citreogularis</i>     | Uncommon  |                      |                       |
|       | Striped Honeyeater                | <i>Plectorhyncha lanceolata</i>   | Abundant  |                      |                       |
|       | Spiny-cheeked Honeyeater          | <i>Acanthagenys rufogularis</i>   | Abundant  |                      |                       |
|       | Red Wattlebird                    | <i>Anthochaera carunculata</i>    | Abundant  |                      |                       |
|       | White-fronted Honeyeater          | <i>Purnella albifrons</i>         | Abundant  |                      |                       |
|       | Pied Honeyeater                   | <i>Certhionyx variegatus</i>      | Rare      | V                    | -                     |
|       | White-fronted Chat                | <i>Epthianura albifrons</i>       | Common    | V                    | -                     |
|       | Hooded Robin (south-eastern form) | <i>Melanodryas cucullata</i>      | Common    | V                    | -                     |
|       | Jacky Winter                      | <i>Microeca fascinans</i>         | Common    |                      |                       |
|       | Red-capped Robin                  | <i>Petroica goodenovii</i>        | Common    |                      |                       |
|       | White-browed Babbler              | <i>Pomatostomus superciliosus</i> | Rare      |                      |                       |
|       | Chestnut-crowned Babbler          | <i>Pomatostomus ruficeps</i>      | Uncommon  |                      |                       |
|       | Chestnut-backed Quail-thrush      | <i>Cinclosoma castanotus</i>      | Abundant  | V                    | -                     |
|       | Varied Sittella                   | <i>Daphoenositta chrysoptera</i>  | Uncommon  | V                    | -                     |

| Group          | Common Name   | Scientific Name   | Abundance | TSC Act <sup>1</sup> | EPBC Act <sup>2</sup> |
|----------------|---|---|-----------|----------------------|-----------------------|
|                | Gilbert's Whistler  | <i>Pachycephala inornata</i>                                      | Uncommon  | V                    | -                     |
|                | Golden Whistler   | <i>Pachycephala pectoralis</i>                                    | Uncommon  |                      |                       |
|                | Rufous Whistler   | <i>Pachycephala rufiventris</i>                                   | Abundant  |                      |                       |
|                | Grey Shrike-thrush  | <i>Colluricincla harmonica</i>                                    | Common    |                      |                       |
|                | Crested Bellbird  | <i>Oreoica gutturalis</i>   | Abundant  |                      |                       |
|                | Grey Fantail  | <i>Rhipidura albiscapa</i>  | Common    |                      |                       |
|                | Willie Wagtail  | <i>Rhipidura leucophrys</i>                                       | Common    |                      |                       |
|                | Magpie-lark   | <i>Grallina cyanoleuca</i>  | Common    |                      |                       |
|                | Restless Flycatcher   | <i>Myiagra inquieta</i>   | Common    |                      |                       |
|                | Grey Butcherbird  | <i>Cracticus torquatus</i>  | Abundant  |                      |                       |
|                | Pied Butcherbird  | <i>Cracticus nigrogularis</i>                                     | Common    |                      |                       |
|                | Australian Magpie   | <i>Cracticus tibicen</i>  | Abundant  |                      |                       |
|                | Grey Currawong  | <i>Strepera versicolor</i>  | Abundant  |                      |                       |
|                | White-breasted Woodswallow  | <i>Artamus leucorhynchus</i>                                      | Rare      |                      |                       |
|                | Masked Woodswallow  | <i>Artamus personatus</i>   | Uncommon  |                      |                       |
|                | White-browed Woodswallow  | <i>Artamus superciliosus</i>                                      | Common    |                      |                       |
|                | Dusky Woodswallow   | <i>Artamus cyanopterus</i>  | Rare      |                      |                       |
|                | Black-faced Cuckoo-shrike   | <i>Coracina novaehollandiae</i>                                   | Common    |                      |                       |
|                | Ground Cuckoo-shrike  | <i>Coracina maxima</i>  | Uncommon  |                      |                       |
|                | Little Crow   | <i>Corvus bennetti</i>  | Common    |                      |                       |
|                | Little Raven  | <i>Corvus mellori</i>   | Uncommon  |                      |                       |
|                | Australian Raven  | <i>Corvus coronoides</i>  | Abundant  |                      |                       |
|                | White-winged Chough   | <i>Corcorax melanorhamphos</i>                                    | Uncommon  |                      |                       |
|                | Apostlebird   | <i>Struthidea cinerea</i>   | Uncommon  |                      |                       |
|                | White-backed Swallow  | <i>Cheramoeca leucosterna</i>                                     | Rare      |                      |                       |
|                | Welcome Swallow   | <i>Hirundo neoxena</i>  | Uncommon  |                      |                       |
|                | Fairy Martin  | <i>Petrochelidon ariel</i>  | Rare      |                      |                       |
|                | Tree Martin   | <i>Petrochelidon nigricans</i>                                    | Common    |                      |                       |
|                | Silvereye   | <i>Zosterops lateralis</i>  | Uncommon  |                      |                       |
|                | Mistletoebird   | <i>Dicaeum hirundinaceum</i>                                      | Common    |                      |                       |
|                | Australian Pipit  | <i>Anthus novaeseelandiae</i>                                     | Rare      |                      |                       |
|                | Zebra Finch   | <i>Taeniopygia guttata</i>  | Rare      |                      |                       |
| <b>Mammals</b> | Short-beaked Echidna  | <i>Tachyglossus aculeatus</i>                                     | Uncommon  |                      |                       |
|                | Southern Ningau   | <i>Ningau yvonneae</i>  | Uncommon  | V                    | -                     |
|                | Western Grey Kangaroo   | <i>Macropus fuliginosus</i>                                       | Common    |                      |                       |
|                | Red Kangaroo  | <i>Macropus rufus</i>   | Rare      |                      |                       |
|                | Yellow-bellied Sheath-tail-bat  | <i>Saccolaimus flaviventris</i>                                   | Uncommon  | V                    | -                     |
|                |   | <i>Mormopterus "Species 3" (little penis)</i>                     | Common    |                      |                       |
|                |   | <i>Mormopterus "Species 4" (big penis)</i>                        | Common    |                      |                       |
|                | White-striped Freetail-bat  | <i>Tadarida australis</i>   | Abundant  |                      |                       |
|                | South-eastern Long-eared Bat, also known as Greater Long-eared Bat (south-eastern form) | <i>Nyctophilus corbeni</i> (also known as <i>N. timoriensis</i> ) | Abundant  | V                    | V                     |
|                | Lesser Long-eared Bat   | <i>Nyctophilus geoffroyi</i>                                      | Abundant  |                      |                       |

| Group | Common Name               | Scientific Name               | Abundance | TSC Act <sup>1</sup> | EPBC Act <sup>2</sup> |
|-------|---------------------------|-------------------------------|-----------|----------------------|-----------------------|
|       | Gould's Wattled Bat       | <i>Chalinolobus gouldii</i>   | Abundant  |                      |                       |
|       | Chocolate Wattled Bat     | <i>Chalinolobus morio</i>     | Common    |                      |                       |
|       | Little Pied Bat           | <i>Chalinolobus picatus</i>   | Abundant  | V                    | -                     |
|       | Inland Broad-nosed Bat    | <i>Scotorepens balstoni</i>   | Common    |                      |                       |
|       | Little Broad-nosed Bat    | <i>Scotorepens greyii</i>     | Common    |                      |                       |
|       | Inland Forest Bat         | <i>Vespadelus baverstocki</i> | Abundant  | V                    | -                     |
|       | Southern Forest Bat       | <i>Vespadelus regulus</i>     | Common    |                      |                       |
|       | Little Forest Bat         | <i>Vespadelus vulturnus</i>   | Rare      |                      |                       |
|       | House Mouse <sup>#</sup>  | <i>Mus musculus</i>           | Abundant  |                      |                       |
|       | Domestic Dog <sup>#</sup> | <i>Canis lupus familiaris</i> | Uncommon  |                      |                       |
|       | Red Fox <sup>#</sup>      | <i>Vulpes vulpes</i>          | Abundant  |                      |                       |
|       | Cat <sup>#</sup>          | <i>Felis catus</i>            | Common    |                      |                       |
|       | Rabbit <sup>#</sup>       | <i>Oryctolagus cuniculus</i>  | Common    |                      |                       |
|       | Goat <sup>#</sup>         | <i>Capra hircus</i>           | Common    |                      |                       |

<sup>1</sup> Threatened species status under the NSW *Threatened Species Conservation Act, 1995* (current at 25 July 2012).

<sup>2</sup> Threatened species status under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (current at 25 July 2012).

E = Endangered, V = Vulnerable, M = Migratory.

Key: ^ = named according to Wilson and Swan (2010).

# = introduced species.

Rare = one sighting only.

Uncommon = more than one sighting but encountered only infrequently.

Common = encountered frequently but not in high numbers relative to other species abundance.

Abundant = encountered frequently and in large numbers relative to other species abundance.

Note: Microbats recorded during the surveys only from ANABAT units were assigned an abundance category, assuming that one individual was present when the species was recorded.

Nomenclature consistent with CSIRO (2006) *CSIRO List of Australian Vertebrates: A Reference with Conservation Status*,

## References:

Commonwealth Scientific and Industrial Research Organisation (2006) *CSIRO List of Australian Vertebrates A Reference with Conservation Status*.

Wilson, S. and Swan G. (2010) *A Complete Guide to Reptiles of Australia* 3<sup>rd</sup> Edition. New Holland Publishers. Sydney, Australia.



## Appendix D: Co-ordinates of Threatened Species Recorded

| Common Name                  | Scientific Name              | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|------------------------------|------------------------------|---------|----------|------------|-----|---------|----------|
| Bardick                      | <i>Echiopsis curta</i>       | E       | -        | 12/05/2012 | 1   | 713223  | 6268474  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 14/05/2011 | 1   | 712560  | 6260721  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 30/03/2012 | 1   | 705789  | 6263355  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 31/03/2012 | 1   | 709233  | 6260001  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 31/03/2012 | 2   | 710183  | 6259844  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 31/03/2012 | 1   | 706599  | 6269406  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 1/04/2012  | 2   | 713796  | 6251410  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 1/04/2012  | 1   | 706756  | 6270469  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 1/04/2012  | 2   | 709784  | 6260208  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 1/04/2012  | 1   | 705577  | 6262130  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 2/04/2012  | 2   | 711546  | 6272122  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 2/04/2012  | 2   | 705758  | 6263272  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 2/04/2012  | 1   | 712090  | 6257377  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 19/04/2012 | 3   | 715714  | 6246860  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 20/04/2012 | 5   | 715714  | 6246860  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 20/04/2012 | 1   | 715714  | 6246860  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 21/04/2012 | 3   | 715714  | 6246860  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 22/04/2012 | 1   | 719810  | 6250021  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 22/04/2012 | 1   | 713799  | 6251408  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 22/04/2012 | 1   | 711845  | 6255718  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 23/04/2012 | 2   | 712226  | 6244973  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 24/04/2012 | 2   | 706958  | 6256399  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 25/04/2012 | 1   | 711204  | 6242819  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 25/04/2012 | 1   | 711204  | 6242819  |
| Chestnut-backed Quail-thrush | <i>Cinclosoma castanotus</i> | V       | -        | 25/04/2012 | 1   | 712606  | 6261037  |

| Common Name                           | Scientific Name              | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|---------------------------------------|------------------------------|---------|----------|------------|-----|---------|----------|
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 25/04/2012 | 2   | 718118  | 6245815  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 26/04/2012 | 1   | 711242  | 6257871  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 13/05/2012 | 2   | 713317  | 6266768  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 13/05/2012 | 2   | 713148  | 6268569  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 13/05/2012 | 1   | 710134  | 6266839  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 15/05/2012 | 2   | 713148  | 6268569  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 15/05/2012 | 2   | 710134  | 6266839  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 15/05/2012 | 2   | 713317  | 6266768  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 15/05/2012 | 2   | 709917  | 6266535  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 15/05/2012 | 2   | 713217  | 6267892  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 712784  | 6265962  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 712449  | 6265922  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 712151  | 6265888  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 706528  | 6268862  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 706628  | 6269556  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 706652  | 6269788  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 2   | 713328  | 6266187  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 16/05/2012 | 1   | 712107  | 6265887  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 2   | 706998  | 6267334  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 2   | 710906  | 6267993  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 2   | 707550  | 6268617  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 1   | 711269  | 6264933  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 1   | 711586  | 6264711  |
| Chestnut-backed Quail-thrush          | <i>Cinclosoma castanotus</i> | V       | -        | 17/05/2012 | 2   | 712534  | 6260529  |
| Chestnut-backed Quail-thrush (tracks) | <i>Cinclosoma castanotus</i> | V       | -        | 21/04/2012 | 1   | 711983  | 6255164  |
| Chestnut-backed Quail-thrush (tracks) | <i>Cinclosoma castanotus</i> | V       | -        | 24/04/2012 | 1   | 717259  | 6247002  |
| Chestnut-backed Quail-thrush (tracks) | <i>Cinclosoma castanotus</i> | V       | -        | 24/04/2012 | 1   | 711119  | 6253354  |
| Chestnut-backed Quail-thrush (tracks) | <i>Cinclosoma castanotus</i> | V       | -        | 25/04/2012 | 1   | 712372  | 6255877  |

| Common Name                       | Scientific Name                        | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|-----------------------------------|--|---------|----------|------------|-----|---------|----------|
| Gilbert's Whistler                | <i>Pachycephala inornata</i>           | V       | -        | 1/04/2012  | 1   | 713796  | 6251410  |
| Gilbert's Whistler                | <i>Pachycephala inornata</i>           | V       | -        | 23/04/2012 | 1   | 712629  | 6251410  |
| Gilbert's Whistler                | <i>Pachycephala inornata</i>           | V       | -        | 26/04/2012 | 1   | 711728  | 6257047  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 30/03/2012 | 3   | 713258  | 6259855  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 30/03/2012 | 2   | 707257  | 6272621  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 31/03/2012 | 4   | 705161  | 6259298  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 31/03/2012 | 2   | 707257  | 6272621  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 1/04/2012  | 1   | 713258  | 6259855  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 1/04/2012  | 2   | 705742  | 6263289  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 1/04/2012  | 1   | 707257  | 6272621  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 2/04/2012  | 1   | 710183  | 6259844  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 2/04/2012  | 1   | 705161  | 6259298  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 2/04/2012  | 1   | 711604  | 6272119  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 20/04/2012 | 1   | 712118  | 6250111  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 21/04/2012 | 3   | 712048  | 6256984  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 22/04/2012 | 11  | 714966  | 6256117  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 23/04/2012 | 1   | 714966  | 6256117  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | 13/05/2012 | 1   | 710855  | 6267845  |
| Greater Long-eared Bat            | <i>Nyctophilus timoriensis/corbeni</i> | V       | V        | <Null>     | 4   | 713258  | 6259855  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 15/11/2011 | 1   | 716957  | 6260490  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 20/04/2012 | 1   | 712118  | 6250111  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 20/04/2012 | 2   | 712118  | 6250111  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 21/04/2012 | 1   | 715714  | 6246860  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 22/04/2012 | 1   | 711845  | 6255718  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 22/04/2012 | 1   | 714966  | 6256117  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 25/04/2012 | 2   | 705281  | 6253819  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 11/05/2012 | 3   | 716189  | 6256414  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 13/05/2012 | 2   | 706596  | 6266679  |

| Common Name                       | Scientific Name                        | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|-----------------------------------|--|---------|----------|------------|-----|---------|----------|
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 13/05/2012 | 1   | 706306  | 6267333  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 14/05/2012 | 1   | 706596  | 6266679  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 15/05/2012 | 2   | 713223  | 6268474  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 15/05/2012 | 1   | 706596  | 6266679  |
| Hooded Robin (south-eastern form) | <i>Melanodryas cucullata cucullata</i> | V       | -        | 17/05/2012 | 1   | 705523  | 6262130  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 1/03/2012  | 5   | 711517  | 6272074  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 29/03/2012 | 4   | 705742  | 6263289  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 30/03/2012 | 1   | 710183  | 6259844  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 30/03/2012 | 1   | 713258  | 6259855  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 30/03/2012 | 3   | 707257  | 6272621  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 31/03/2012 | 1   | 705161  | 6259298  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 31/03/2012 | 2   | 705742  | 6263289  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 31/03/2012 | 1   | 707257  | 6272621  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 1/04/2012  | 2   | 713258  | 6259855  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 1/04/2012  | 1   | 711604  | 6272119  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 1/04/2012  | 1   | 705742  | 6263289  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 1/04/2012  | 1   | 707257  | 6272621  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 2/04/2012  | 3   | 713258  | 6259855  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 20/04/2012 | 1   | 712118  | 6250111  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 21/04/2012 | 4   | 712048  | 6256984  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 21/04/2012 | 1   | 716886  | 6255685  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 21/04/2012 | 4   | 716886  | 6255685  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 22/04/2012 | 1   | 712118  | 6250111  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 22/04/2012 | 1   | 712048  | 6256984  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 22/04/2012 | 2   | 714966  | 6256117  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 23/04/2012 | 1   | 712118  | 6250111  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | 23/04/2012 | 1   | 712048  | 6256984  |
| Inland Forest Bat                 | <i>Vespadelus baverstocki</i>          | V       | -        | <Null>     | 1   | 713258  | 6259855  |



| Common Name     | Scientific Name               | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|-----------------|-------------------------------|---------|----------|------------|-----|---------|----------|
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 29/03/2012 | 1   | 710159  | 6259961  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 30/03/2012 | 1   | 705972  | 6260275  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 25/04/2012 | 1   | 718118  | 6245815  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 25/04/2012 | 1   | 719093  | 6249705  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 13/05/2012 | 1   | 713317  | 6266768  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 13/05/2012 | 4   | 710134  | 6266839  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 15/05/2012 | 1   | 713317  | 6266768  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 15/05/2012 | 1   | 710134  | 6266839  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 15/05/2012 | 1   | 709917  | 6266535  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 16/05/2012 | 1   | 712783  | 6266059  |
| Jewelled Gecko  | <i>Diplodactylus elderi</i>   | V       | -        | 17/05/2012 | 2   | 711586  | 6264711  |
| Little Eagle    | <i>Hieraaetus morphnoides</i> | V       | -        | 26/04/2012 | 1   | 246383  | 6355325  |
| Little Eagle    | <i>Hieraaetus morphnoides</i> | V       | -        | 13/05/2012 | 1   | 706596  | 6266679  |
| Little Eagle    | <i>Hieraaetus morphnoides</i> | V       | -        | 17/05/2012 | 1   | 707550  | 6268617  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/03/2012  | 80  | 713267  | 6259829  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/03/2012  | 17  | 711517  | 6272074  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/03/2012  | 4   | 705743  | 6263349  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/03/2012  | 34  | 705210  | 6259297  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/03/2012  | 18  | 707228  | 6272662  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 30/03/2012 | 1   | 711604  | 6272119  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 1/04/2012  | 1   | 707257  | 6272621  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 21/04/2012 | 2   | 716886  | 6255685  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 22/04/2012 | 1   | 712118  | 6250111  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 23/04/2012 | 1   | 712118  | 6250111  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 23/04/2012 | 1   | 715714  | 6246860  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 14/05/2012 | 3   | 713287  | 6266783  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 12/05/2012 | 2   | 710095  | 6266788  |
| Little Pied Bat | <i>Chalinolobus picatus</i>   | V       | -        | 13/05/2012 | 1   | 710095  | 6266788  |

| Common Name               | Scientific Name             | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|---------------------------|-----------------------------|---------|----------|------------|-----|---------|----------|
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 14/05/2012 | 2   | 710095  | 6266788  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 12/05/2012 | 2   | 713178  | 6268568  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 13/05/2012 | 2   | 713178  | 6268568  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 12/05/2012 | 2   | 706555  | 6266645  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 13/05/2012 | 7   | 706555  | 6266645  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 22/04/2012 | 1   | 715721  | 6246880  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 21/04/2012 | 1   | 716943  | 6255666  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 21/04/2012 | 1   | 712018  | 6250162  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 20/04/2012 | 1   | 712075  | 6256996  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 19/04/2012 | 1   | 717237  | 6253475  |
| Little Pied Bat           | <i>Chalinolobus picatus</i> | V       | -        | 19/04/2012 | 1   | 714940  | 6256141  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 23/04/2011 | 18  | 717242  | 6253553  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 13/05/2011 | 3   | 727866  | 6252687  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 15/05/2011 | 3   | 717000  | 6255000  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 16/05/2011 | 3   | 716147  | 6256412  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 26/11/2011 | 11  | 716500  | 6261060  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 28/11/2011 | 4   | 717004  | 6255766  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 28/11/2011 | 2   | 717004  | 6255766  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 30/03/2012 | 1   | 707221  | 6272611  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 31/03/2012 | 3   | 705758  | 6263272  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 1/04/2012  | 3   | 710140  | 6259920  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 1/04/2012  | 4   | 705758  | 6263272  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 1/04/2012  | 7   | 707221  | 6272611  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 2/04/2012  | 3   | 707221  | 6272611  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 19/04/2012 | 13  | 716239  | 6256430  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 20/04/2012 | 5   | 716886  | 6255685  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 20/04/2012 | 29  | 716670  | 6256515  |
| Major Mitchell's Cockatoo | <i>Cacatua leadbeateri</i>  | V       | -        | 21/04/2012 | 7   | 720116  | 6241796  |

| Common Name                 | Scientific Name            | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|-----------------------------|----------------------------|---------|----------|------------|-----|---------|----------|
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 21/04/2012 | 14  | 719980  | 6241776  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 23/04/2012 | 13  | 717190  | 6253692  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 23/04/2012 | 5   | 717054  | 6260779  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 23/04/2012 | 4   | 714966  | 6256117  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 23/04/2012 | 11  | 711729  | 6254879  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 23/04/2012 | 1   | 717243  | 6253553  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 11/05/2012 | 2   | 717083  | 6260845  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 13/05/2012 | 12  | 713223  | 6268474  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 13/05/2012 | 17  | 713148  | 6268569  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 15/05/2012 | 2   | 706596  | 6266679  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 16/05/2012 | 2   | 706652  | 6269788  |
| Major Mitchell's Cockatoo   | <i>Cacatua leadbeateri</i> | V       | -        | 17/05/2012 | 4   | 706998  | 6267334  |
| Mallee Worm-lizard          | <i>Aprasia inaurita</i>    | E       | -        | 24/04/2012 | 3   | 706958  | 6256399  |
| Malleefowl (heard possible) | <i>Leipoa ocellata</i>     | E       | V        | 1/04/2012  | 1   | 711546  | 6272122  |
| Malleefowl (heard possible) | <i>Leipoa ocellata</i>     | E       | V        | 2/04/2012  | 2   | 711546  | 6272122  |
| Malleefowl (mound active)   | <i>Leipoa ocellata</i>     | E       | V        | 15/05/2012 | 2   | 713191  | 6268752  |
| Malleefowl (mound inactive) | <i>Leipoa ocellata</i>     | E       | V        | 26/04/2012 | 1   | 711728  | 6257047  |
| Malleefowl (mound inactive) | <i>Leipoa ocellata</i>     | E       | V        | 12/05/2012 | 1   | 710123  | 6266752  |
| Malleefowl (mound inactive) | <i>Leipoa ocellata</i>     | E       | V        | 18/05/2012 | 1   | 714308  | 6269807  |
| Malleefowl (mound possible) | <i>Leipoa ocellata</i>     | E       | V        | 13/12/2011 | 1   | 707162  | 6261323  |
| Malleefowl (observed)       | <i>Leipoa ocellata</i>     | E       | V        | 13/05/2012 | 1   | 713185  | 6268566  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 29/03/2012 | 0   | 710228  | 6259887  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 1/04/2012  | 0   | 705619  | 6262363  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 1/04/2012  | 0   | 710123  | 6260066  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 13/05/2012 | 2   | 710855  | 6267845  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 15/05/2012 | 1   | 713198  | 6268255  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 15/05/2012 | 1   | 713217  | 6267892  |
| Malleefowl (tracks)         | <i>Leipoa ocellata</i>     | E       | V        | 15/05/2012 | 1   | 713185  | 6268566  |

| Common Name                  | Scientific Name                          | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|------------------------------|--|---------|----------|------------|-----|---------|----------|
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 15/05/2012 | 1   | 713223  | 6268474  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 15/05/2012 | 1   | 710855  | 6267845  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 15/05/2012 | 1   | 710123  | 6266752  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 712784  | 6265962  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 712783  | 6266059  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 706652  | 6269788  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 710367  | 6267155  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 713169  | 6269182  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 16/05/2012 | 1   | 713192  | 6268752  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 710906  | 6267993  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 711072  | 6265072  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 711071  | 6265072  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 711747  | 6264547  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 712106  | 6264261  |
| Malleefowl (tracks)          | <i>Leipoa ocellata</i>                   | E       | V        | 17/05/2012 | 1   | 712464  | 6245348  |
| Pied Honeyeater              | <i>Certhionyx variegatus</i>             | V       | -        | 1/04/2012  | 1   | 710140  | 6259920  |
| Rainbow Bee-eater            | <i>Merops ornatus</i>                    | -       | M        | 31/03/2012 | 1   | 707226  | 6272662  |
| Regent Parrot                | <i>Polytelis anthopeplus</i>             | E       | V        | 24/04/2012 | 4   | 712583  | 6251437  |
| Southern Ningau              | <i>Ningau yvonneae</i>                   | V       | -        | 30/03/2012 | 1   | 705758  | 6263272  |
| Southern Ningau              | <i>Ningau yvonneae</i>                   | V       | -        | 2/04/2012  | 1   | 705758  | 6263272  |
| Southern Ningau              | <i>Ningau yvonneae</i>                   | V       | -        | 13/05/2012 | 1   | 713148  | 6268569  |
| Spinifex Slender Blue-tongue | <i>Cyclodomorphus melanops elongatus</i> | E       | -        | 13/05/2012 | 1   | 710134  | 6266839  |
| Spotted Harrier              | <i>Circus assimilis</i>                  | V       | -        | 21/04/2012 | 1   | 714397  | 6248207  |
| Spotted Harrier              | <i>Circus assimilis</i>                  | V       | -        | 23/04/2012 | 1   | 716835  | 6256107  |
| Varied Sittella              | <i>Daphoenositta chrysoptera</i>         | V       | -        | 1/04/2012  | 6   | 713796  | 6251410  |
| Varied Sittella              | <i>Daphoenositta chrysoptera</i>         | V       | -        | 1/04/2012  | 2   | 711546  | 6272122  |
| Varied Sittella              | <i>Daphoenositta chrysoptera</i>         | V       | -        | 22/04/2012 | 6   | 715714  | 6246860  |
| Varied Sittella              | <i>Daphoenositta chrysoptera</i>         | V       | -        | 22/04/2012 | 0   | 713799  | 6251410  |



| Common Name   | Scientific Name                  | TSC Act | EPBC Act | Date       | No. | Easting | Northing |
|---|----------------------------------|---------|----------|------------|-----|---------|----------|
| Varied Sittella                                       | <i>Daphoenositta chrysoptera</i> | V       | -        | 22/04/2012 | 0   | 715702  | 6246870  |
| Varied Sittella                                       | <i>Daphoenositta chrysoptera</i> | V       | -        | 24/04/2012 | 5   | 715259  | 6247002  |
| Varied Sittella                                       | <i>Daphoenositta chrysoptera</i> | V       | -        | 13/05/2012 | 6   | 706614  | 6266075  |
| White-fronted Chat                                    | <i>Epthianura albifrons</i>      | V       | -        | 16/05/2011 | 15  | 716738  | 6254554  |
| White-fronted Chat                                    | <i>Epthianura albifrons</i>      | V       | -        | 16/05/2011 | 12  | 716999  | 6253884  |
| White-fronted Chat                                    | <i>Epthianura albifrons</i>      | V       | -        | 31/03/2012 | 1   | 705758  | 6263272  |
| White-fronted Chat                                    | <i>Epthianura albifrons</i>      | V       | -        | 22/04/2012 | 11  | 717145  | 6253785  |
| White-fronted Chat                                    | <i>Epthianura albifrons</i>      | V       | -        | 22/04/2012 | 1   | 716883  | 6255032  |
| Yellow-bellied Sheath-tail Bat                        | <i>Saccolaimus flaviventris</i>  | V       | -        | 30/03/2012 | 1   | 711679  | 6259889  |
| Yellow-bellied Sheath-tail Bat                        | <i>Saccolaimus flaviventris</i>  | V       | -        | 20/04/2012 | 1   | 717240  | 6253665  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 1/03/2012  | 8   | 713267  | 6259829  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 1/03/2012  | 2   | 705210  | 6259297  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 1/03/2012  | 1   | 707228  | 6272662  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 19/04/2012 | 0   | 716943  | 6255666  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 19/04/2012 | 0   | 712018  | 6250162  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 19/04/2012 | 0   | 712075  | 6256996  |
| Yellow-bellied Sheath-tail Bat (Anabat, not-positive) | <i>Saccolaimus flaviventris</i>  | V       | -        | 19/04/2012 | 0   | 717237  | 6253475  |

TSC Act = NSW *Threatened Species Conservation Act, 1995* (current at 25 July 2012).

EPBC Act = Commonwealth *Environment and Biodiversity Protection Act, 1999* (current at 25 July 2012).

V = Vulnerable, E = Endangered, M = Migratory.